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Editorial.....

Dear Readers

Greetings from CIMR

In the month of January 2020, Chetana's Institute of Management and Research conducted a conference on the Theme – ‘**A Water Secure World**’ and invited participation from academia, industry experts, and management students. In the issue of March-2020 few conceptual and empirical research papers related to the effective usage of water, use of technology in water management, quality monitoring mechanisms, treatment and reuse of wastewater, and industry support required to mitigate the global water crisis were published. In this issue of September -2020 papers on water management including artificial intelligence, mental stress, and green HR practices in organizations, are published.

United Nations advocacy of Sustainable Development Goal (SDG) for 2030 gave paramount importance to water and was captioned as – *Goal-6: To Ensure access to water and sanitation for all*. Moreover, ‘*P21-Framework of 21st Century Learning*’ was also suggested to incorporate themes like ‘Environmental Literacy’ in the academic curriculum. With this aim, the institute sought to introduce management students and faculty to ‘Environmental Literacy’ with regards to water. The conference ignited the spark in all academicians and students to write research papers and generate knowledge resources about this immensely important subject matter.

In this issue, various articles cover the entire gamut of the theme, ‘A Water Secure World’. Artificial Intelligence and Machine Learning can predict the usage of quality water for human consumption, agriculture, industries with a higher level of accuracy. An in-depth discussion on how the change of product design will reduce the usage of water in industries, as it is an important ingredient of cosmetic and personal care products was studied. While hiring people across industries if HR managers consider the values and sensitivity towards preservation of environmental resources, then future employees recruited will try to use water resources judiciously. The pro-environment behavior must be developed through training, appraised systematically and should be rewarded in the organization.

The importance of water therapy as a remedy to reduce mental stress was highlighted. The use of simple devices like Faucet and Shower Aerators optimize the water consumption, yet there was a dire need of creating awareness about such products in urban households’ setup. An interesting feasibility study on virtual water trade in the context of ‘India’ addresses the important question “If we exchange commodities and services, why not exchange virtual water?”

I sincerely thank the CIMR Management Team who took the lead in the endeavour of 21st Century learning goals and organized the conference. I thank CIMR and CRKIMR Conference team who worked very hard for the conference. My special thanks to the authors for their intellectual contributions to the theme. I express my sincere gratitude to the reviewers’ team for their valuable contribution to improving the quality of research papers. The publication of all these articles disseminates knowledge and sensitizes the society for use of water resources.

Dr. Mrinali Tikare

September 30th 2020

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Developing Behaviour for the Environment through Green HRM

¹ Dr. Mahesh Luthia and ² Dr. John Evar Strid

Abstract

With Corporate Social Responsibility (CSR) becoming an integrated aspect of business Green Human Resources Management (GHRM) is gaining significance as a practice related to strategic management. However, little research exists on how GHRM contributes to developing awareness among employees on environment issues. Based on existing literature and research, this conceptual paper attempts to define 'GHRM' and outlines various practices that are integrated into this approach. The paper proposes that GHRM facilitates a developing awareness among employees towards environmental issues and helps encourage pro-environmental behaviour among employees. Based on stakeholder and social exchange theory, the paper discusses mechanisms that firms can use to recruit employees with aligned values, use training and development to further develop skills, appraise employees and reward them for adopting pro-environment behaviours so that they contribute to the environment goals of the firm. Finally, the paper makes recommendations on practices that can be adopted by firms to create awareness on water management among their employees and future research areas.

Keywords: GHRM, CSR, Water Security, Water Management, SHRM

1. INTRODUCTION

Environmentally conscious practices such as energy conservation, energy efficiency, and water security are trending issues that planners are focusing on to create a sustainable future. Sustainability campaigns

can achieve the desired result if intellectual capability and social integration among members of the society were utilised (Sodiq et al., 2019). Corporate involvement can aid these campaigns, develop a culture supportive of sustainability, and integrate Corporate Social Responsibility (CSR) initiatives

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into business habits. Green Human Resources Management (GHRM) can play an important role in creating a strong organisation culture around core values, foster open communication, and educate employees on CSR programs and encourage them to actively engage in community activities (Nancy, 2004). Implementation of sustainability requires a strategic shift, through major set of actions and a transformation of thinking beyond just sustainable practices (Landrum & Ohsowski, 2018).

HR professionals can support organisations in designing sustainable practices, such as GHRM that can make important contributions to the success of an organisation by communicating values that support long term interests (Meisinger, 2007). For organisations to achieve ecological sustainability, they need to understand how GHRM practices can inspire eco-friendly behaviour among employees, which then would also have a positive impact on organisation performance (Emilisa & Lunarindiah, 2020). A recent stream of studies (Jabbour, Santos & Nagano, 2010; Renwick, Redman, & Maguire, 2013; and Donohue & Torugsa, 2016) have developed a conceptual framework and tested it empirically to establish the positive effects of GHRM practices on environmental management. However, only limited research examines how Human Resource (HR) professionals can embed practices to create awareness on water security and address the key concern of water as a scarce resource.

1.1 Need of the Study

Nowadays more and more organisations are taking a proactive approach on implementing sustainability practices and integrating environmental management in their strategic plans. GHRM practices can play an important role in helping the organisation to achieve these environment objectives. The study outlines how GHRM practices support environmental performance and management and develop pro-environmental behaviour among employees to help

organisation for effective water management.

1.2 Objective of the Study

The objective of this research is to present a synthesis of existing conceptual and empirical findings to:

- a) Outline the concept of Global Human Resource Management
- b) Examine how GHRM practices can enable organisations to sensitize their employees towards environment issues and stimulate pro-environmental behaviour (OCBE) for water management.

The contribution of this paper is to draw together HR practices related to Environment Management, identify some best practices related to creating awareness on water management and lastly outline future research areas in the study of GHRM focusing in particular on Indian firms, a field for which only limited research exists. More specifically this paper addresses the following key question: Can HR play a pivotal role in sensitizing employees to contribute to green initiatives and in particular to creating a water secure world?

2. METHODOLOGY

To achieve the review of prior research the researcher used the archival method common to the field of study (Jabbour *et al.*, 2010; Renwick *et al.*, 2013; and Donohue and Torugsa, 2016). The review process involved systematic review of published articles in peer reviewed journals, available through Emerald Insights, EBSCO, JSTOR, Proquest, and Sage Journals, in addition to white papers and case studies on GHRM, CSR, environmental management, water management, water conservation, and other related areas. The researcher also examined organisation behaviour theories to provide theoretical foundation to the

HR practices that could help in developing a sound conceptual framework.

3. LITERATURE REVIEW

3.1 GHRM

Environmental management has emerged as one of the key areas of management research. Millman and Clair (1996) were pioneers in exploring the role of GHRM in environmental management. Their “Model of Environmental HRM practices” outlined the importance of human resources as an enabler for implementing a strategy to manage environmental issues. From a strategic management perspective, the HR function faces huge pressure to meet stakeholder expectations and respond to environmental issues. These pressures have broadened the scope of HR functions to also include external stakeholders’ social and environment concerns. The findings of Jackson & Seo (2010) and Millard (2011) have established a positive link between GHRM environmental management practices and financial performance and helps create a workforce that is more environmentally aware (Renwick et al., 2013).

According to Renwick, Redman & Maguire (2008), the integration of corporate environmental management into human resources is termed as GHRM. Mampra (2013) defined it as “the use of HRM policies to encourage the sustainable use of resources within business enterprises and promote the cause of environmentalism which further boosts up employee morale and satisfaction” (p.1273).

Opatha & Arulrajah (2014) defined GHRM as “policies, practices, and systems that make employees of the organization to adopt green initiatives for the benefit/welfare of the individual, society, natural environment, and the business” (p. 104). Kar and Praharaj (2017) defined Green HR as ‘the contribution of HR policies and practices of a corporate agenda for preservation and protection

of natural resources (p. 47). They suggested utilizing employee interaction and engagement to create awareness, increase commitment to environmental stewardship, and inspire sustainable practices. Ultimately, GHRM entails the adoption of policies aimed at promoting sustainable use of resources within an organisation and at promoting general environment sustainability in order to benefit all sections of society (Sardana, 2018). Hence, we suggest that GHRM should be viewed as a set of innovative and proactive Strategic Human Resources Management (SHRM) practices that sensitise employees towards environmental concerns and which aim at developing employee development, motivation, and engagement and facilitate pro-environmental behaviors (Paille et al., 2014).

Various studies have examined the role of human resource practices aimed at enhancing firms’ environment performance (Paille, Chen, Boiral, & Jin, 2014; Renwick, et al., 2013; Wagner, 2013; Renwick, Redman, & Maguire, 2013, Wehrmeyer, 1996) and have been able to provide empirical and conceptual evidence for a relation between GHRM and environmental practices.

Paille et al. (2014) also established a positive link between SHRM and Organizational Citizenship Behaviour for the Environment (OCBE), describing how SHRM helps to foster an environment which directly involves employees and makes them ‘willing to cooperate’ with the firm by adopting behaviour beyond the job description to benefit the environment. Daily et al. (2009) defined OCBE as “discretionary acts by employees within the organization not rewarded or required that are directed toward environmental improvement” (p. 246). Paille et al. (2014) suggested SHRM influenced employees’ attitudes and behaviour through promoting pro-environmental behaviours which serve as a mechanism to reach environmental objectives.

4. THEORETICAL BACKGROUND

SHRM and the more narrowly focused GHRM take on an important role in developing practices to address ethical and social concerns, including the environment. These human resource measures draw on stakeholder theory (Freeman, 1999), which helps us to understand how human resources within businesses can function while offering guidelines for best practices based on moral and philosophical principles.

The theoretical background to explain how GHRM can foster pro-environmental behaviours embedded within OCBE can be found in the social exchange theory (SET). This theory provides an explanation for the rationale of obligations that are generated through interaction between individuals and their reciprocal interdependence. Organisational research has used this theory extensively to explain how HR can enhance employees' engagement and commitment. SET provides a strong theoretical support to describe changes in voluntary behaviours of employees through the use of SHRM/GHRM. According to SET, employees reciprocate voluntarily to demonstrate more environmentally friendly practices, support environmental causes, and suggest initiatives when they receive strong support from their leaders. When leaders encourage and help employees, they can have a positive influence on behaviour. Social learning theory also underpins claims that green training enables organisations to heighten awareness on environment issues. SHRM/GHRM practices can impact employees' behaviours and help firms achieve environmental objectives (Renwick *et al.*, 2013). Hence based on stakeholder theory, SET, and empirical evidence, we propose that GHRM facilitates the sensitisation of employees towards environmental issues and develops pro-environmental behaviours.

4.1 The Importance of GHRM

The most important methods to develop employees' awareness of environmental concerns among must involve, empower and engage them. HR professionals can facilitate organisations' design of sustainable practices and encourage personnel to actively engage in CSR activities (Lockwood, 2004). Furthermore, HR make an important contribution to the success of an organisation by communicating values that support its long-term interests (Meisinger, 2007).

GHRM facilitates the recruitment, education/training, and motivation of employees so they conduct themselves in an environmentally responsible manner. Such an approach also enhances a firm's public relations and corporate image (Shrivastava, 1995). GHRM can help develop competencies among employees not just in large firms but also small firms. Such an approach can motivate employees to commit themselves to environment issues and implement some unique approach to address environmental concerns (Paillé *et al.*, 2014).

4.2 Green Hiring

Recruiting and selecting the right employees is an important function of GHRM (Lok & Chin, 2019; Guerci, Longoni & Luzzini, 2016; Renwick *et al.*, 2013). Identifying employees who are prepared to commit themselves to environmental concerns is the starting point for HR to engage with employees on environmental issues and identify pro-environmental behaviors. Renwick *et al.* (2013) further suggest that green practices support the employer branding process as the potential applicants feel that their values are aligned. Recruiting employees that are willing to engage in environment management will enable firms to engage employees in environmental preservation and understand the organization's environmental goals and implement the environmental programs (Yap Peng Lok & Chin, 2019).

In order to develop pro-environmental behaviours among employees to manage water resources, specific criteria for each functional department can be translated in responsibilities and action plans which later be evaluated during the performance appraisal process (Kar and Praharaj, 2017). Including environmental protection related to the tasks, duties and responsibilities in a job description would not only demonstrate the organisation's commitment towards the environment but also help the applicant to identify their particular responsibilities within the position to protect the environment (Datta, 2015; Arulrajah, Opatha, & Nawaratne, 2015). As part of the recruitment process, HR must design induction programs in a manner that will allow new entrants to be able to clearly understand the environmental culture in the organisation and take-up issues such as water and energy conservation, waste management and other environmentally responsible practices (Cherian & Jacob, 2012; Datta, 2015; Deshwal, 2015; Kar and Praharaj, 2017). Hence, firms must focus on identifying potential applications who believe in the need to manage water resources and also are willing to extend their commitment. Such values can then be re-enforced and shaped through effective training programs as a part of the induction and ongoing personnel development implemented through HR.

4.3 Green Training

Training is considered as the most powerful intervention to heighten awareness on social and environmental issues among employees. Training programs can be used as an effective mechanism to generate 'eco-literacy' and create awareness of the organisation's environmental goals. These programs support skill development through increased employee awareness of green issues in general and of best environmental practices specifically (Roy & Thérin, 2008). Environmental training programs help firms develop employees' knowledge base and capacity to implement green practices. Because of

the knowledge that these programs impart, employees can implement learned environmental skills and adopt sustainable practices as a part of their daily work routine (Lok & Chin, 2019).

