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Management of Water Resources by Corporate Companies – A Global Challenge

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ABSTRACT : *Water is an essential element for life on earth. With increased business activity and companies targeting big markets to maximize economic activity there is a big threat to fresh water resources. In the globalization concept companies have started operating in transparency towards sustainable operations. The CEO Water Mandate's Guide to Responsible Business Engagement with Water Policy set out principles for more understanding of the need for water conservation at global level. WWF defined water risk in three basic categories, all of which combine can give an overall picture- Physical risk, Regulatory risk and Reputation risk. Companies are working towards minimizing and conserving water resources to sustain operations. A number of initiatives were being taken up by corporate houses to mitigate the threat due to depleting water resources. Through 3R initiatives for water resource management-Reduce, Reuse, Recycle and monitoring of effluent discharge is being practiced towards achieving water stewardship. Corporate business is following Global Reporting Initiative Index (GRI) – standard in their disclosure with metrics like, source, consumption and recycling mechanism involved. The present communication throws light on various international initiatives and guidelines available to sensitize global companies on the issues of water conservation.*

KEYWORDS – *Water resources, corporate companies, Management initiatives, Global protocols*

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I. INTRODUCTION

There is an increased pressure on natural resources especially fresh water which is essential for life on earth. With increased business opportunities companies are competing to augment economic resources in the globalized market. Companies tend to over look certain measures and discipline in natural resource use while focusing on economic gains and retaining market. However, with global sanctions and protocols for carrying out business in sustainable manner companies have started operating in transparent way. UN resolved to push the MDGs in a more elaborative way with specificity to each developmental goal. The UN declared MDG's stress initiatives for protecting water resources and to promote conservation strategies. WWF is playing a catalytic role in water stewardship through partnership and donor aided projects. WWF sphere heading water stewardship globally through key action points, knowledge impact, internal action, collective action and influence governance. Companies started operating in more sensible way to safe guard water resources and other natural resources[1]. Realizing the impact of sustainability reporting in maintaining their goodwill in the society in which it operates [2] companies are divulging measures taken towards conserving water resources. An attempt was made to summarize the global initiatives made over the years in shaping water stewardship policy. The present paper also, analyses the efforts made by companies towards this goal and their achievements.

II. MATERIALS AND METHODS

The study is based on the disclosures made by different companies on conservation strategies and achievements in water use in their plants at different operations. Study is also, focused on vulnerability assessment practices by global corporations in sustaining their business. The water stewardship initiatives made at global context and guidelines/protocols available are presented and discussed. The study was carried out on a focus group of corporate sector companies operating in different domain. Data mining and inference was drawn to highlight the areas for conservation. The companies selected for the study are presented in TABLE 1.

Table 1: Companies considered for the study

S.N	Company	Sector	Area of operation
1	Reliance Industries Ltd[3]	Textiles, basic chemicals, fertilizer, plastics and synthetic rubber and man-made fibers.	Global
2	Vedanta[4]	Metals, mining and oil & gas	Global
3	Coco-cola company[5]	Soft beverage	Global

4	Birla Carbon[6]	Carbon black	Global
5	DuPont[7]	Polymers, crop-protection, industrial bio-science, electronics & communication, nutrition & health	Global
6	Honda[8]	Automobiles	Global
7	Ford[9]	Automobiles	Global
8	Maruti Suzuki[10]	Automobiles	Global
9	General Motors[11]	Automobiles	Global
10	Samsung[12]	Electronics	Global

III. RESULTS AND DISCUSSION

Availability of water for business activities is very essential and becomes critical factor for its continued activity. Water use-efficiency and conservation are a priority for major establishments. Many corporate companies have focused water stewardship efforts in the areas where they can have the impact, including improving water-use efficiency and re-use, managing waste water, and mitigating water risk. The important indicators with respect to water are availability, use-efficiency and conservation practices. Towards this direction companies are working for technologies to conserve and minimize water use through use-efficiency. Global efforts are in place to protect interest of ethnic groups through investments in restoration and rejuvenation of water bodies.

3.1. Initiatives at global level on water stewardship

Commitment to UN Global Compact (UNGC) Communication on Progress (COP) Mapping envisages specific criteria for water resource management under environmental stewardship (TABLE 2). UN has set guidelines for standard methodology for environmental stewardship[13]. Companies are following. Companies are now attempting measures for reduction in specific freshwater consumption per unit manufacturing, setting goals and reporting in global standard index protocol.

