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Industry Initiatives to Addressing Water Concerns in India Today: The Inward and the Outward Looking Possibilities

Chandan Palaksha*, Nachiketas N., Purba Halady Rao*****

Abstract *In India, water is fast becoming a scarce resource. As our country proceeds to achieve developments towards being a knowledge-based economy, competing demands for this limited resource coming from households, industry, and agriculture have wide-ranging implications for the country's future. In line with these challenges, Indian industry is realising the importance of conserving and managing water, not only because of the growing scarcity and poor water quality impacting industrial operations, but also because of the fact that they are becoming conscious of their responsibility to (a) conserve water resources and (b) ensure clean water, for their own operations and to help communities around. In order to assess the extent of awareness of the industry to possible initiatives to address water challenges, an empirical research has been undertaken using survey research on a population of practicing managers across the country. This empirical research considers the severe impacts of the water crisis situation and examines if industry participation would help communities as well as their own operation in conserving and preserving this scarce resource. As part of this research, the awareness of private sector to the possible initiatives which are available to help water management has been considered in (a) internal sense (companies looking at the water efficiency in their own operations), and in (b) external sense (looking beyond the walls of the factory to help communities manage and cope with the water crisis situation).*

Keywords *Water Management, Empirical Research, Private Sector*

INTRODUCTION

Traditionally, India has always had large freshwater reserves, numerous rivers and water basins, ample rainfall and mountain glaciers melting into sweet water streams. However, the increasing population, urbanisation, industrialisation, and consequent over-exploitation of surface and groundwater over the past few decades have resulted in water scarcity in many regions of our country. While the country needs growth in the economy, this growth is driving increased water usage across sectors. Wastewater is increasing significantly and in the absence of proper measures for treatment and management, the existing freshwater reserves are being polluted. Increased urbanisation is also driving a change in consumption patterns and increased demand for water-intensive agricultural crops and industrial products (Grail Research, 2009).

In 1987, the World Commission on the Environment and Development (WCED) defined sustainability as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987). The present paper will consider the water-related aspect of sustainability while including all activities focusing on the part of private sector in different organisational initiatives, which might help conservation and responsible use of water in their own organisation as well as in the daily life of communities. Water sustainability has to be a cross-disciplinary concept having relevance at both individual and organisational levels. In today's industry, it is increasingly important for organisations to understand how and why to address (a) water sustainability in and for their operations, in many different modalities and in many different capacities and (b) contribute and participate in water management for communities. This is extremely important in India today essentially because of an impending water crisis situation which might engulf Indian industry in the near future as well as lives of people/communities in a desperate way.

In developing countries, like India, it is often a challenge to provide clean water of desired quantity and quality at the desired place. This is especially in monsoon climates where 70-90% of the annual rain falls in just 3-4 months, either there is too much water and often floods in the wet season, and too little water and often droughts in the dry season. Also, at times, enough water may be available but the quality may be unacceptable (Jain, 2012).

Parikh (2013) says that India's water crisis is rooted in three causes. The first cause is insufficient water per person as a result of population growth. With a population of 1.2 billion, according to the 2011 census, we have only 1,000 cubic

* Great Lakes Institute of Management, Chennai, Tamil Nadu, India. Email: chandan.h@greatlakes.edu.in
** Great Lakes Institute of Management, Chennai, Tamil Nadu, India. Email: nachiketas.n@greatlakes.edu.in
*** Great Lakes Institute of Management, Chennai, Tamil Nadu, India. Email: purbarao@yahoo.in.

meters of water per person, far less than the required standard of 1700 cubic meters per person per year. Actually, a country is considered water-stressed if it has less than 1,700 cubic meters per person per year. The second cause for water crisis is poor water quality as a result of lack of proper investment in water-treatment facilities in urban India. Water in most rivers in India is largely not fit for drinking, and in many stretches not even fit for bathing. Despite some initiatives being taken to clean up rivers, much of the river water remains polluted with a high coliform count at many places (Parikh, 2013). The third cause for water crisis is dwindling groundwater supplies due to over-extraction by farmers and industrial pollution seeping into the groundwater.