Apart from sensitizing and educating employees and changing their practices, these training programs can help modify their underlying attitudes and external behaviours throughout the organisation. Carefully designed and implemented training programs can provide specific knowledge and pointers on aspects such as health and safety, energy efficiency, managing waste, and recycling of scarce resources. Without appropriate training, realising environmental objectives would be difficult and hence green training should be integrated into the learning process of the organisation (Arulrajah, Opatha, & Nawaratne, 2015; Donohue and Torugsa, 2016). With CSR activities being integrated in a firm's activities, training programs could enable employees to become socially responsible, manage potential resistance to CSR activities, and develop stronger employee commitment. HR can focus on team learning and act as a facilitator to promote sharing of ideas, opinions and encourage employees to conceptualise ideas to secure scarce resources (Mtembu, 2019). Since training has a positive impact on the willingness of employees to adopt sustainable behaviours (Pellegrini, Rizzi & Frey, 2018), it can serve as a powerful tool to sharpen employee awareness of socially relevant issues such as recycling of resources.

In order to genuinely modify the employees' mindset and institutional behavior with respect to environmental goals, the learning and development programs must go beyond the boundaries of developing job-related competencies and focus on the development of pro-environmental behaviours (OCBE). Training programs must include environment issues such as water management, recycling, energy conservation, etc. and must cover a wide

range of topics related including business risks of not adopting environmentally sustainable practices. Training should be a mechanism to promote green policies and procedures and support companywide initiatives on specific issues such as managing and conserving water effectively which this paper will focus on as an example. Green teams can be formed to monitor and identify ways to reduce water usage. Awareness of simple practices such as monitoring sink faucets and toilets for leakage could be communicated (Jackson et. al, 2011; Kar and Praharaj, 2017). E-learning online and web-based training programs can be used as a training mechanism for creating awareness on water conservation and management (Datta, 2015; Deshwal, 2015). In manufacturing firms, the top management can involve employees to suggest innovative ways to implement water recycling reduce usage and manage effective disposal of water waste. Through training programs, a feeling of ownership can be created to manage water effectively across the organisation.

4.4 Performance Evaluation

Motivating employees to commit themselves to environmental issues and evaluating performance in the implementation of best environmental practices are some of the biggest challenges that HR faces. Green performance appraisal (Renwick et al., 2013), involves evaluating employees for their environmental efforts; environmental performance evaluation undertaken by employers can encourage employees to pay attention to environmental issues.

Feedback within the appraisal system can provide a strong mechanism to improve pro-environmental behaviours (OCBE) among employees. If employee reviews do not provide adequate and related feedback, training on any issue would lose its effectiveness (Govindarajulu and Daily, 2004). For example, HR can provide feedback to employees on how they have achieved goals related to water

conservation and what else could be done in future to further achieve goals. To support the organisational goals related to water management, training by itself may not serve as an entirely effective mechanism. Performance review, compensation schemes, feedback systems, and increased visibility with the senior management can complement training programs and improve employee commitment to water management (Perron, Coté and Duffy, 2006). An employee's contribution to create awareness of and familiarize peers with water conservation can be included as a key job performance area and assessed as part of the appraisal program. This recognition will help encourage water conservation and other environmental goals, enhancing learning and prompting employees to integrate environmental sustainability into their daily job activities (Datta, 2015; Deshwal, 2015).

Evaluating implementation of environmental criteria in job descriptions during the appraisal process would help place emphasis on a green culture within the organisation and reward employees who have implemented effective action plans, for example, through adopting effective practices to reach water conservation goals (Kar and Praharaj, 2017).

4.5 Compensation and Rewards

A well-designed compensation strategy can reinforce and further motivate employees towards environmental responsibility (Govindarajulu & Daily, 2004). Compensation and rewards are a fruitful way to motivate employees to demonstrate pro-environmental behaviours and help HR to boost employee morale. Employees feel that their efforts are rewarded (Antony, 2018). However, limited research provides evidence of a positive link between compensation and environment management practices. Organisations can consider both economic and non-economic rewards to motivate employees to adopt water management practices. As part of the GHRM strategy a variable component for adopting some

best practice related to water management could be linked to increased pay or financial rewards for strong ‘eco-performance’ (Jabbar and Abid, 2014; Kar and Praharaj, 2017). In general, such extrinsic rewards can serve as a strong mechanism to motivate employees’ opinion of a firm’s eco-initiatives and encourage their implementation. They contribute to employees’ self-esteem and recognize their efforts. Such rewards can motivate them to become involved in problem solving to achieve environmental goals (Jabbar and Abid, 2014).

However, many firms have not directly incentivised support for environmental goals with pay and rewards. In the past, emphasis has often been on non-monetary rewards and recognition (Govindarajulu & Daily, 2004; Renwick et al., 2013). For example, some organisations reward employees for possessing knowledge and practice concerning environmental legislation and goals through some sort of internal recognition within the firm. Such non-economic rewards and recognition programs for water management would not only motivate employees to adopt these practices, but encourage other employees to adopt them. Such rewards could recognize creativity and initiative in adopting water conservation. For an example, Hindustan Petroleum Company Limited India (HPCL) has identified “water security” among the top global risks in terms of developmental impact and has deployed a ‘4R’ approach to monitor water consumption and identify opportunities for water conservation. The 4Rs stand for Reduce, Reuse, Recycle and Recharge and encourage a comprehensive approach to water management. HPCL has created ‘Sustainability Awards’ as part of their program to recognise employees who have adopted best-in-class practices in refineries and marketing locations for water consumption. The company has executed its employee awareness program on water management initiatives through contact programs, newsletters and technical bulletins. In addition to employee aware-

ness programs, they also conduct stakeholder engagement sessions on a regular basis. More companies can use such awards to generate public recognition of green efforts of individuals and demonstrate the commitment of top management to environmental goals (Deshwal, 2015).

In addition, peer to peer recognition programs can be designed to allow employees to promptly recognize and appreciate colleagues for their adopting water management techniques. As part of an employee engagement program, a small video clip or an article in the in-house newsletter featuring employees and the best practices they adopted to reduce, re-cycle and re-use water resources can be showcased thereby potentially inspiring other employees to follow their example. Other examples of recognising employee contribution towards managing water effectively could be displaying the employee on a ‘wall of fame’, awarding them with green mugs, and involving employees in green contests. During a green week in the workplace, short presentations could be organised on examples of how employees have conserved water.

These compensation and reward efforts can provide a sound foundation to favour the positive impact of HR practices in creating awareness and developing pro-environmental behaviours (OCBE) among employees. The studies of compensation and rewards have made a major contribution to the development of a framework for GHRM and clarified the positive outcomes that it can achieve.

5. RESULTS AND DISCUSSION

Through GHRM, HR professionals can make a positive impact on sensitizing employees to the achievement of green objectives through recruitment, training, appraisals and pay processes. Selecting the right candidates who align with the firm’s environmental goals, training employees on sustain-

nable practices, and rewarding them for adopting right attitudes and engaging in environment management all can contribute to the intergration of best green practices into a business and develop pro-environmental behaviours (OCBE). GHRM can encourage a reflective approach to improve organisation learning and create awareness on social issues. HR professionals have a significant role in building organisational capabilities and developing organisational citizenship behaviours to support change in economic, social and environmental perspectives to develop a new competitive advantage (Rimanoczy and Pearson, 2010).

6. CONCLUSION

The existing literature on GHRM reveals how the different conceptualisations contribute different perspectives to practices to implement environmental management and increase performance to meet environmental goals. The body of literature suggests that adopting Green HRM practices can contribute to creating awareness of environmental issues and stimulate pro-environmental behaviour (OCBE). These sorts of initiatives require commitment starting from top management and continuing down to every employee in the firm. Specific GHRM practices can help firms incorporate green objectives into their business, thereby creating the internal culture neccesary to achieve them. For example, a business can use specific GHRM policies to create awareness on reducing, re-cycling and re-using water. Social exchange theory (SET) lays the foundation for the positive effects of GHRM practices on environmental attitudes and behaviours. Through effective training, the setting of position specific environment expectations, a performance review precedure that takes into account the realization of these expectations, and the implemenation of a motivational reward program GHRM can mould employees' attitudes and behaviours to encourage them to meet environmen-

tal objectives. Firms must focus on meeting stakeholder expectations as part of their business obligation and give environmental issues such as water security a top priority.

The study has some limitations, in that it only examines the functional dimension of GHRM practices and their impact on employees' environmental attitudes and behaviours. Other considerations such as those related to team work and leadership and how they relate to environmental implementation could also be included. The present study does not consider regulatory and other stakeholder pressures related to environmental practices which firms face. In the future, empirical studies could be conducted to test relationships between GHRM practices and OCBE specifically focusing on water management. Additional studies could be conducted to explore the effect of this relationship mediated by institutional factors such as regulative pressure (Kang & He, 2018). In the current climate, businesses face many critical environment issues for which they must develop strategies if they are going to be remain competitive. To do this, they need to go beyond mere greenwashing public relation strategies and actually implement realistic enviromental goals. For example, water security is an example of one of the most serious enviromental problems. For this reason, it is a good example of the most important domains for future research to examine how HR can change it practice to evolve into GHRM, making HR a fundamental strategic partner to support the continuing viability firms in a world crying out for increased effort to preserve the environment.

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Artificial Intelligence in Water Management

¹ Harish Chandar and ² Tanaj H. Savalgi

Abstract

In the field of technology such as Computer Science, Robotics, Engineering and as well as in Medicine and Economics “Artificial Intelligence” is being used predominantly. According to the studies, it has been observed that the approach of Artificial Intelligence gives almost accurate predictive results for real-time data such as linear and non-linear, or other systems. The adaptability and scalability of AI/ML spans several categories of functions. The following paper is based upon the use of Artificial Intelligence for Water Management.

Keywords: Artificial Intelligence, Water, Big Data, Machine Learning

INTRODUCTION

One of the most important things that is needed for human beings to sustain life is Water. The need for effective and efficient Water Management has not changed over time. Nowadays water utilities are equipped with data driven technologies that allow them to extract information about water supply that has been previously undiscovered.

Software provided by Artificial Intelligence, is one of the newest tools that has been assisting in smart water management. Earlier software support used

complex programming and algorithms to derive outputs or decisions by narrowing the available choices. The new tools of Artificial Intelligence are changing these methods and techniques. Due to the ability of Artificial Intelligence to adapt and process large amount of data, it is considered as an ideal tool for managing water resources in an ever changing environment.

Nowadays water utilities have two choices: seek new supply to deal with resource volatility, or optimize current usage within the available supply. Water utility managers can create dynamic strate-

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gies, tactical and financial operations for their utilities by using Artificial Intelligence, new software-as-a-service platforms, as well as low cost sensors and affordable communication networks. Also the Municipalities can build and execute a better plan based on the requirements of capital projects, understand the real-time water loss, operate distribution of networks more efficiently by considering the ever increasing demands from customers. Artificial Intelligence unleashes the power of imagination of water professionals. For example Artificial Intelligence can be used to automate the inspection of sewer systems or the accuracy of meters.

PROBLEMS RELATED TO WATER MANAGEMENT

People need fresh and clean water for personal care, agriculture and industrial uses.

The report generated by “The UN World Water Development” in the year 2019 says that, about 4

billion, which roughly represents two-third of the world population is experiencing severe scarcity of water. Along with the rising demand for fresh and clean water, the quality and supply of water is deteriorating. From around the world, Arid Regions are mostly facing the issue of scarcity of water resources. In such regions the access of fresh water from lakes, or rivers as well as ground water is very limited. The regions which are mainly facing the issue related to water scarcity are Mexico, Northern and Southern Africa, The Middle East, India, and Northern China. Economic Scarcity of Water applies in the areas, where there is lack of financial resources as well as human capability to invest in water resources and meet local demand. After observing the statistics related to availability or access of water, the next issue is of water quality which reduces the amount of water for consumption, sanitation, agriculture, and industrial purposes. Acceptance of water quality depends on the intended purpose of water. For example, water that is unhealthy for the consumption of human beings can still be used for industrial or agricultural use.

PROBLEMS AND ISSUES

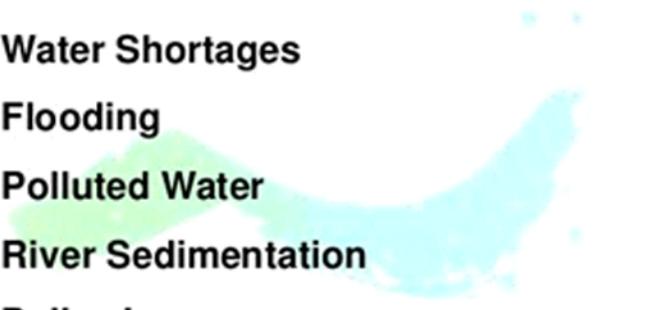
- 
- 1) Water Shortages**
 - 2) Flooding**
 - 3) Polluted Water**
 - 4) River Sedimentation**
 - 5) Policy Issues**
 - 6) Legal Issues**
 - 7) Institutional Issues**

Fig. 1.