Table 2: UNGC Communication on Progress Mapping

Criterion 13:The COP describes robust commitments, strategies or policies in the area of Implementation
Criterion 14:The COP describes effective management systems to integrate the environmental principles
Criterion 15:The COP describes effective monitoring and evaluation mechanisms for environmental stewardship
Criterion 16:The COP describes key outcomes of integration of the environmental principles

In October 2008, the UN Global Compact Office officially established the Transparency Policy for the CEO Water Mandate. COP-Water[14] includes the following three basic elements:

1. Statement of continued support for the UN Global Compact's CEO Water Mandate. At minimum, the COP-Water must contain an explicit statement of continued support for the CEO Water Mandate which renews the company's ongoing commitment to the initiative and its six elements.
2. Description of policies and practical actions that participants have taken to implement the CEO Water Mandate elements since joining the initiative or since the endorser's most recent COP-Water. The minimum requirement is to explicitly address past or planned activities for all of the CEO Water Mandate elements. It is expected that within five years, the COP-Water will address concrete activities and, if applicable, policies, that reflect the company's implementation of all six of the CEO Water Mandate elements.
3. Measurement of outcomes or expected future outcomes using, as much as possible, broadly accepted water-related indicators or metrics, for example those in the GRI G3 Guidelines. At minimum, the COP-Water must contain a definition of performance indicators, a basic measurement (qualitative and/or quantitative) of outcomes, or future expected outcomes, related to the CEO Water Mandate elements. The CEO Water Mandate's Guide to Responsible Business Engagement with Water Policy set out principles[15] for more understanding of the need for water conservation at global level (TABLE 3).

Table 3: Principles for CEO water Mandate's Guide

Principle 1:Advance sustainable water management
Principle 2:Respect public and private roles
Principle 3:Strive for inclusiveness and partnerships
Principle 4:Be pragmatic and consider integrated engagement
Principle 5:Be accountable and transparent

UN-Water annual conference in the year of 'water and sustainable development', 2015 recommended several actions. The key issues raised are 1) **Develop a corporate water stewardship strategy for c**reating a strategy with public commitments and goals aligns business and development objectives, reduces long-term risks, and identifies new opportunities. 2) **Increase collection and disclosure of water-related information-**To

develop a meaningful corporate and public water policy to support water stewardship. 3) **Leverage new financial instruments to support water projects.** Financing is scarce for sustainable water management projects. New financial instruments, such as those provided by IDB's Structured and Corporate Finance Department, are available to help catalyze private sector investments in climate and water risk mitigation and sustainable development. WWF's (2013) concept of water stewardship comprises- water awareness, Knowledge impact, internal action, Collective action and Influence governance. WWF is playing a role in water stewardship programmes and focusing on implementation through support from companies, donors, NGOs and others[16] (TABLE 4).

Table 4: WWF 's agenda on global Water stewardship mission

1. Identifying companies in basins	Map companies (SMEs and MNCs) in priority river basins and create collective action at scale and to engage financial institution donors and buyers in all river basins.
2. Implementation	Work with companies in priority areas to implement water stewardship projects at scale.
3. Risk Analysis	Further develop the Water Risk Filter (waterriskfilter.org) to help all companies and investors take the first step to recognizing the importance of water.
4. Valuation	Continue to develop corporate appreciation of water and continue to strengthen the business case for engagement in water stewardship.
5. Validation of impacts	Water stewardship to ensure sustainable resource management that delivers mutual benefits.
6. Speaking up	To be vocal on initiatives and claims, and challenge others to create meaningful change and to see strategies published on their websites.
7. Working with investors, pension funds and financial institutions	Collaborate with financial institutions to create the right questions, incentives, benchmarking and reward systems to drive better performance.
8. Communicating	To highlight and to multiply impact by encouraging others to replicate successful approaches.
9. Key partnerships	Work with selected leading businesses that have either demonstrated leadership in water stewardship or who share our vision and are committed to becoming good water stewards.
10. Collaboration	To promote the collaborative spirit among many groups, companies and NGOs on water stewardship has been inspiring.

Water risk is distributed unevenly, with highly varied possibilities for users to cope with scarcity and pollution events. WWF defined water risk in three basic categories, all of which combine can give an overall picture- Physical risk, Regulatory risk and Reputation risk (TABLE 5).