All the same, one of the most significant causes of water pollution is industry dumping their effluent waste in the rivers, lakes, canals and other water bodies in an uncontrollable manner.

The effluents contaminate the water so much that the people residing around the polluted water bodies develop skin diseases, stomach problems and other health issues. (http://www.deccanchronicle.com/nation/current-affairs/300717/more-bellandur-lakes-in-making.html).

This current research endeavours to examine the reasons why the issue of water sustainability is so critical in Indian industry today and assess to what extent it is aware that it could make a significant difference by adopting a voluntary responsibility to addressing the water situation in this country. In the process, this research also purports to assess the extent of corporate awareness to the existence of initiatives available to address water crisis situation in our country, the way it is going to affect the industry as well as community, and the possible initiatives which industry can take up to address and minimise impacts of such water crisis. Though water sustainability is as important from an individual perspective as it is from an organisational perspective, we would focus on the latter more because of the premise that industry initiative usually has much larger impact and is more measurable than individual initiative (Water for Business, 2012).

In many parts of the world today, particularly in emerging economies - where the spread of industrial and agricultural activity has become very high, the water scarcity situation is becoming a problem because the consumption of water is much larger than what the local aquifers and river basins can hold. In many such situations, water consumption exceeds water availability by a ratio of more than three to one (www.ceres.org/resources/reports/aqua-gauge, page 41). Today's industry uses fresh water directly for its manufacturing activities, and relies on water indirectly too in the processing of supplies from the suppliers in the inbound supply chain. It uses water as a solvent and cleaning agent, for cooling purposes in industrial and energy generation processes, to wash away contaminants, for irrigation, and to extract fossil fuels. It is used as a key ingredient in many products too. Because of large-scale water scarcity, lack of clean water, and inefficient water management systems, many businesses are strategically inclined to promote and invest in improved water resource management (CDP 2012, Ceres, 2009). These strategies are based on their growing understanding that water risks are caused not only by a company's own water use and pollution, but also by the watershed context in the environment company operates in. Thus, water risks can be mitigated if industry addresses water concerns both inside and outside of their organisation. As part of these concerns industry also needs to be aware that in case they produce effluent water waste, they would need to mitigate the effluents before releasing waste water outside, in the local water bodies. This can be achieved by putting up treatment plants in their premises.

In this context the CEO Water Mandate (2014) proposes the business case for sustainable water management and develops a system of good practice guidance, to identify and encourage integrated corporate water stewardship. The mandate argues that companies can not only act significantly to achieving more sustainable and effective water management in their own operations, but that in many areas their participation may prove to be in vital, particularly in emerging markets where government capacity and resources are limited. Their participation can contribute to uplifting the lifestyles of communities in a significant way.

These days corporate social responsibility (CSR) has been widely acceptable. However, in context of water management, CSR could provide major solutions to water crisis situation. On one side, a CSR program is relevant for companies that use lots of water in their operations. Here it is related to water efficiency that goes along with a responsibility to ensure their surrounding communities will not suffer from water shortages because of the companies' operations. On the other side, water provision can be seen as a business opportunity that provides a solution for the community; hence it refers to social entrepreneurship (Triwadiantini, 2010).

Thus, water-related corporate initiatives can be looked upon as comprising two components, distinct but interrelated, as one focusing on water efficiency and conservation internally to the organisation, and the second looking externally, beyond the walls of the factory, to help communities and environment addressing water crisis situation. We refer to these two components as inward initiatives and outward initiatives. The inward initiatives must include prevention of water pollution at the source, before release outside of the factory.

In general corporate organisations respond to water challenges in different manner, depending upon the location,

sector, resources and levels of risk. Many such corporate organisations try to improve their own water-use efficiency and provide adequate wastewater treatment in their operations. All the same, others endeavour to go beyond their own operations to encourage and facilitate more sustainable water management throughout their supply chain and to engage in the water management of the environment, they operate, thereby helping the communities surrounding the organisations in addressing the water crisis (Pegram, Orr, & Williams, 2009; Newborne & Mason, 2012; Morrison, Morikawa, Murphy, & Schulte, 2009).