The above diagram shows the list of issues and problems related to Water Management Globally.

UNICEF states that non harmful physical qualities of water, such as colour, taste, and smell could cause water to be considered as poor quality and deemed unusable by its users. However, issues like water pollution and water quality deterioration are mostly contributed by the lack of proper waste water treatment. Day by day the quality of water is getting reduced due to the reason that, most of the collected waste water is returned to the surface water directly without treatment. Another reason for the degradation in water quality can be, the compromised networks required to bring the waste water to the treatment plants. It is estimated that due to limited pipe network to collect and transport waste water, about 15% of China's waste water treatment facilities are not being used.

CAN WE USE ARTIFICIAL INTELLIGENCE IN WATER MANAGEMENT?

Water flowing through taps and pipes is not the only reason for wastage of water, another reasons such as inefficiency in utilities of water management by current population is also equally responsible

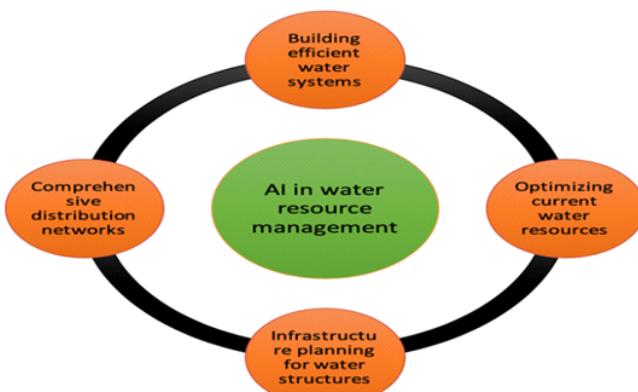


Fig. 2.

for wastage or rather unnecessary excessive water consumption. Due to the increased number of techniques/campaigns such as "Smart Water" and "Digital Water" Artificial Intelligence has come into picture and at the top most level.

The above figure describes the advantages of Artificial Intelligence in Water Management. We can make use of Artificial Intelligence in water management if we have proper statistical data from previous records. Such a set of data is termed as Big Data. In the next section we will discuss about what Big Data is.

WHAT IS BIG DATA?

Big Data refers to the huge amount of data generated all over the globe at higher rate. The data could be of two types either structured or unstructured. Big Data is so complex and large in size that none of our traditional databases can store that data. It is a field that is used to analyse, extract information or deal with datasets that are very large in size and complex that cannot be handled by traditional database storage software. Capturing the data, storing the data, data analysis, visualization, updating and data source are the challenges involved in Big Data. Data that are Multidimensional can also be represented as OLAP data cubes or as tensors. A set of Techniques and Technologies is required in Big Data along with new forms of integration to reveal insights from datasets that are diverse, complex, and of a massive scale.

Constantly creating data by means of social media, business applications, telecom and various other domains, generates Big Data. To facilitate the growth and development Big Data Analytics is been mainly used by the Companies. There are various tools that can be used for processing Big Data such as, Hadoop, Hive, Pig, Kafka, etc. It all depends on what the requirement is of an organization.

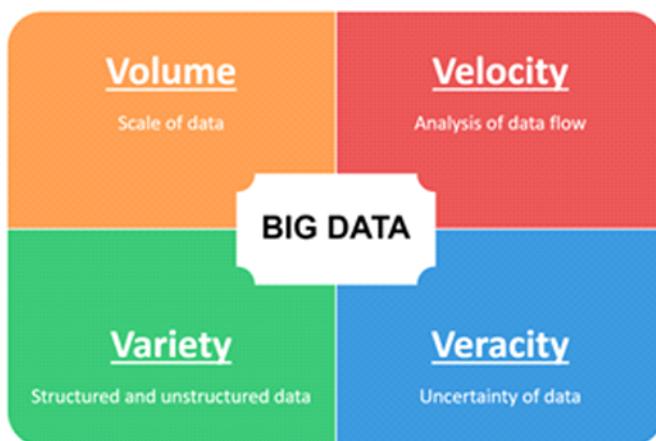


Fig. 3.

The above figure shows the description about characteristics of Big Data.

Volume: It represents the quantity of data stored.

Variety: It represents the nature and type of the data.

Employee_ID	Employee_Name	Gender	Department	Salary_In_lacs
2365	Rajesh Kulkarni	Male	Finance	650000
3398	Pratibha Joshi	Female	Admin	650000
7465	Shushil Roy	Male	Admin	500000
7500	Shubhojit Das	Male	Finance	500000
7699	Priya Sane	Female	Finance	550000

Examples of Big Data

Typically a big Stock Exchange as shown can create several Gigabytes of data (1000's of Gigabyte) per day.



Fig. 4.

Velocity: It represents what is the actual speed the data is being stored and processed in order to meet the challenges of growth and development.

Veracity: It represents the value and quality of data.

Unstructured Data

A data which is not organized in fixed format is known as unstructured data. A heterogeneous amount of data having various simple text files, images, videos, etc. The output returned by Google search is an example of unstructured data.

Structured Data

A data that is stored, accessed and processed in a fixed format is known as Structured Data.

A classical Aeroplane as shown in the figure ,if it is air borne for about 30 minutes can easily create 1000s of Tera Bytes of Data which can usually grow to more than this number with several flights in a day.



Fig. 5.

WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial Intelligence is a technical approach to make a computer, a robot, or a product to think like how humans think. It is the study of how does human brain think, learn, decide and work, when it comes for solving the problem. And the final output of this study is intelligent software systems. The main aim of AI is to improve computer functions related to human knowledge like reasoning, learning, and problem solving. Statistical methods, computational intelligence and traditional coding are the approaches that are involved in AI.

Artificial Intelligence has the capability to handle and work with large amounts of datasets. It also has the ability to learn along with new and improving technology by improving itself with each and every new set of data that it processes. Due to all these abilities Artificial Intelligence is considered to be the best option for dealing with everyday scarcity of entity like water. The typical definition

Artificial Intelligence

Any technique which enables computers to mimic human behavior.

Machine Learning

Subset of AI techniques which use statistical methods to enable machines to improve with experiences.

Deep Learning

Subset of ML which make the computation of multi-layer neural networks feasible.

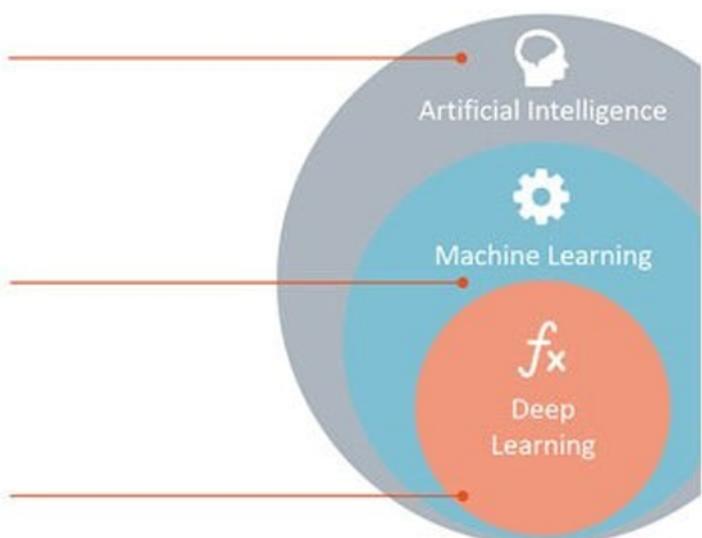


Fig. 6.

APPLICATION OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence in Healthcare: Now a days, to make faster and better diagnosis than humans companies are using machine learning and Artificial Intelligence. One of the examples of this is IBM Watson. This system understands natural language and gives response to questions asked. Artificial Intelligence is a study to emulate human intelligence into computer technology that could assist both, the doctor and the patients.

Artificial Intelligence in Education: Artificial Intelligence helps to assess students and adapt to their needs, helping them work at their own pace.

Artificial Intelligence in Business: Highly repetitive task normally performed by humans are now being made possible with the help of Robotic Process Automation. Chatbots are the example that are incorporated in to e-commerce websites to provide immediate service to customers.

How to use Artificial Intelligence and Machine Learning in Smart Water Management?

In the previous sections we have learned about what

is Big Data, what is Artificial Intelligence and its Applications. Further discussion will be purely focused on how we use AI in smart water management and what are its main areas of concern in which it can be deployed. Artificial Intelligence in Smart Water Management can be used in various ways. The use of AI in water management depends on the areas in which it is mainly needed. In India and in general, the main area of concern related to water management is the Water Quality and the Quantity of Water. This is a matter of concern as water is used in many ways such as, for human intake, agriculture, industries and many more. First we will focus on the issue related to Quality of water.

Quality of Water

The purity of water, the nature of water ie:- toxic or nontoxic and other such parameters play a big role in water management. Using advanced techniques such as Internet of Things along with AI and ML, it is possible for us to create significant head way as far as water quality is concerned. A quick proposal from our side to help alleviate this issue is as shown in the figure below.

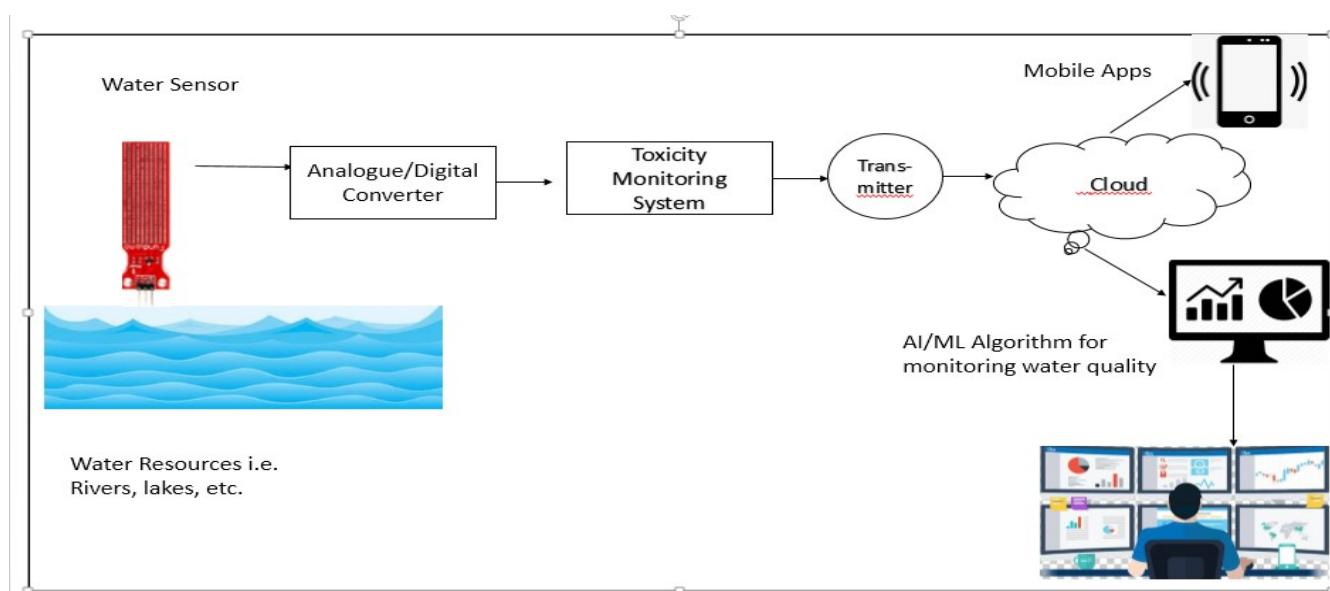


Fig. 7. Monitoring quality of water

The above diagram shows how the quality of water management should be improved by making use of Artificial Intelligence and Machine Learning. Detecting and Improving quality of water means to identify what type of chemical pollutants, toxic waste are getting mixed in water and by what amount. From this we can make out the level of toxicity in water. This can be made possible by making a system that uses Artificial Intelligence and Machine Learning. There must be an IOT sensor in water sources like, rivers, lakes, etc. The analogue signals generated by the sensor will be converted to digital signals by using Analogue to Digital Converter, the Digital signals will be fed then to the Toxicity Monitoring System that will check the quality of water depending upon the signals provided by the sensor. By using the Transmitter

that particular data will be transmitted to Cloud and from cloud it will be made available to Computers and Mobile Platforms that uses the Artificial Intelligence and Machine Learning Algorithm to Analyse and Predict the quality of water and then the Concerned Authorities can Monitor the Quality of Water that is being supplied to the people and can do the process of Quality Control in Water Management.

After managing the issue of Water Quality, the next big issue that comes into picture is Quantity of Water. Along with Quality of Water it is also important to know how much amount of water is wasted in a day so that the appropriate quantity of water can be supplied in a particular area as per the usage.