Table 5: Water Risk linked to location and company sensitivity towards water management

Type of risk	Physical risk	Regulatory risk	Reputation risk
Basin-related Risk- Linked to Location	Water quantity (scarcity, flooding, droughts) and quality (pollution) within the river basin and the impacts this might have on society and the environment.	Strength and enforcement of water regulations and the consequences of restrictions by public institutions; either felt through direct regulatory action or from neglect, blockages or failure.	Perceptions around water use, pollution and behaviour that may have negative impacts on the company brand and influence purchasing decisions. Public perceptions can emerge rapidly when local aquatic systems and community access to water are affected.
Company related Risk- Linked to Behaviour	Water quantity and quality issues related to the performance of the company and its supply chain. Water quantity	The potential for changes in pricing, supply, rights, standards and license to operate for a particular company or sector.	When the actions of the company are poorly executed, understood or communicated with local stakeholders and where perceptions and brand suffer as a consequence.

3.2. Performance of select corporate companies on water stewardship and the disclosures

Water use and conservation performance disclosures suggest that companies are making robust plans towards the goal of efficient management of available water resources. Corporate business is following Global Reporting Initiative Index (GRI) – standard[17]in their disclosure. The metrics in reporting include source, consumption and recycling mechanism involved. Birla Carbon has set up a subcommittee working group to assess water risks, focusing on economics, flooding and recycling in our production cycle at each plant location. The group produced a map to chart overall risks. Birla Carbon has set a target to reduce 50% of water withdrawal intensity (m^3/t carbon black) versus FY2012 baseline for high- and medium-risk sites (TABLE 6).

Table 6: Global Reporting Initiative Index (GRI) – Standard

Withdrawal source (m^3)	2015	2016	2017
1. Surface water	6,581,739	7,116,414	7,329,432
2. Ground water	4,347,320	4,950,663	4,956,247
3. Rainwater & water recycled	2,808,987	3,299,460	3,652,108
4. Municipal water supplies	5,151,789	4,496,812	3,633,199
5. Total Water recycled & reused	18,889,835	19,863,349	19,570,986
6. Total volume (m^3)	2,808,987	3,299,460	3,652,108
7. Total volume as %	15	17	19

Based on assessments using standard tools, DuPont reported that none of the withdrawals significantly affected any water sources for reasons, none of the discharges account for an average of 5% or more of the annual average volume of a given water body; none of the discharges are known to have or are highly likely to have significant impacts on the water body and associated habitats; none of the discharges are to water bodies that are recognized by professionals to be particularly sensitive due to their relative size, function, or status as a rare, threatened, or endangered system (or to their support of a particular endangered specifies of plant or animal) (TABLE 7). Quality of water and its availability is a key to business activities in beverage companies. Coca-Cola was using 2.7 liters of water to make 1 liter of product in 2004. At the end of 2016, use came down to 1.96 liters per1 liter of product as against to 1.7 liters by 2020. The water-use efficiency achieved was 27% since 2014 (TABLE 8).

Table 7: Water consumption at various manufacturing locations of DuPont

Consumption	2010	2011	2012	2013	2014
1. Groundwater	23,296	23,860	30,856	29,517	28,776
2. Municipal Water	23,405	23,267	18,421	19,415	18,957

Table 8: Coca-Cola Company goals and performance

2020 Goal		Progress (%)		
		2014	2015	2016
1.	Safely return to communities and nature an amount of water equivalent to water used in production of beverages.	94.0	115.0	132.9
2.	Improve water efficiency in manufacturing operations by 25%.	10.0	12.0	13.0

Reliance Industries laid focus on conservation of water at all its operations sites. The industry consumed a total of 121.29 million Cu.M of water in FY 2013-14, as compared to 118.88 million Cu.M of water in FY 2012-13. In 2013-14, over 52% of freshwater withdrawal was reutilised through recycle and reuse at manufacturing locations. The water consumed at all operations is primarily sourced from surface water sources such as lakes, rivers and reservoirs through the local water utility departments (TABLE 9).

Table 9: Water conservation at various manufacturing locations of Reliance Industries Ltd

S.N	Water management (000 Cu. M)	2011	2012	2013	2014
1	Water withdrawal across manufacturing locations	120302	120127	118885	121298
2	Water recycled and re-used at manufacturing locations	60705	65495	65441	63165