In this context, the current research endeavours to 'call for action' on part of private sector to provide solutions to address water scarcity situation in our country both in the inward initiative aspect and in the outward initiative aspect. (Triwadiantini, 2010).

LITERATURE REVIEW

Sustainable Water Management: Challenges and Need for Solutions

As mentioned earlier, in India there has been an upsurge of industrialisation, urbanisation, and continuous growth. While this has contributed tremendously to the growth patterns of the country, it has also led to unprecedented stress on the limited water resources that are on the verge of depletion on account of overexploitation coupled with mismanagement. This water situation will invariably lead the industry to be seriously hit thereby affecting the economy of the country. The industry which consumes 8% of the water resources has taken various measures both "within the fence" and "beyond the fence" to ensure sustainable management of the depleting water resources (CII, 2009).

The challenges to water management and availability are numerous. There is an ever-increasing gap between demand and supply of fresh water, because of the following reasons:

- the total supply often decreases due to water contamination in the water bodies, inconsistent rain due to climate change, sometimes too little leading to droughts, sometimes too much, leading to floods,
- ever increasing demand from industry,
- rise in population,
- rapid urbanisation/ industrialisation,
- growth in irrigation,
- growth in power generation sector,
- lack of treatment of waste water leading to use of fresh water in every operation,
- decrease in ground water due to climate change,
- decrease in the quality of ground water due to industrial pollution (Jain, 2012)

In addition to the industrialisation/ urbanisation issue causing water shortages, climate change impacts have been one of the main causes of water hazards in India today. Decreasing glaciers, sudden, unexpected floods, intense heat waves, long and prolonged droughts, adversely impact both water quality and quantity, leading to huge spread of disease both water use and water washed, mass migration in search of water, decrease in irrigation and crop production and in basic human hygiene (Brookes, Ainger, Howe, & John, 2010; Halady & Rao, 2010).

The industry, communities, and water sector, general must adapt to these changing climatic conditions by developing improved water management approaches that will reduce pressure on already stressed systems. Thus, there will be an urgent need to develop and implement technologies and policies that will reduce and combat greenhouse gas emissions on one side and develop adaptation mechanisms to help communities survive against sudden and intense floods, droughts, diseases and lack of food. In this context, one may consider the two interrelated and often co-existing strategies to address water management which may be adopted by government agencies, NGOs, private sector organisations and communities to help build resilience against the impending water disasters. These two strategies refer to mitigation (addressing the cause and adaptation (addressing the impacts which can no longer be avoided) (Mitchell & van Aalst, 2008; Rao *et al*., 2016; Halady & Rao, 2010).

For the mitigation aspect of water-related strategy, the water sector has to focus on water harvesting and the productive use of rainfall to overcome water shortages at small scales. The water management strategy should focus on:

- preventing pollution of all kinds,
- treating inevitable waste streams,
- possibly reuse wastewater flows,
- campaigning a change towards consumption patterns with a lower water footprint,
- developing water footprint benchmarks for crops and products that reflect reasonable levels of water consumption per unit of production and work towards achieving those benchmarks by focusing on smart and efficient irrigation scheduling and improved soil and crop management.,
- campaigning does not tap into fossil groundwater resources which are to be used only in urgent times, in low amounts and infrequently etc.

(http://www.globalwaterforum.org/2016/01/04/strategies-for-countries-to-mitigate-the-risks-of-extreme-water-scarcity-and-dependency-in-a-sustainable-way/)

For adaptation, one may note that throughout ages communities and societies have always had to cope with various kinds of natural hazards such as floods, droughts, forest fires, earthquakes, and spread of diseases. This coping with nature is essentially adaptation of whole societies to natural phenomena. Such adaptation strategies have taken the form of seasonal migration of communities in search of water in the face of drought, agricultural civilisations inventing techniques for storing water, transfer and irrigation, constructing embankments and dikes and even lowering lakes to protect cities, agricultural land and populations from flooding (Wilk & Wittgren, 2009).