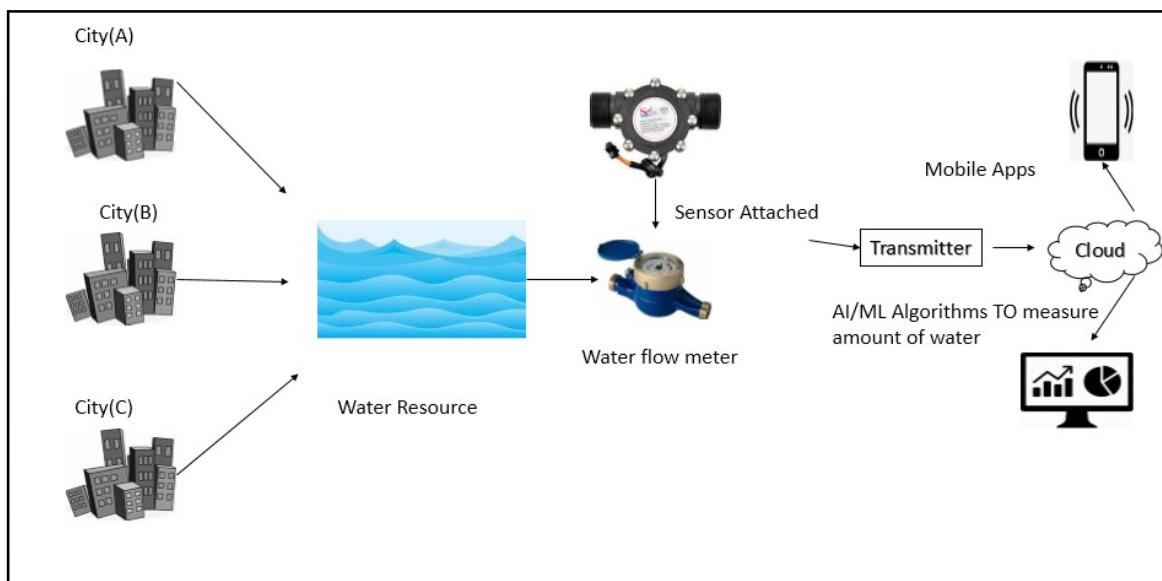


Fig. 8. Measuring quantity of water using Artificial Intelligence

The above given example shows how Artificial Intelligence can be used in managing the quantity of water supplied. Different amount of water is supplied to different areas that include both local houses as well as industries and factories. Survey of all these areas must be made in order to generate Big Data that is to be processed using different

algorithms in Artificial Intelligence and Machine Learning. After the Big Data is generated, it is fed into the Quantity Monitoring System and with the help of Transmitter this data is transmitted to Cloud, and further it is given to the system that has the Algorithm that uses Artificial Intelligence and Machine Learning. This Algorithm predicts how

much water is being wasted on daily basis and accordingly supply of water can be controlled.

So far we have discussed major issues related to Water. In the next section will discuss how Artificial Intelligence can be used in the field of Agriculture to control supply of water required for the crops.

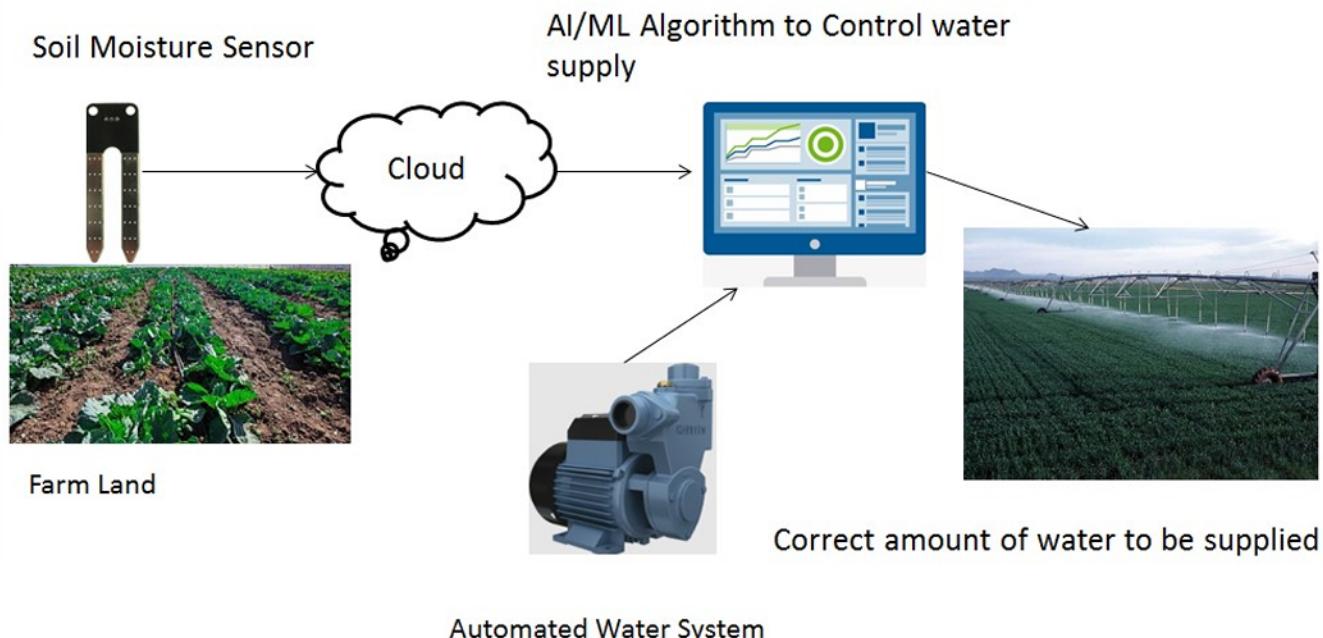


Fig. 9. How to use Artificial Intelligence to manage waste water for agriculture

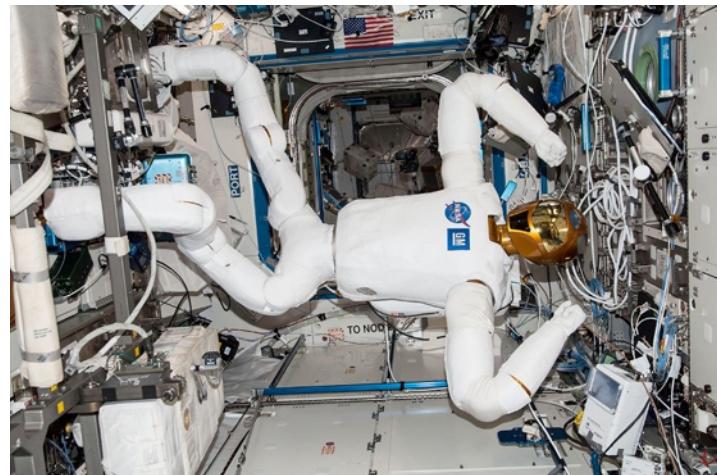
The above figure shows application of Artificial Intelligence in the field of Agriculture. In this application we make use of IOT sensor such as Moisture Detection Sensor. This can be used to sense the amount of moisture in the soil and can analyse and give prediction about how much water must be used for Agriculture in order to maintain proper moisture in soil.

FUTURE SCOPE

As we all know about the significant discovery of water on moon, while on the other hand if we find water on Mars it will be a green signal for humans to live on another planet instead of Earth. Although Mars has similar limitations as that of moon when it comes to Atmospheric Pressure. As compared to Moon Mars has atmosphere but the atmospheric

layer is very thin and light to trap Water Vapour. The sulphate rich soil beneath the ground was discovered by the Mars Rover Spirit that suggests the past presence of liquid water. We can make use of Technology like Artificial Intelligence and Machine Learning for detecting life/water on Mars and Moon. The Algorithms used in Artificial Intelligence and Machine Learning will Analyse and Predict the presence of Water on Mars and Moon.

In future this could be made possible with the help of robots. Instead of sending Human Beings or Astronauts to Mars and Moon we can send Robots called as Robonauts to detect and analyse the presence of water on Mars and Moon.



The application of Robonaut can be made possible by using Machine Learning as the Robonaut can adapt the capability to think for itself in space just like human beings. After reaching Mars or Moon the Robonaut will analyse the surface and detect the presence of water and also can predict the life possibility for human beings on Mars or Moon.

In conclusion , Water Management using AI/ML is one specific and dedicated use , the range and extent of AI/ML is limitless, the limits are imposed perhaps only by human knowledge and imagination.

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A Review of Changing Product Design in Cosmetic Industry, a Step towards Water Conservation

¹ Dr. Athar Qureshi and ² Dr. Jayashree Bhakay

Abstract

Water is an important ingredient of the cosmetic and personal care products. These products contain anywhere from 70-80% water as their base ingredient. Water is also part of the manufacturing process in the cosmetic industry. Another dimension is at the consumer end in the industry, where the use of personal care products leads to consumption of water. The world is edging towards an acute water crisis. Reports have suggested that we might face a 40% gap in water supply by the year 2030, if we do not improve the way we use and manage water. According to the World Water Council, the water crisis is about the management of water and not about having too little water to satisfy our requirements. The crisis is not just affecting people but it is impacting the environment globally, including businesses. The industry has started responding and addressing its share of responsibility in the mitigation of the global water crisis. One such initiative is the response from the cosmetic industry in particular. There have been efforts aimed at changing the product design, where by making the beauty and personal care products waterless. Research has been done on the use of various ingredients which can act as substitute for water. Innovation and use of technology are leveraged to ensure the quality of product remains uncompromised while addressing sustainable development. There have been efforts in the area of governance, where many of these companies have come forward, volunteered and have shared their data around water footprint. The businesses have engaged in water stewardship. These efforts have enabled the policy makers to design better strategies for sustainable development. By changing the product design, there is a slow but a considerable shift demonstrated by the cosmetic industry in addressing the water crisis. A step the industry has taken towards water conservation.

Keywords: Anhydrous Cosmetic Products, Cosmetic Industry, Product Design, Sustainability, Water Footprint, Water Stewardship.

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LITERATURE REVIEW

A review of various literature sources on water in cosmetic products, cosmetic industry, sustainability and water stewardship was undertaken in order to formulate the paper. This paper is an attempt to review the changing trends in product design undertaken by the cosmetic industry for conservation of water. The paper also highlights the rise of conscious consumerism within the cosmetic consumers, especially awareness around environment and health (Nora & Csaba; 2019). There is a steady demand to replace water with organic and natural alternatives in the formulation and in the production process of cosmetic products (Global Data's Q4 2016 Survey; 2016). We have also attempted to highlight the constructive steps taken by various players in the cosmetic industry to address the consumer demands. Several industries have taken additional steps towards sustainability, paving way for the concept of water stewardship (WWF Brief; 2013) and have formulated guidelines and strategies to reduce their water footprint. Both in letter (policies) and in spirit (product design). Sustainability is not just defined in the context of judicious use of resources or saving the environment but is reflected in the context of a sustainable product design. The paper refers to published sources of information available in the public domain and is an attempt to present best practices and understand responsible business behaviour. No primary research was conducted but the paper provides opportunities to conduct primary research on Strategic Business Decisions, Consumer Buying Behaviour, Conscious Consumerism etc.

INTRODUCTION

Water has been used by the cosmetic industry since years because it's cheap, it's a universal solvent and a pH balancer. Water also is considered as a heaviness-cutter in comparison to other ingredients

available as base for cosmetic use. Thus, water is used in the preparation of virtually every cosmetic and personal care product. Most beauty products contain anywhere between 60-85% water, especially the creams. Lotions may contain up to 90% water and shampoos, gels, and toners contain close to 95% water. Water is labelled as aqua (INCI, 1970), on the cosmetic products and is always listed at the top of the ingredients list. The water used as cosmetic product ingredient is called process water. The monitoring of the quality of water used as ingredient in the cosmetic products is guided by the good manufacturing practices outlined by the FDA. The Indian Drug and Cosmetic Act, 1945 (amended in 2016) also lays down guidelines for water usage for the pharmaceutical and cosmetic companies. Water is not just an essential ingredient in the products manufactured by the cosmetic companies, but also used in the manufacturing process. Manufacturing processes often requires thousands of litres of water to clean, refresh and process products; this is called 'virtual water'. From the consumer's side, the use of personal care products also leads to water consumption.

ACTIVITIES OF THE GLOBAL FORUM

In 2012, around 53% of companies reported having experienced water related impacts in the last five years. Around 68% identified water as a considerable risk to their business. According to the World Economic Forum's Global Risk Report, water supply has emerged as one of the top five global risks (in the last seven years) affecting economic growth in the future. The United Nations (UN) recognises 'Water' at the core of sustainable development and has included it in the United Nations Sustainable Goals (SDGs) 2030. Under the SDG 06, the UN recognizes the need of reducing the number of people without sustainable access to clean water (and sanitation). It also emphasizes on efficiently using and managing water to mitigate

the growing demand, to annihilate threats to water security and climate change.

CONSUMER ACTION AND CONSCIOUS CONSUMERISM

The global movement for water consumption has created awareness amongst the consumers. Consumers are becoming aware to this global climate change-related problem and have started evaluating their purchasing choices. There is a trend of environmental and health awareness seen in the consumers. They are questioning the efficiency of production methods, the use of natural resources in manufacturing process, the impact of the product on the environment and initiatives adopted by the companies to mitigate the harm to the environment. According to GlobalData's Q4 2016 Survey, only one in four global consumers are actively buying water less beauty and grooming products or products which can be used without water. Around 39% consumers claim to be interested in such products but not yet buying them.