Honda is working to recycle and reuse water in manufacturing processes very effectively, which utilizes about 4.8 million cubic meters of water each year, about 20%. This ongoing efforts includes installing full recycling systems that allow reuse of almost 100% of all water at units of Honda Automobile Co., Ltd in Japan, Thailand, China. Honda Motorcycles and Scooter India Pvt. Ltd. (HMSI) has introduced a zero-liquid-discharge (ZLD) system that completely eliminates wastewater by reusing all water at its Manesar Plant. ZLD system eliminates waste-water discharged by incorporating advanced technologies, such as electrochemical pre-processing and reverse osmosis into wastewater treatment. Vedanta has incorporated the theme reduce, recycle and harvest. The company achieved 100% utilisation of liquid effluent and 23% reduction in the specific water consumption through RO installation. The Total estimated water savings through interventions is around 240,000 m^3. Ford achieved 62% reduction in water use per vehicle produced, 2000 to 2016. Sanand vehicle assembly and engine plants in India have one of Ford's largest and most advanced water and wastewater treatment facilities. 100% of treated gray water at Sanand facility is recycled and reused within the property. These measures have saved 219,000 cubic meters of freshwater in 2016 and mean that there is zero wastewater discharge at the Sanand plants. Water conservation is an integral part of the Environment Management System at Maruti Suzuki. The Company recycles and reuses water and no water is discharged outside the boundary. Canal water is used as the major source in order to conserve ground water. Rain water is also harvested and used. Innovative methods to conserve water on the shop floor are encouraged. Water consumption per car, Gurgaon Plant indexed to base year 2000-01 was 46% while, water consumption per car, Manesar Plant was 23% (TABLE 10). General Motors corporate water stewardship strategy is intended to build on local water conservation efforts. General Motor's commitment to water management is also reflected in transparency and disclosure efforts through CDP's water program. General Motors gave special consideration to plants located in water stressed areas, for water treatment technologies. In Arlington, an anticipated 17.8 million gallons of water and US$38,000 per year, and at Hamtramck a total US$1.6 million annually was saved in North America operations (TABLE 11).

Table 10: Sources of water for Maruti Suzuki operations

Sources of water	2012	2013	2014
1. Surface Water (Canal Water)	1,495,754	1,967,786	1,980,981
2. Ground Water (Tube Well Water)	305,018	23,207	62,740
3. Rainwater	550	1,800	3,341
4. Recycled Water	1,234,767	1,361,102	1,897,856
5. Total	3,036,089	3,353,895	3,944,918

Table 11: Water consumption (m^3/vehicle) at General Motors at manufacturing locations

Location/Region	2014	2015	2016
1. North America	5.49	5.32	5.08
2. South America	3.64	3.87	4.01
3. Europe	5.52	5.1	4.32
4. International	3.32	3.51	3.51

Through 3R initiatives for water resource management (Reduce, Reuse, Recycle) and monitoring of effluent discharge Samsung reached 50 tons/KRW 100 million in intensity-based water consumption, a goal set under EM2020 vision. In monitoring water resource risks at global production sites and setting response strategies, Samsung adopted the water resource management methodology suggested by the Food and Agricultural Organization (FAO), World Business Council For Sustainable Development (WBCSD), and the World Resource Institute (WRI). As a result of such risk analysis, five countries (where 12 subsidiaries are located) were identified as water-stressed countries, and this propelled us to set risk handling strategies based on the CDP Water guidelines (TABLE 12 &13).

Table 12: Performance Summary Of Samsung In Water Conservation

Metrics	2014	2015	2016
1. Water consumption (Kt)	74,684	2,414	104,253
2. Industrial water (Kt)	49,806	58,444	62,986
3. Municipal water (Kt)	23,659	32,830	40,147
4. Underground water (Kt)	1,219	1,140	1,120
5. Intensity of water consumption (t/KRW 100 million)	41	53	60
6. Wastewater discharge (Kt)	55,428	72,583	81,716
7. Reuse (Kt)	37,594	46,200	48,602
8. Rate of reuse (Kt)	50.3	50	46.6
9. Suppliers' water consumption (Kt)	327,638	134,733	-