Thus, there do exist many different outlooks to address water crisis situation in India today. To streamline and optimise this enormous work it is felt that industry and the private sector, in general, may be involved to add efficiency, competence and strategic thinking to deliver the action plans which would help our country develop resilience in all aspects of water challenges in situations of floods, water shortage, disease and insanitary conditions. All the same, the perspective and awareness of private sector to the whole umbrella of possible initiatives has not been widely assessed yet. It is therefore the objective of this research to consider their awareness to the possible initiatives which exist to address impacts of water situation, both inward-looking and outward-looking, to address this crisis.

Inward and Outward Corporate Initiatives to Address Water Crisis Situation

Corporate initiatives to address water crisis may be broadly categorised as looking inwards into their own company operations, and looking outwards, beyond the walls of the factory, to help communities and surrounding environment become water efficient. Many industries use huge volumes of water, as a solvent and cleaning agent, to cool industrial and energy generation processes, to dilute contaminants, to extract fossil fuels, and as a key ingredient in many products, among many other uses. However, since water scarcity has become a concern in India, many businesses are making an effort to promote and invest in improved water resource management (CDP, 2012, Ceres, 2009). This is based on their growing understanding that water risks are caused sometimes by their own water use and pollution, requiring the need for efficient water management inside the company, so that effluents are not released in the water bodies surrounding the company which drastically affect not only the company but also the communities around them.

So on one side, it makes business sense for companies to adopt efficient water management internal to their operations. On the other side, the society as a whole and media increasingly request companies to consider social and environmental problems while doing business activities. Thus, CSR activities are highly encouraged and they have become quite a regular feature in world-class companies. Today, regulatory framework has also come as an initiative to control those business activities which make a harmful effect on the society and corporates are encouraged to take up initiatives as investment options and voluntary activities to community engagement, global warming, manage the use of natural resources, human rights and water management (Rani & Hooda, 2013).

The inward initiatives comprise:

1. investment in recycling and treatment of industrial wastewater,
2. incorporation of efficient water usage practices in company operations,
3. investment in rain water harvesting facilities,
4. recycling of industrial waste water discharge internal to company,
5. investment in waste water treatment plants so polluted water does not go out,
6. incorporation of 3R: reduce, reuse, recycle,
7. incorporation of sewage water management generated internally and recycling of the same,
8. monitoring of water consumption in operations,
9. optimisation of cooling tower operations,
10. setting up water conservation equipment,
11. putting up used water cleaning and recirculation systems,
12. optimisation of inbound logistics so as to conserve water,
13. holding awareness seminars on water conservation for employees,
14. optimisation of processes to reduce effluent waste water
15. prevention of pollution at the source,
16. striving to make the industry zero-water industry,
17. promoting green building concept on water conservation programme (Grail research, 2009).

The outward initiatives comprise:

1. ensuring that effluent waste water and other pollutants do not enter any of the water bodies,
2. help in providing irrigation water and increasing agricultural production in the community,
3. watershed development as a community initiative,
4. providing drinking water and purification systems in a community,

5. participating and helping in community water management,
6. helping set up drinking water and purification for a community,
7. helping farmers halt watershed erosion and grow more food as community initiative,
8. improving infrastructure and sanitation facilities in neighboring residential areas,
9. improving sanitation and availability of drinking water in communities.

Research Question

In this research, the main objective was to consider all aspects of water challenges existing in our country and to determine to what extent industry was aware of possible initiatives they can undertake to address these issues in the (a) internal direction, inward initiatives as well as in the (b) external direction, outward initiatives (Grail Research, 2009).

RESEARCH METHODOLOGY

To achieve the objectives as indicated in the Research Question, an empirical research was undertaken using a survey questionnaire as a research instrument.