INITIATIVES OF BUSINESS INDUSTRY TO MITIGATE THE WATER CRISIS

The Industry in its response has started intensifying its efforts on water conservation. Some businesses are already using their skills and resources to lead initiatives that will create a more water-secure future. They are generating new revenue streams from water-smart technologies and reducing operational risk by efficient use of water. Some have extended their social responsibility, through Corporate Social Responsibility (CSR) funds to replenish the depleting ground water table, promote water harvesting and creating awareness around overuse of water. The Cosmetic Industry has also taken cognisance of the water crisis and initiated processes and ingredients that ensure products limit their dependence on water. Apart from the sustainability

aspect, water serves as a good medium for the growth of micro-organisms. Preservatives are added in order to increase shelf life of water based cosmetic products. Reduction of water footprint in products would aid to reduce the use of synthetic chemicals and preservatives. This would enhance the results leading to better skincare. Drawing inspiration from this idea, several brands have started designing water less beauty solutions.

Way back in 2008, the industry leaders realized that the profitability and the viability of their business in the long run depends the right quality and quantity of water available. The future of the business also depends on availability of water at the right place and time to meet the requirements. This interest by the business community caused the creation of WWF's Water Stewardship Programme in 2008. Water Stewardship for business is defined as "a progression of increased improvement of water use and a reduction in the water-related impacts of internal and value chain operations" (WWF; 2013). It is also a commitment to the sustainable management of shared water resources in the interest of the public. It emphasises on the collective action and participation of various stakeholders. Organizations like the World Business Council for Sustainable Development (WBCSD) have developed the Global Water Tool and India Water Tool for carrying out water risk assessment. The project helps businesses to move from water risk assessment to the implementation of collective response strategies. Some of which include the responses at the watershed level, sharing of best practices and helping the business to lead by way of joint valuation exercises. CDP also encourages the businesses to participate in multi-stakeholder dialogues.

Companies have participated and established transparency and accountability around their usage of natural resources as part of the best practices governing their business. Companies have volun-

tarily engaged in assessments by third part organizations. Water Footprint Network (WFN) has devised an assessment tool which quantifies and maps water footprints, assesses the sustainability, efficiency and equitability of water use and identifies which strategic actions should be prioritised in order to make a footprint sustainable. CDP runs the global environmental disclosure system and supports businesses to measure and manage their risks and opportunities on water security and other issues. CDP considers that companies that measure their environmental risk are strategically in a better position to manage their water footprint. It adds that transparent businesses who follow the good governance practices such as; information disclosure or sharing data are aiding the policy makers to devise evidence base action plans to mitigate the water crisis.

NEW PRODUCT DESIGN

Water Stewardship definition is undergoing a transition and is focusing beyond CSR. Water stewardship is mostly risk-focused and does not tie up to business strategies. Also, stewardship manifests itself in collective action and conservation programs via corporate partnerships with NGOs. These tactics in themselves create value and positive impact, however, they are not enough to compel significant corporate investment of resources. Corporate resources are typically committed to those initiatives that build brand value, drive revenue and reduce operating costs. Stewardship can reduce costs through improved social license to operate and improved business continuity.

Many cosmetic brands (especially the ones promoting organic and vegan products) have replaced water by essential oils or botanicals. Though most of them not necessarily created with the environment in mind, they have improvised the products to use less water and indirectly benefit the water

conservation process. Anhydrous Cosmetic Products as they are called, have shown better skin penetration and results. Brands like Frudia, May Coop, Peach & Lily, The Lotus and Whamisa, already feature anhydrous products or substitutes of water in their product lines. Kaiderma Skin Care products (Mariner Biomedical, Inc., California-USA) also have the anhydrous range of products. The latest entrant is 'aN-hydra' a new waterless skincare brand from Canadian beauty product manufacturer Susanne Langmuir. Cosmetic brands are also adopting alternate strategies in product development. They are developing concentrated formulas, two in one products, rinse-less hydrous solutions and solid bars.

Driven by a mission to conserve water, Pinch of Colour, a USA based cosmetic company started manufacturing water-less products since its inception in 2016. The efforts to achieve water conservation and sustainability went beyond the water-less products and translated in philanthropic partnerships with; Healing Waters Organization, Clean Water for Children and Ekenywa. It creates awareness about water conservation by sharing tips for the same with the consumers on their website. The company continues its efforts in reducing its water foot print and creating a sustainable planet.

The global cosmetic leader L'Oréal developed a 'Water Policy' and has pledged to commit to 60% reduction in water consumption per finished product by 2020. To achieve this, the company is directing its efforts into a multipronged approach. This approach involves respectful use of the resources which are minimised as per the needs. The company has also focused on water reuse and recycling projects at their sites. In 2018, the company has achieved around 48% reduction in water consumption. Through its Water Policy, the company pledges its commitment to fostering water stewardship. It is also committed to optimise water consumption

in its operations and reducing its water footprint. The brand has also started aligning their efforts with the UN SDGs and innovating with new technologies throughout their products' life cycle. A recycling system was installed in the L'Oréal plant located at Spain in 2016. The treated water is reused for the plant manufacturing process requirements such as cooling and washing of equipment's. The plant reduced its total water consumption by 15% in 2016 as compared to 2015, and by nearly half compared to 2005.

Unilever Ltd. has aligned its targets with the UN SDGs in the 'Unilever Sustainable Living Plan' (USLP). These targets directly address the risks and opportunities in the markets. The company measures the consumption of water by the consumers while using their products. Managing the water added to the products during the manufacturing process is also the part of the USLP. The company has initiated 4,000+ water management plans, which are implemented along with its suppliers and growers with an aim to address water quality and quantity. By the end of 2018, the company had achieved the target desired for 2020. The amount of water abstracted by their factories was cut down by 44% per tonne of the production since 2008. They have managed to save 22 billion litres of water each year as compared to 2008. In 2018, Unilever launched its 'Love Beauty and Planet' range which uses fast-rinse technology in its conditioners. 'Domestos Flush Less' was launched by the company in 2018 in response to the acute water crisis in South Africa. The product, which is a toilet spray can not only disinfect but also eliminates odours by targeting the odour causing micro-organisms. 'Day 2' is another innovative product by the company. It is a dry spray that can be used on garments and washing can be avoided. This helps to save time and water in between washes and also increases the life of the cloth.

Stop the Water While Using Me! is a cosmetic brand from Germany. It has printed its message and brand name on its products. They also started a campaign called "Be a # WATER LOVER, my friend" on the occasion of the World Water Day. The company has initiated the 'Good water projects', where it donates a share of their revenue thus aiding projects that provide fresh and clean water in areas that need them the most. Vapour is a cosmetic brand from New-Mexico and reflects its commitment to living in harmony with nature and respecting natural resources. Sustainability is an ever-evolving conversation according to the company and the company evaluates its choices on an ongoing basis. They are located in Taos, a dry desert terrain and water is recognized as a limited terrain. Around 97% of products manufactured by Vapour are water-less formulations. The lips and cheek products of the company are 100% waterless. The Showerglass limited edition with the quick rinse technology under the Pantene shampoo range was launched by Procter & Gamble (P&G). The new technology enabled shampoo requires just five minutes in the shower. The company also innovated the packaging. The shampoo package includes an hourglass which allows the consumer to time their shower. These unique and innovative features have helped the consumers take shorter showers and save water. Emami, an Indian cosmetic brand has also launched a waterless face wash under its grooming segment. The product replaces water with Aloe Vera and minerals from marine extracts. It helps to clean and hydrate the face and eliminates the need for water for cleansing.

CONCLUSION

Water plays an important role in the world economy. Apart from human consumption and agriculture, large quantities of water is used for cooling and heating, in the industry. Water is an excellent (universal) solvent for a wide variety of substances

both mineral and organic and thus finds an extensive application as product base, especially in the cosmetic industry. The industry, one of the principal stakeholders in sustainable development has been instrumental in mitigating the water crisis faced globally. The focus is both on the industries of the developed economies as well as the developing economies. The cosmetic industry has demonstrated their willingness to participate in the conservation of water and has began addressing it from the sustainability view point. Identifying water related impact on business the industry has been slowly transforming the way they are doing business. The change in the product design has been the key to this transformation. The concept of water-free beauty and personal care products has become the cornerstone of the new age cosmetic products. Water has been substituted with various essential oils or botanicals, which have been found to eliminate the risk of microorganism growth, are more potent as well as provide better penetration and take care of the skin. Research and innovation to find means to minimize the use of water in the products and adopting alternate strategies in product development such as concentrated formulas, two in one products, rinse-less hydrous solutions and solid bars have been successful both from the cosmetic view point as well as delivering an environmentally sustainable product. The companies have also started engaging the consumer by creating awareness around the water free product and have applied behaviour change communication models that address the consumption of water while using the personal care products. Measures adopted for minimising the use of water during the manufacturing process has shown positive results in water conservation. Reducing the water footprint has become the hallmark of governance and a key indicator for a successful and responsible business. Responsible business is now seen beyond the social responsibility of the company and beyond the engagement with the consumers or community at

large. Brands like Pinch of Colour, L'Oréal, Unilever Ltd., Stop the Water While Using Me!, Vapour, Procter & Gamble (P&G) and Emami have demonstrated Water Stewardship. They have developed stellar products which can reduce the water footprint and address sustainable development without compromising on the product quality or their brand image. In fact, restructuring or changing the product design, by moving towards anhydrous (water free) products, by embracing efforts that lead to water-saving and providing consumers with greater transparency on the sources of water used, these cosmetic brands have become the crusaders of sustainable development.

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Water Treatment for Reducing Mental Stress

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Abstract

Aim: To find out various water treatments that are being used for reducing stress and effects of the same. **Methodology:** by surveying scholastic write-ups, publications, and alternate origins, appropriate to the specific field of study. The investigation should account, explain, compile, impartially assess and make the earlier study clear.

Keywords: Stress, Water Therapy

LITERATURE REVIEW

Knowles (2016) states that a lot of people can completely acknowledge the extent to which an unwinding body-wash is able to assist them, to relax subsequent to a tense day. Actually, a lengthy bath in the bathtub is frequently to remove unpleasant feelings, a day's hurt and sufferings, related to both, the mind and body. However, a lot of people are unaware of the healing treatments by water – the application of aqua removes both, suffering and tension and is in fact an acknowledged arrangement

for relieving tension, and is indeed a frequently recommended medical care from the National Health Service.

Actually, the healing properties of water belong to the very distant past of a native or inhabitant of prehistoric Greece when it was applied to heal a diversity of disorders related to medicines and spirit, from addiction to habitual sleeplessness, from the disease, causing painful inflammation and stiffness of the joints to the disease of an abnormally high body temperature caused by rheumatism.

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A native priest of Bavaria, Pastor Sebastian Kniepp, is ascribed as the person who founded healing treatment by water. He became fully aware in the remote past i.e., in the nineteenth centenary that people were able to remain healthful by doing away with refuse in their physical existence - letting go the infections through the application of water at high temperature.

This present day, the external application and healing treatments of water are recommended for both, depression and pure bodily sickness. It is frequently the finest method to assist the public with issues of ability to move freely and easily to make one tension free and enhance their span of motion.

Few human-beings advocate inner healing treatments also with water. It includes the application of particularly treated aqua to clean the large intestine of accumulated faeces that few persons trust to be damaging to the general well-being.

Exterior Healing Treatment by Water: Advocates of this optional arrangement of relieving suffering and stress, assert that at the time of experiencing suffering or under excessive tension, the pressure of the blood goes up and the pace of heartbeat competes.

Normal healing treatments by water frequently include just gliding on a surface of a moderately hot water in basin or bathtub. It brings relaxation to inflated links and ends the strain in the physique that happens at the time of suffering or stress. The fundamental principle of healing treatment by water is: to greater the extent it is done, the gains will be greater.

Advocates of exterior healing treatments by water assert that in a period of initial 300 seconds of therapy, patient's pressure of the blood reduces and

he or she experiences more peace. Additional treatment enhances flow and distribution of blood and makes bands or bundles of fibrous tissue in his/her body sense little stress.

Accompanying added therapy, they assert that the patient's resistance to disorders indeed starts to become better, he or she experience improvement in general, and the patient possesses an enhanced resistivity to tiredness. In consideration of the persons with particular disorders like impaired muscle coordination and/or other disabilities, typically caused by damage to the brain before or at birth, the healing treatments of water frequently provide a feeling of independence and wellness that may be possibly absent in their daily existences.

Further, in case it is not adequate, uncompromising admirers of healing therapy by water state that with frequent therapy, the person can appear improved also, as contaminations are cleansed from the patient's physique causing his / her skin colour markedly improved.

Kinds of Healing Treatment by Water: Patients can feel healing treatment by water in various manners for relieving tension with ease and efficiency. They involve:

In-house body wash: Patients can carry out their body wash with moderately hot water, including smooth and viscous body-wash liquids, therapy with aromatic plant extracts and essential smooth and viscous liquids, etc. Thereafter they can unwind. Wax sticks lightening is an option.

Steam-Bath: Patients apply of high temperature at non-wet condition to cleanse small apertures on skin and to lessen and disappear tensions of the day.

Hammam or body-wash associated with history of the Ottoman Empire: Patients trying to attain high temperature water, that a steam-bath performs in an unlike kind of surrounding.