Table 13: Global Water Resource Risk Analysis and Strategy by Samsung

Country	Type	Strategy
Korea	Physical risk (floods)	Create wetlands and dikes in response to floods affecting streams in the vicinity of our worksites; Purchase disaster insurance policies and regularly check flood control equipment
India	Physical risk (water quality degradation)	Increase the frequency of conducting in-house water quality analysis and the efficiency of water treatment facilities
Poland	Reputational risk (wastewater leaks)	Build an emergency response system and conduct regular drills in preparation for wastewater leaks
Egypt	Physical risk (droughts)	Secure water tanks to store water sufficient for one day operation of production facilities on average
South Africa	Regulatory risk (discharge)	Sewage and wastewater from worksites move to the terminal treatment facility within the industrial complex for processing, and thus pose lower risks of environmental accidents (no in-house sewage/wastewater treatment facility under operation)
Common	Physical risk (water quality degradation)	Secure water quality through the pre-intake water treatment process
	Physical risk (water outages)	Install dual water intake facilities and water collecting facilities to prevent production delays
	Regulatory risk (regulatory change in water use & discharge)	Abide by the in-house criteria stricter than country-specific legal discharge criteria
	Regulatory risk (enactment of efficiency standards)	Conduct water efficiency reviews in building new facilities and make facility investment to improve the water efficiency of existing facilities
	Regulatory risk (uncertainty over new regulations)	Continuously monitor global environmental regulations
	Reputational risk (lawsuits)	Monitor effluent discharge; Build an EMS for new manufacturers

3.3: Global standards for water stewardship and risk analysis

Global initiatives have helped to formulate methods for assessing risks and water conservation practices. A six-step methodology advocated by the European Water Stewardship Standard; the Alliance for Water Stewardship Standard[18,19] is the basis for water risk and mitigation practice internationally (TABLE 14).

Table 14: Water Stewardship Standard Metrics

1.	Commitment to assess risks
2.	Water inventory of site-specific water balance data, an inventory of water challenges and an understanding of water conveyance and treatment systems
3.	Water risk assessment to carry out a generic water risk assessment, coupled with a detailed local source vulnerability assessment
4.	Water risk mitigation plans (WRMPs) to develop plans required for both internal and external mitigation
5.	Implement and monitor WRMPs to deploy plans, including internal actions and external engagement, tracking progress
6.	Communicate performance to report on progress, both internally and externally

Big business groups are partnering with many organizations such as World Wildlife Fund (WWF), USAID, United Nations Development Programme and Global Water Challenge on programs to advance water stewardship. Corporate companies have pledged to increase water use efficiency in manufacturing sites and down supply chain and promoting partnerships with a range of actors[20]. The types of projects

1. Improve safe access to water and sanitation (includes installing wells, water storage facilities, purification and septic systems).
2. Protecting watersheds (includes conserving or restoring water quantity or quality).
3. Provide water for productive use (includes efficiency projects such as rainwater harvesting or water reuse for irrigation).

Assessing water vulnerability is an important domain of activity for global companies to sustain water stress in sites at different locations. Companies are partnering with the World Business Council for Sustainable Development (WBCSD) and the World Resource Institute (WRI) to assess the water stress level through the WRI's Aqueduct tool. Plants based in India were complemented by the assessment using the specific India Water Tool. Indian water tool Version 2 (IWT2.0) is an online tool for companies to understand water related risks and prioritize actions toward sustainable water management[21]. WRI's Aqueduct risk mapping tool helps in knowing where and how water risks and opportunities emerging worldwide[22] (TABLE 15).

Table 15: WRI's Aqueduct risk mapping tool

Indicator	Low (0-1)	L-M (1-2)	M-H (2-3)	High (3-4)	Extremely high (4-5)
1. Inter-annual variability	< 0.25	0.25-0.5	0.75	1.0	>1.0
2. Seasonal variability	< 0.33	0.33-0.66	1.0	1.33	>1.33
3. Flood occurrence	0-1	2-3	4-9	10-27	>27
4. Drought severity	< 20	20-30	40	50	>50

Steps in water conservation include minimizing use, reuse and recycle water as much as possible. Directing used water in the manufacturing process at one place into retention ponds so that it can be re-directed back into another process where high-quality water is not a required. Some of technological approaches towards water conservation are- 1. Maximising the use of treated effluent through Filtration, Ultra Filtration and Reverse Osmosis. 2. Variable frequency drive for optimization of pump operation. 3. Use of low faucets to reduce water consumption. Reverse Osmosis using different kinds of membranes is an efficient technology. However, high energy cost, variability in feed (treated effluent) characteristics, high cost of membranes and skilled manpower for operation are some challenges faced in adoption of the technology.

IV. CONCLUSIONS

The study concludes that corporate companies should explore more possibilities in the areas of development of water use efficient technologies, conservation techniques at all stages of operations, cost-effective desalination of sea water thereby saving the fresh water resources of the area and implementing rainwater harvesting facilities at all locations. Minimizing water use and withdrawals to minimize the stress on local water sources, which in turn helps lessen the risk that, in times of drought, local water sources may be depleted beyond carrying capacity. Companies should identify site specific risks and plan mitigation programmes to continue the operations,

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