The questionnaire comprised questions on awareness for internal initiatives and external initiatives. It comprised demographic variables such as age, sex (female=0, male=1), income, education, level (junior manager, middle manager, senior manager, director, or above).

There was a question D,:

Do you think private sector should get involved in adaptation process to address water crisis situation in India? Yes No

This would serve as a binary dichotomous variable for subsequent analysis.

The empirical research was implemented on a population of Indian managers working in different organisations in the private sector. The data collection was non-probability sampling. The questionnaire was digitalised and the link sent to population of middle managers at different levels in the country. The final sample size was 166.

The questionnaire essentially sought awareness from Indian managers in private sector on a 4-point Likert scale on items under Objective 1 and Objective 2 as given above.

First, Cronbachs alpha was computed for the two constructs, inward initiatives and outward initiatives. Thereafter, two composite variables inward and outward, were computed forming part of the database. Next, Linear Discriminant Analysis was carried out with D as the dependent variable.

RESULTS FROM DATA ANALYSIS

Reliability Analysis

In this analysis, one checks if all the variables under each construct measure the same theme. This measure is computed as Cronbach's alpha, which is a function of the bivariate correlations between each pair of variables. A Cronbach's alpha value > 0.6 is considered acceptable for further analysis.

The Cronbach's alpha for the two constructs were obtained as shown in Table 1.

Table 1: Cronbach's Alpha

Construct	Cronbach's alpha
Awareness to Inward Initiatives	0.965
Awareness to Outward Initiatives	0.938

The alpha values were very high indicating two composite variables could be created in them.

SIGNIFICANCE TESTING FOR THE TWO AWARENESS CONSTRUCTS, INWARD INITIATIVES AND OUTWARD INITIATIVES

Using a simple 1-tail t-test, the means and the associated t-values were obtained as shown in Table 2.

Table 2: Result of t-test

Construct	t-value	Significance
Awareness to Inward Initiatives	1.631	.101
Awareness to Outward Initiatives	-1.352	.179

The results show that both awareness to inward initiatives as well as outward initiatives were not significant at 5 % level of significance. Awareness to inward initiatives was significant at 10 % level of significance. This implied that awareness to outward initiatives does not exist yet.

Linear Discriminant Analysis

Discriminant analysis works on an extensive database with many predictor/ independent variables, X1, X2, X3… and a binary dichotomous variable, which in this case is D.

The indicators of model fit is given by eigen value and Wilk's lambda, whose significance should be < 0.05

Linear discriminant analysis was carried out with the binary dichotomous variable, D, (Do you think the private sector should get involved to address water crisis situation in India?) as a dependent variable and all demographic variables, awareness to inward initiatives and awareness to outward initiatives as predictor variables.

The results were obtained as shown in Table 3.

Table 3: Indicator of Model Fit

Eigen Value	**.467**
Canonical Correlation	.564
Wilk's Lambda	.682
Significance	.000

Since the significance of Wilk's lambda was < .05, the model fit was considered totally acceptable. The relative importance of the predictor variables is obtained by examining the structure correlations or canonical loadings. These are simple correlations between each predictor variable and the discriminant function.

The structure matrix was obtained as shown in Table 4.

Table 4: Structure Matrix

	Canonical correlations
Awareness to Inward Initiatives	.923
Awareness to Outward Initiatives	.723
Sex of respondent	.216
Managerial level in organisation	.215
Income of respondent	.168
Age of respondent	.116
No. of years company operating	.063
Number of employees in company	.047

Thus, the most critical variable to impact the propensity of the private sector to address water concern is awareness to inward initiatives, followed by awareness to outward initiatives. Also, this propensity is demonstrated more by male managers who are at a higher level in the organisation. Higher income and higher age have moderate impact. No. of years of operation of the companies, and size of the companies in terms of number of people have little or no impact on the propensity.