Sitz body-wash: Patients wet one of the lower extremity of the leg below the ankle in a bucket of aqua at high temperature and another in a bucket of water at low temperature, thereafter shuffle the feet in the buckets. It is useful for a swollen vein/s in the region of the anus and issues related menstruation like Pre Menstrual Tension.

Body-wash in quickly rotating volume of water - typically caused by the meeting of conflicting currents: water globules of air cause this moderately hot body-wash additional unwinding.

National Health Service therapy: Consecutive to hurt or shock, because of particular illnesses, General Practitioners recommend two parts in direct contact or collective work-out program in a tank with moderately hot water.

Interior Healing Treatment by Water: It is a separate subject totally. Further, it is recognized as “colonic hydrotherapy” or “colonic irrigation”, it is frequently applied to heal particular colon issues like a condition of difficulty in emptying the bowels, usually associated with hardened faeces, too much accumulation of gas in the alimentary canal, Irritable bowel syndrome, a swollen state caused by retention of fluid or gas and continuous pain in head, that are frequently noticed to be attached to excessive tension.

This mode of healing treatment by water applies decontaminated and sterilized aqua that frequently has been cured with cleaning natural inorganic substances, and distinctive tube/s. The aqua is softly guided into the large intestine and thereafter permitted to leave, cleaning out refuse material,

remainder relating to faeces, gaseous fluids, related to mucus and further collection of waste that has accumulated within the large intestine.

Numerous persons having healing treatment related to colon by water earlier return for therapy again, stating that it assisted them to give up heaviness, and experience revival and rejuvenation.

Fault-finders of this optional healing treatment, nevertheless, state that it is not necessary and can in fact be damaging to the well-being, because watering related to colon removes essential microorganisms while it is removing refuse matter. Patients may attempt to go through hydrotherapy and observe.

Further traditional healing treatment by water is globally acknowledged as an advantage to nearly everybody, because it affects building people's existence with reduced tension by way of harm-free methods totally related to nature.

In case any patient is doubtful, he/she may move himself/herself fast in a high temperature body-wash at the close of the day for seven days, and observe to what extent he/she experiences improvement. He/she might be quite cheerfully taken by a surprise.

Rapolienė, Razbadauskas, Sàlyga, and Martinkënas (2016) conducted a study with an aim to examine consequences of the natural inorganic substance aqua, having excessive-quality of being saline related to internal heat of earth on tension and tiredness. Methodology: One hundred eighty mariners were selected in random manner into 3 classes: Related to internal heat of the earth (Sixty-five), pleasant sounds (fifty), and command (sixty five). The class related to internal heat of earth was treated one hundred eight grams per litre, degree of being saline aqua body-wash related to internal heat of earth for fourteen days, 5 times per 7 days. Basic

result was influence on tension and tiredness. Subordinate result was the influence on ability to perceive, state of mind, and physical suffering. Outcomes: The betterments after the treatment of disease by bathing in mineral springs were declining in count along with magnitude of tension-associated signs, there was also a decline in physical suffering and generic, bodily, and mind related tiredness, and a betterment in tension-associated signs administration, state of mind, process of making active, inspiration, and ability of perceiving with influence extent from eight tenth to two and three tenth. In the pleasant sound treatment class, there were important affirmative alterations in the count of tension signs, magnitude, state of mind, physical suffering, and action with the influence extent of four tenth to one and one tenth. The scholars did not notice any important affirmative alterations in the regulated class. The comparing amidst the classes displayed that the treatment of disease by bathing in mineral springs was better to healing treatment by pleasant sounds and without therapy class.

Inferences: The treatment of disease by bathing in mineral springs is advantages for reducing tension and tiredness in contrast with pleasant sounds or without treatment class. Body-wash by aqua with the internal heat of the earth has an ability to decrease tension generated by occupation or life circumstances.

Shaw (2009) states the connection between water and reducing the tension. In case anybody is searching an easy method to relax from his/her existence full of tension, he/she may attempt the following: consume aqua from a drinking container. It may be quite simple, but the connection of aqua and decreasing tension is thoroughly recorded. Every organ of our body, even our brains, require aqua to perform appropriately. In case anybody loses large amount of water, his/her physique will not perform appropriately and it can result into tension.

“Studies have shown that being dehydrated by just half a litre can increase your cortisol levels,” states Amanda Carlson, RD, director of sports nourishment at Athletes’ Performance, a coach of the sports-persons among the best on the earth.

“Cortisol is one of those stress hormones. Staying in a good hydrated status can keep your stress levels down. When you don’t give your body the fluids it needs, you’re putting stress on it, and it’s going to respond to that,” Carlson informs WebMD.

It means that consuming more than adequate aqua throughout twenty-four hours may not wondrously bring about the person’s monetary issues, children’s difficulties in academy, and timelines in occupation to vanish. However, in case the person is previously tensed by confronting with every of these conditions, he/she does not require the extra tension of abnormal loss of water from body in addition to his/her stress.

“You’re actually likely to get more dehydrated when you’re under stress, because your heart rate is up and you’re breathing more heavily, so you’re losing fluid,” says Renee Melton, MS, RD, LD, director of nourishment for Sensei, a builder of networked and mobile mass reduction and nourishment schemes. “And during times of stress, you’re more likely to forget to drink and eat well. Just getting enough fluids helps to keep you at your best during times like these.”

Tension and Water Deprivation: Interrupting the Round: Tension is able to generate deprivation of water, and deprivation of water is able to generate tension. This is an evil circle. Anybody is able to interrupt it by increasing additional aqua drinking into his/her 24 hours. “Stress can result in many of the same responses as dehydration — increased heart rate, nausea, fatigue, and headache — so if you can remain hydrated you can reduce the

magnitude of the physiological responses we have to stress,” says Trent Nessler, PT, DPT, MPT, M.D. of Baptist Sports Medicine in Nashville.

Keegan (2003) states the healing treatments to lower tension and worry. Quality of being creative in facing sufferers’ requirements is needed every day by the employees in intense and crucial attention settings. For the sufferers needing crucial attention, numerous optional and interdependent healing treatments inclusive of healing treatment by aroma, healing treatment by water, comedy, formation of mental images, the rubbing and kneading of muscles and joints, and pleasant sounds can be applied with success like complementary healing treatments to assist lowering tension.

Shortsleeve (n.d.) states aqua, in its each formations, is extreme largely curative and anybody is able to harvest the psycho-physical advantages in the cold season of the year also.

A person possibly has few loving recollections of existing close to aqua: the shore any person aged up, proceeding to the oceans any person engaged in snorkelling in on his/her vacation/trip taken when newly married, the pond towards the rear of the person’s father’s/mother’s residence.

There is a reasoning behind calmness experience from these recollections: Study displays that pictures pertaining to aqua can aid any person to bust tension and discover pleasure. Actually, a person living near the seashore is likely to be delighted and with more wellness than the people who are not living there. This is as per the European Centre for Environment & Human Health.

“Water makes you happier, healthier, more connected to other people, and better at what you do,” states Wallace J. Nichols, Doctor of Philosophy, the composer of written work, Blue Mind.

This creates perception. Human beings have applied aqua for its curing qualities for decades. Human physique is built up of sixty % aqua. “When NASA searches the universe for life, their simple mantra is ‘follow the water,’” states Nichols. “While you can live without love, go far without shelter, survive a month without food, you won’t make it through the week without water.”

Keeping Brain in contact with the Sea: The excellent method to consider specific occurrences to anybody’s mental processes at the time he/she is close to aqua is to consider in relation to specific things he/she is forgetting, states Nichols. Assuming a person strolling on the roads of an excessively occupied large town conversing on the mobile (automobiles, bikes, devices sounding a warning, alarms, and everything).

“You’re trying to listen to the conversation, but there’s other activity going on. Your brain needs to filter that out,” he states. “The physical stimulation of everyday life is enormous. You’re always processing, filtering, and calculating every sound and movement around you.”

Any person’s brain carries out each of these at extreme high pace that applies huge power, causing the person experience fatigue. Additionally, even at the time any person’s objective is to unwind in the gymnasium (at that place possibly the person watches television set) or at an occupied recreational play (at the place the person is encircled by loud, harsh and confused sound) the person is possibly yet getting a large number of stimulants. “Distractions can be physically and mentally stressful.”

At that time visualize walking away from each of those and existing by the sea. “Things are simpler and visually cleaner,” states Nichols. “Going to the water goes beyond distraction. It gives your brain

a rest in a way that the gym doesn't." Naturally, he includes that numerous entities are able to ease the person's exhausted mental state: pleasant sounds, creation, exertion, companions, favourite animals, natural world. "Water is just one of the best because it combines elements of all the others."

The advantages of aqua: Researches point out, that just existing near aqua is able to enhance degree of "feel-good" brain compounds (such as dopamine) and lower quantum of cortisol, the secreted tension compound, states Nichols. Few studies in addition points out that "ocean therapy" and periods expended in floating on the crests of the waves is able to contribute to reducing signs of post-traumatic stress disorder in ex-member of the armed forces. The advantages are enhanced in case any person have a good time on the ocean accompanying somebody immediate to him/her. "We find that people's relationships deepen-they connect more," Nichols states. Living with somebody in or near the aqua, he states, is able to enhance extent of oxytocin, a compound that contributes in faith-development. It aids the person to note a fresh story regarding his/her relations. "If your relationship is all about being in stressful, indoor situations, floating in the ocean can really make your relationship better."

In the existence of aqua, Nichols states any person's brain carry out other activities, also, such as "mind wandering". It is essential for creativeness. "You start working at different levels on the puzzles of your life," he states. It signifies understanding, "aha" instants (downpour of manifestations of divine), and innovations that don't regularly happen to the person at the time he/she is tense.

Restore the shore mentally: Even if a person is fixed in a large town entirely surrounded by land, or encountering a black, freezing cold season of

the year, there is yet feeling that something desired may happen. "Water in all forms can help you slow down, disconnect from technology, and shift your thoughts," states Nichols. "In the city or in the winter, float spas, tubs and showers, fountains and water sculptures, as well as water-related art can help you access the same benefits." These encounters are curative (they take the person's mentality and physique into a recovering form), Nichols states he/she is able to further stimulate beneficial recollections of earlier encounters with aqua, causing him/her to return to joyful location. His advice: "End every day with a quiet, hot bath as part of your winter wellness routine."

OBSERVATIONS & FINDINGS

Very wide range of water treatments are prevailing with various claims about their effectiveness.

CONCLUSIONS & RECOMMENDATIONS

Validity of the various treatments needs to be established through quantitative techniques so as to give objective basis to the claims.

Directions and indicators for policy makers need to be highlighted as mental stress is a social issue and cost effective remedies for it should be marketed and popularised.

Future scope of research can be regarding the public awareness about it and social media use to provide water usage for reducing mental stress and general well-being can be explored.

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Managing Water Security through Shower and Faucet Aerators in Urban Cities

*** Jitesh Parab**

Abstract

Water is not a commodity it is a life-making material. Over 2/3rd of our planet is water and over 2/3rd of our body is water. So where has it gone? It has not gone anywhere but it is not just where we need it. While various studies have focused on water conservation in the industrial setting, there is a limited no. of studies that examined water conservation behaviour at urban households in developing nations. This paper addresses the research gap by examining practical applications of Faucet and Shower Aerators for water management and also analysing perception among urban households in Mumbai. This research is an eye-opener to the fact that there is a lack of awareness and will to use a simple device like aerators.

Keywords: *Urban households, Faucet Aerators, Shower Aerators, Reduce, Water Conservation, Awareness, Mumbai*

INTRODUCTION

Water is the need of life, and is likely to pose the greatest challenge on the account of increased demand with population rise and economic development. Water use has been increasing worldwide by about 1% per year since the 1980s. Global water demand is expected to increase by 20 to 30% above the current level of water use, mainly due to rising demand in the industrial and domestic sectors (World Water Development Report, 2019). The National Institution for Transforming India (NITI Aayog) has declared that the country is “suffering from the worst water crisis in its history, and millions of lives and livelihoods are under

threat.” India is ranked 13th in overall water stress. It also has more than 3 times the population of the other 17 extremely stressed countries combined. To eradicate the problem of water crisis one can use 5 R’s formula i.e. Reduce, Reuse, Respect, Recharge and Recycle the wastewater. We can reduce the use of water through several mechanisms including water sensors, floats, and alarms. This study focuses on the individual water concerns towards saving water and the awareness about Aerators among people.

Aerators are a small attachment that can be inserted in an existing spout or can be fitted onto the end of the tap. Aerators are also known as flow

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regulators. Aerators act as a sieve, separating a single flow of water into many tiny streams that introduce the air into the water flow. These will control the amount of water that flows through the tap or shower without affecting the pressure as they mix the water with air.

Out of the number of benefits, the most obvious one is that the water usage drops precipitously, as it reduces water consumption. This will not only help the environment but will also cause the water bill to drop. Alpha Gala says that a typical tap throws up about eight litres of water per minute, but if the aerator is installed it will reduce it to about three litres per minute. (Nomita Devidayal, May 6, 2019).

While there are various studies which have focused on water conservation in the industrial setting, there are a limited no. of studies which examined water conservation behaviour at urban households in developing nations. This paper addresses this research gap by examining practical applications of Faucet and Shower Aerators for water management and also analysing perception among urban households in Mumbai.

REVIEW OF LITERATURE

The theory of reasoned action (TRA; Fishbein & Ajzen, 1975) explains the intentions of urban households to adopt practices that conserve water and use of appliances. TRA helps us to understand how intentions to save water result in the adoption of certain practices which are evident from the behaviour of individuals. The study was aimed at understanding user awareness and practices towards water conservation.

There are tools and systems to check your water usage. “You can install faucet aerators on your taps. If you use five litres of water for a shave, an aerator

could help you use just a litre or so,” said V. Srinivasan, 59, a civil rights activist who has been working in the area of water conservation and harvesting.

As a one-time measure aerators have been fitted in existing taps of Tejas Express (22119/22120) without any replacement or modification. Over 25% of water consumption has reduced because of this initiative, which is one of the significant steps towards water conservation. (Thai New Service group May 21, 2018)

“Water-friendly alternative products are a good idea. But the real purpose of the products can only be achieved when it is taken to the common people, including ones in rural areas. As of now, most of such products are sold with a commercial purpose and are not pocket-friendly,” commented J. Saravanan, a water expert based in Chennai.

As the aerator has been operating for more than 10 years the electric cost of the aeration system is 8.99 million Yuan per year. If we replace it with a new aerator the cost will decrease and will go about 8.09 million Yuan per year. Therefore 0.9 million Yuan will be saved per year. (Changqing Liu, Shuai Li, Feng Zhang, 2011)

METHODOLOGY

To gain a deeper understanding of the usage of aerators, a survey was carried out to gain perception.

After a project feasibility study, the city of Mumbai was chosen to conduct this research. The questionnaire method was followed to conduct the research, and to get a bigger picture, plumbers, and water purifier repairmen were interviewed. The individual survey reveals the consumption, availability, access and the outlook of people towards saving water.

Primary data was collected by circulating a Google form through emails and WhatsApp. Secondary data was collected through the research papers and articles published till date. 109 people were selected at random to conduct a survey. They were asked some basic questions. They were specifically designed to know whether people are concerned about the seriousness of the topic. Do they prefer saving water? To predict the average use of water by an individual. Is society aware of the advance technology which saves water? What techniques did they use to save water? Are they aware of this device called Aerators?

FINDINGS AND DISCUSSIONS

Various studies have examined efficiency appliances to have a positive impact on water savings within households, and have resulted in a reduced demand of water in residential areas. Awareness programs have an additional impact on the adoption of such practices and development of the right attitude towards conserving water (Lee, Tansel & Balbin, 2013). Lack of awareness on water saving aerators, and the resultant non-usage of them to restrict water consumption was the key issue identified. Lack of awareness on water-saving aerators resulted in 81% of the respondents not having installed such devices (Fig 1). 53% of the respondents (Fig. 2) were not even aware of such a device that could help them save water.

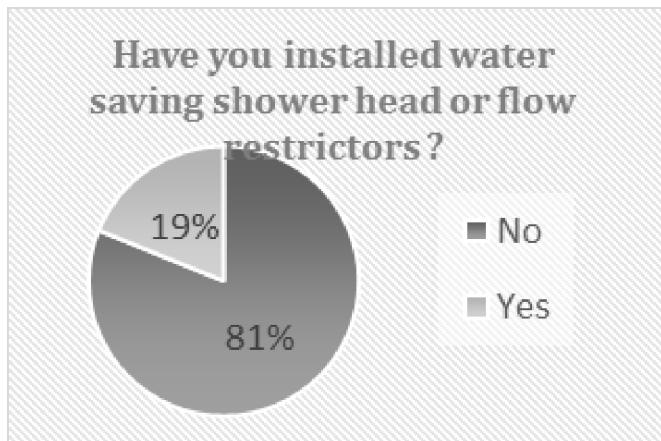


Fig. 1

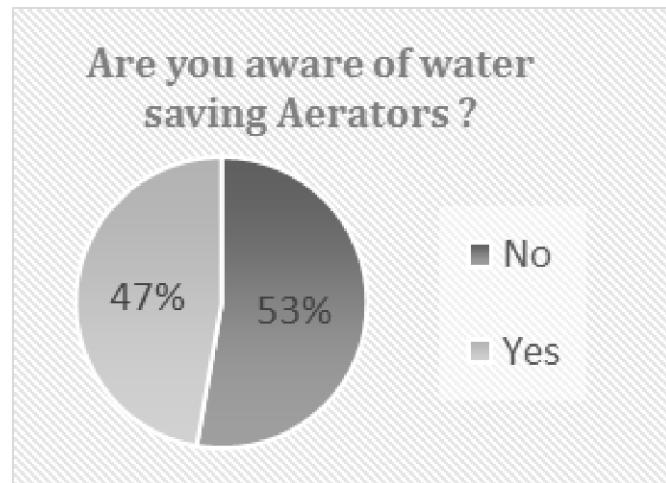


Fig. 2

Habits and rituals largely affect water conservation and hence little attention is paid to saving water or using technology that can reduce consumption. Additionally, lack of awareness results in not considering water efficiency while buying new products (Kelly, David & Fong, 2015). The traditional habit of using soap and water for cleaning hands after meals was a prominent practice among 52% of the respondents.

Water harvesting was not considered as a priority, which was evident as 71% of the respondents were not using any rainwater harvesting practice to save water for household applications.

The study also examined how individuals save water during daily chores. This practice can be attributed to frugality that encourages individuals to save resources. Frugality is a dimension of confusion

and high context cultures, which encourages members of society to control desires and act morally. Such cultures, give importance to savings, recycling, and conservation. Chang (2013) identified attitude toward frugality, as a key driver of an individual's behaviour towards water conservation. One of the most important findings which emerged was that 76% of respondents turned off water during shampooing and soaping themselves, 55% of them were turning the water off while washing vessels to save water, and 49% use a glass of water against running water while brushing their teeth.

The study draws attention that even though 75% of the respondents experience some water shortage there is little attention paid to conserve and recycle water.

IMPLICATION OF THE RESEARCH

Awareness of the user's water consumption and their use of devices was found to be limited with less than half being aware. Many households did have some favourable habits and practices to save water but a lot more such activities need to be done to conserve rainwater and use mechanism that can reduce the usage of water.

The research draws attention towards the importance of awareness programs on different means to reduce, re-cycle and re-use water for a sustainable future. This kind of climate change and depletion of resources, calls for a change in people's attitude and behaviour, towards saving this precious resource and make use of modern technology for water security.

Involving different segments and creating awareness on water aerators can have a huge impact on water management and largely benefit the environment. There is a knowledge gap that is affecting the

public's perception and attitude towards the treatment of water. It is a need to keep a buzz around the water issues of our country by sharing all the different statistics, along with increasing their knowledge and raising awareness. To spread awareness about the faucet Aerators the companies should design various campaigns that will create an impact on human minds. Not only the companies, but the government also should take part in promoting this device to eradicate the excessive use of water.

This paper only covers aerators which are used in faucet and showers, but there are also different types of aerators used for water treatment. They are not just limited to the urban areas but they are used in the agriculture fields and rural areas also.

Fountain Aerators: These are the aerators with special nozzles to produce a fine spray because of which they are also known as spray aerators.

Gravity Aerators: In gravity aerators, water is allowed to fall by gravity, such that a large area of water is exposed to the atmosphere, sometimes aided by turbulence.

Injection Aerators: To release fine air bubbles from the compressor unit these aerators consist of a tank with perforated pipes, tubes or diffuser plates, fixed at the bottom.

Even though people may be aware of aerators, very few of them are ready to spare a nominal amount on their own to install such devices. Companies need to come up with unique ideas which will create an impact on the final customers towards using the same. There should be more emphasis on the marketing of this device as making optimum use of water is the need of the era. Media (such as newspapers, TV, social media platforms, etc) can

be made use of, which will have a great influence on the perception of the public and will help to promote the device to reduce the use of water. Every new infrastructure tender which constitutes plumbing especially for water consumption must introduce compulsory norms for the inclusion of Aerators for faucet and showers. Companies, as a part of their CSR practices, act must include installation of Aerators thereby contributing to the cause

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**Virtual Water Trade:
An Assessment of Implementation Feasibility in India**

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Abstract

Policies and distinct steps are taken by nations facing water shortages such as India, China and Middle East Asia. The demand control techniques are identified with growing population and increased demand for food, water and insufficient supplies. As a profitable renewable water supply, Simulated Water has been embraced. Virtual Water must be treated as the need of the hour with Advanced Water Supply Management (IWRM).

The Virtual Water Trade (VWT) is the concept when commodities and services are exchanged, so is VW. When a country imports one ton of wheat instead of producing in its own country, it is saving about 1,300 cubic meters of real water. If this country is facing water crisis, the water that is ‘saved’ can be used for other means.

VW can be stated as water that is used for producing a commodity, not in the real sense, but in a virtual sense. The term virtual refers to the fact that at the end, the water which is not contained in the final product is the VW, also known as ‘embedded water’. External water is thus added on to a country’s ‘internal water’. For the quantitative definition of VW, principally two different approaches are proposed and applied till date. In one approach, the VW content is defined as the quantity of water that was used to produce any commodity. It depends on certain conditions, including place, time of production & water usage and its efficiency. Producing 1 kg of grains in a dry region requires 2 or 3 times more water than producing the same quantity in a humid region. In the second approach producer’s perspective is taken, and here VW is defined as the content of commodity where the quantity of water that might be required to produce the good at the required place is considered. This is especially important if the question is posed: what quantity of water can one save if one imports a commodity rather than producing it oneself? One relevant concept that is associated with VW is the ‘water footprint’. The worth of VW as an alternate water resource is extremely important basically for water short nations.

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This paper focuses on concept of worldwide VW trade. The paper emphasizes on analysing global status of V.W.T. & implementation of V.W.T at National & State level in India.

This research concluded that, after studying the worldwide scope of V.W.T there's an opportunity for the appliance of the VW concept at the national level and at state level taking under consideration, water endowments, and other natural and social economic conditions. We've also examined the worldwide statues of V.W.T across different nations and have located some essential factors required for successful V.W.T in importing counties. The VW trade seeks ways to consciously and efficiently utilize the internal and external water sources to alleviate water crises. Research also shows that V.W.T is already being practiced at an inter-state level in India.

Keywords: VW, VW Trade, Water Management, Food Security.

INTRODUCTION

Tony Allan first coined the VW definition, also referred to as embodied water, in 1993. It is the freshwater content needed for a food to be produced. A hamburger, for example, needs around 2,400 VW litres. During the entire process, from growing feed crops for the cows, to slaughtering and processing the meat, water is needed. Food is the primary source of consumption for VW.

As food and other items are sold globally, they are accompanied by their water footprint within the form of VW. When land is not a limiting factor for food production, VW trade within or between nations is sometimes seen as an alternative option to water transfers. The largest gross exporters of VW worldwide are the USA, China, India, Brazil, Argentina, Canada, Australia, Indonesia, France and Germany, and thus the largest gross importers of VW are the USA, Japan, Germany, China, Mexico, France and the Netherlands. In North and South America, South Asia and Australia, the most important net exporters of VW are located. North

Africa, and thus the Middle East, Mexico, Europe, Japan, are the most important net VW importers. Researchers from Anna University, Chennai, quantified the volume of VW trade in India in a recent study in November 2019. Between 2006-2016, the study measured differences in total trade and found that India exported an average of 26,000 million litres of VW per year. The best food item in terms of exports were rice, followed by buffalo meat. India exported VW amounting to 496.98 trillion litres during the 10 years studied, and imported 237.21 trillion litres.

LITERATURE SURVEY

In order to sustain life, fresh water is an essential source. As a result of recent Sustainable Development Goals (SDGs), freshwater scarcity can be a challenge to realise water security, and recognise the value of sustainable use of freshwater.

VW, not in the real sense, but in the virtual sense, is defined as water 'embodied' in a product. This implies the water needed for crop production. The

word virtual refers to the need for water to produce food that is not present in the final product. ‘Embedded vapour’ or ‘exogenous water’ has also been called VW.

The Countries virtually export or import water used for food processing, referred to as “VW.” Through the international exchange of food resources, the international trade network thus means that VW flows from exports to importing nations.

Trade in different types of goods, including plants, livestock, luxury (e.g. coffee, tea, and alcohol), and other products are contributing to the global trends in VW transport. With relation to these product types, major contributors to the VW network displays various exchange patterns. The importers believe only a limited percentage of the global population has access to VW.

The VW Trade is still occurring today, but not exactly under the same name. Between 1997 and 2001, an average of 987 km³ of VW was exchanged annually within the agricultural goods class.

The VW strategy seeks ways to use interior and external water sources intentionally and effectively to mitigate water scarcity. Within the whole package of integrated water source management, the VW strategy should be an integral part.

OBJECTIVES

1. To study the global scope of VWT
2. To analyze global status of VWT
3. To examine implementation feasibility of VWT at National & State level in India
4. To identify factors enhancing VWT Implementation feasibility.