Thus, the results from linear discriminant analysis clearly brought out the significant impacts of awareness to inward and outward initiatives to a propensity of private sector acting to address water situation. All the same, we still needed to know if inward initiatives did lead to outward initiatives. To ascertain the validity of this hypothesis, a linear regression was carried out with dependent variable/ construct as outward initiatives.

Multiple Linear Regression Analysis

In the multiple linear regression, the dependent variable was chosen as outward initiatives construct. The independent variables were Inward initiatives, age, sex, level, income, years of operation, and size of the company in terms of manpower.

The Indicators of Model Fit

Coefficient of Determination, R = .904

R square = .817

Adjusted R-square =.804

Associated F-Value in ANOVA = 62.625

Significance of F = .000

The regression coefficients and their significance are given in Table 5.

Table 5: Regression Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
B		Std. Error	Beta			
1	(Constant)	.110	.211		.522	.603
	Inward	.898	.045	.885	19.801	.000
	Age of manager	-.170	.082	-.108	-2.080	.040
	Sex	.069	.083	.038	.828	.410
	Income	.064	.045	.087	1.434	.155
	Level	.109	.064	.102	1.704	.092
	No. of years company operating	-.048	.035	-.070	-1.357	.178
	Size in terms of number of employee	.017	.044	.019	.382	.703
a. Dependent Variable: awareness to Outward Initiatives						

The results show that the construct awareness towards outward initiatives is significantly impacted by inward initiatives (5% level of significance) as well as the age of the manager. The level of the manager is significant at 10% level of significance.

DISCUSSION OF RESULTS

In an earlier research on industry participation on water crisis situation, an empirical study concluded that industry did have an awareness that they could help in the recycling of waste water and practice water conservation in their operations. It showed further that such awareness would lead to voluntary participation on behalf of managers both in the individual capacity as well as in the organisational capacity (Rao *et al*., 2016). These initiatives comprising recycling and treatment of waste water, ensuring effluent waste water is not released outside in the local water bodies and conservation, constitute inward looking initiatives. In this current research, though awareness to inward initiatives is still the most critical factor leading private sector to act, awareness to outward initiatives too follow immediately in a significant manner as observed in the discriminant analysis.

Access to water is recognised as a basic human right, so we are committing rights violations when we are not able to provide with individuals' access to clean water. Water supply is generally the responsibility of government, but recent research has come up with the finding that corporate social responsibility (CSR) can have a significant impact on the sustainability of freshwater supply in countries in the developing world (http://ec.europa.eu/environment/integration/research/newsalert/index_en.htm).

Also, it emerges in our current research from the discriminant analysis that the age of companies has little/ no impact on the propensity of private sector to participate in water management concerns. Thus companies, irrespective of when they started operation and size in terms of manpower, can be interested to come up with strategies to address water concerns, perhaps starting with inward-looking initiatives and then leading to outward-looking initiatives. In other words, companies can start with water efficiency in their own operations, prevent water pollution at the source and then move on to stop their own polluting of surrounding water bodies and enable communities to cope with the water crisis in our country.

In the linear regression section, with awareness to outward initiatives as a dependent variable, awareness to inward initiatives is the most significant variable having an impact on outward initiatives, followed by age and level of the managers, with age having a negative impact.

This implies that the awareness of outward initiatives starts with awareness to inward initiatives and the awareness is higher for younger managers who are at higher levels in the organisation.

Fig. 1: Combining Discriminant as well as Linear Regression analysis results

The significant link from 'awareness to inward initiatives' to 'awareness to outward initiatives' emerges as logical and relevant in the industry today. If the company operations focus on conserving water internally and preventing the generation of pollution and effluent water, automatically the polluted water output would cease leading to local water bodies not getting contaminated. But, what is unexpected is awareness of companies practicing water conservation and efficiency internally, is leading to extending the awareness to help communities outside of their walls too.

This could be because once they get more technically efficient in water management inside, they are willing to extend this expertise to help water management on the corporate social responsibility arena too. Thus, such awareness leads private sector to actually get down to address the water crisis situation on the broader basis and contribute towards responsible management and responsible citizenship so urgently needed today.

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