METHODOLOGY

1. Global Scope of VW Trade

VW is an attractive area of debate, exploring the growing water deficit. In countries with water problems, the population is about 1.6 billion people (as per the 2016 International Bank for Reconstruction and Development Group) and this number will double in the next 20 years. Water deficits may hinder prospects for growth, and a few regions may experience a drop of up to 6% of GDP by 2050, with agricultural, income and property-related water shortages. Nevertheless, though 70% of total water is used worldwide for agriculture and food processing, international trade with physical water (bulk or bottled water) may be a restricted phenomenon. Allan (1997) records that water deficit countries’ food imports suggest an importation of water contained in the traded goods. VWT means to import items requiring an excellent quantity of water in their production cycle (so-called water-intensive products) and limiting the export of water-intensive goods, the favourable chance of scaling back increased water consumption.

Several reports and studies suggest that VWT will boost food security by enabling water-short nations to learn to efficiently use water.

A few areas in China often suffer from water shortage. If China’s government is pushing revolution and infrastructure to help minimise these problems, some water management may also help. In China, a lot of water-deficit regions and decentralisation in manufacturing tends to be an inter-regional case. Perhaps if we understood where and the way it is handled, something might be learned about maintaining or decreasing VWT. Perhaps viable policies could be expressed, provided few immediate reasons. In conclusion, we use the multi-regional input-output tables of China straddling two cycles to detect the exchange of the three categories

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of items in a given region: local final goods, local intermediate items, and items shipped to other regions and nations. In 2012, we remember that goods traded regionally in China included 30.4 percent of all water used worldwide. Thanks to higher shipping volumes of water-intensive products, water usage increased significantly worldwide, over 2007-2012. The increase in value chain-related trade, as suspected, has actually become a significant contributing factor. Coastal areas tended to be higher recipients of VWT from within the provinces, although there were various explanations, (e.g., 67.8 percent of net inflow) and Zhejiang for value-chain related trade (40.2 percent of net inflow) earned more to meet the ultimate demand. In short, the variability of our research demonstrates an urgent need to investigate trade forms and water scarcity while developing the

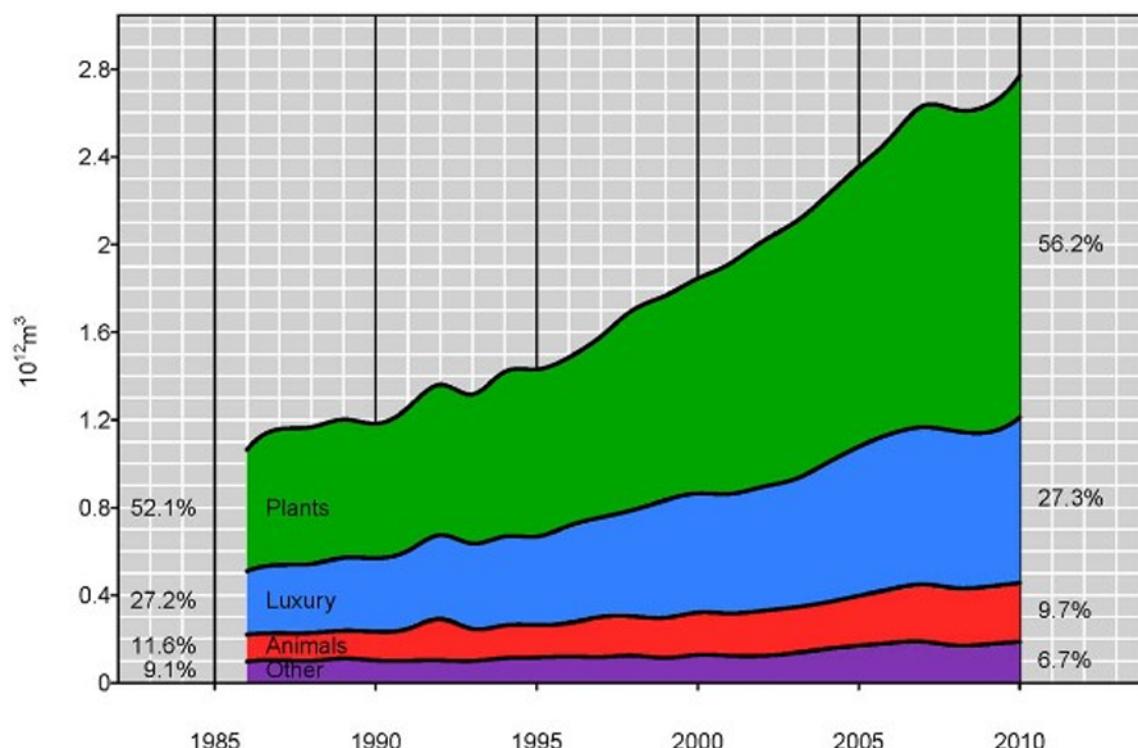
distribution and management strategy of water resources.

2. Global VW Trade

Since 1986-2010, the major players in the VW Network have been the USA, Japan, Argentina, India, Indonesia and China. Japan and China are among the largest importers, and the USA and Brazil are among the largest exporters worldwide.

Among the crop products, the predominant products traded in VW volume since 1986-2010, with wheat being the top commodity, are cereal grains, oils and cotton lint.

Among the luxury goods, coffee and chocolate are consistent in all 25 years of the Top 15 items.



From the year 1986- 2010, VW trade has increased for Crop Products and Luxury items but remained constant for animal products and other commodities and fibres.

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Country wise VW trade

Table 1. The top 5 net importers (top) and exporters (bottom) and their virtual water export import balance (10^{11} m^3) for the years 1986, 1993, 2000 and 2010.

Rank	1986 Balance	1993 Balance	2000 Balance	2010 Balance
1	Japan	-0.77	Japan	-0.85
2	USSR	-0.54	Germany	-0.48
3	Italy	-0.37	Italy	-0.36
4	Germany	-0.32	Republic of Korea	-0.34
5	United Kingdom	-0.23	Russian Federation	-0.29
1	United States of America	0.85	United States of America	1.04
2	Australia	0.60	Argentina	0.53
3	Argentina	0.44	Australia	0.40
4	Thailand	0.34	Brazil	0.39
5	Brazil	0.33	India	0.33
			United States of America	1.15
			Brazil	1.87
			United States of America	1.155
			Argentina	1.48
			Indonesia	0.84
			Canada	0.72

Although VW trade changes can be seen worldwide, there are significant changes at the national level.

China- China was a significant net VW exporter in 1986, with 9 percent of imports attributable to luxury goods. By 2010, however, Chinese imports accounted for 214% of the total production of crops and other animal-related resources, and 41% of their exports were luxury goods. The worldwide VW imports are presently dominated by China.

Turkey- Turkey, with 5% of global VW exchange, was the 2nd largest importer of animal related goods and non-edible agro commodities.

Italy- With 3 percent of all global VW trade, Italy was the 3rd largest importer. It has considerably doubled its share of VW imports and boosted its luxury goods exports.

Japan- For the past 25 years, the proportion of VW imports has been stable.

Germany- Since 1991, its VW imports have more

than doubled, while its exports of luxury goods have increased.

The United States of America- continues to be a major importer of luxury and animal-related goods. One of the world's leading contributors to VW's trade in animal products was 9%, alongside Germany.

Russia- By 2010, Russia accounted for 8% of VW's trade in animal products.

Brazil- Brazil's VW exports have risen three times in 2010, since 1986.

India- India's VW exports have risen by 5 times more by 2010, since 1986.

In conclusion, although the changes in VW trade are constant for the 25-year period globally, changes in the four groups of plant-related products, luxury products, animal-related products and other products of each nation have been highly variable.

3. VWT at National & State Level in India

If we look at the per capita supply of water, the eastern Indian states of Bihar, Jharkhand and Orissa enjoy a competitive advantage over the major VW exporters, the northern states of Punjab, Uttar Pradesh and Haryana. The per capita supply of water in all three eastern Indian states is considerably higher than in the northern states.

What we here propose is that the water-rich states in eastern India should be producing much of India's food requirements and exporting food grains to the water-scarce states.

When we go for reality check we found that we are already practicing this virtual trade. And these states are shown within the figure 1 below:

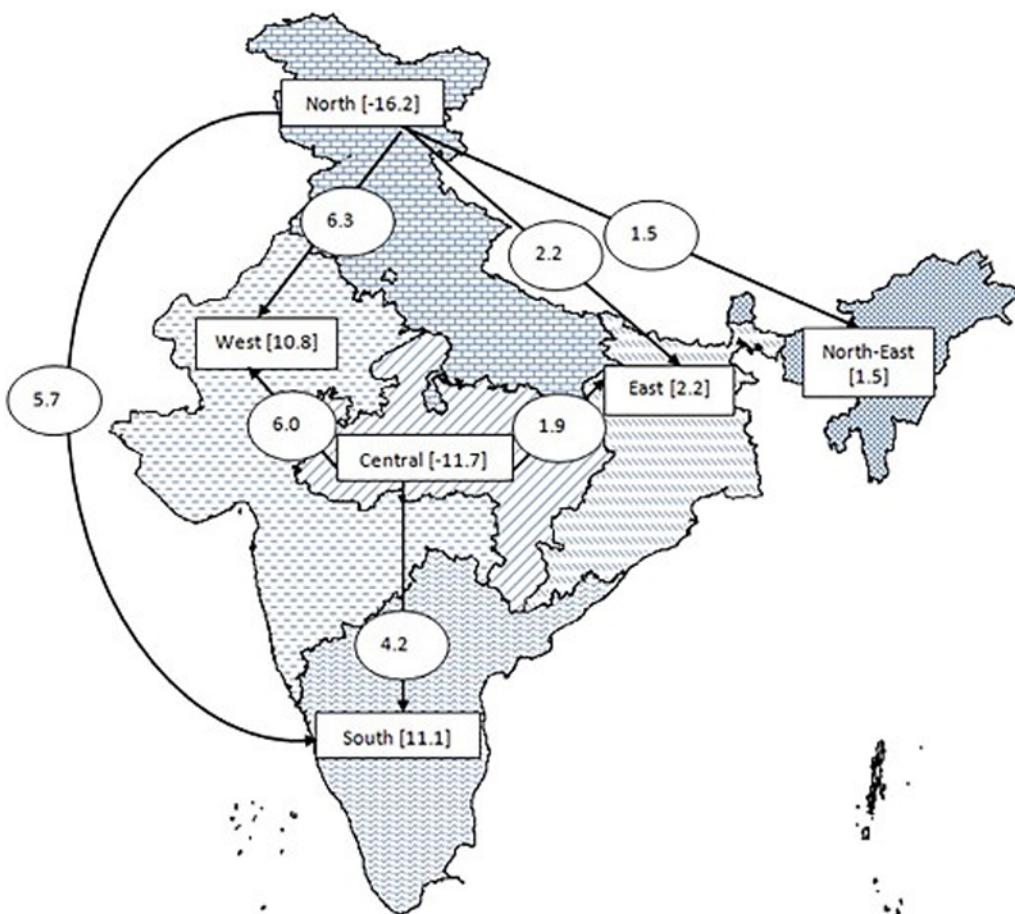


Figure show VWT between 2005-2014, zone-wise VW flows (PL / year). (Values in boxes are net exports or imports of V.W. Values in a circle display large movements between regions).

So now subsequent thing is finding the way to increase the efficiency of VW trade different states of India.

4. FACTORS AFFECTING VWT

(a) Adequate exchange revenue and social absorption capacity:

VW Trade calls for the appropriate supply of foreign currencies or a favourable balance of payments that a nation needs to import food in the future. In

addition to this, a high social absorption potential could be a vital requirement for the success of VW Trade. Although the reduction of agricultural operations in future for importing countries would make farmers and rural workers obsolete in the long run, the introduction of the policy includes alternate non-agricultural income prospects.

(b) Abandoning the paradigm of food sovereignty:

It is politically responsive as VW exchange entails the abolition of the paradigm of national food sovereignty. Attempts to attain a particular degree of national freedom are sponsored by the growing recognition of reciprocal dependency. As globalisation progresses, this process has been taking place for a long time in many countries, and it is becoming extremely difficult to grasp why food should be an exception in this respect. The very truth though, is that growing VW Trade may ultimately raise the importing nations' reliance on the exporting nations and theoretically leave them with hospitable political leverage. This is also highly unpopular and one of the reasons why the countries involved quit the concept privately, i.e. without explicit announcements from national decision-makers (e. g. Egypt, Jordan). The importing countries involved would decrease the likelihood of growing political reliance by widening the number of nations from which they import products. The main trustworthy trade partners they want should also be chosen, who will be prepared to ensure that their exports do not suffer from any political problems that occur.

(c) The alternative produced must be marketable:

It is fair to leave current kinds of production as long as there is a marketplace for economic goods created as substitutes and at least as much profit can be made from them. Consequently, economic conditions must be favourable for the nations engaged in VW Trade. The non-tariff trade barriers

remain a huge obstacle for developed nations, able to contend on the global market for manufacturing or consumer products. The VW agenda could then be efficiently pursued as long as international exchange barriers were further lowered.

(d) Good transport and infrastructure in rural areas:

Likewise, good rural connectivity is a necessary prerequisite for a successful VW Trade programme. In rural regions, where the delivery of imported food is not assured and persists within metropolitan areas where it first enters, residents may lose food security and market prices may escalate, resulting in significant social impacts, such as urban migration and eventual unchecked urbanisation.

(e) VW Trade could be amid a process of centralization and cause a growth in government power:

VW Trade would gain a monopoly from the central government on any grain or grain delivery if politically imposed, which might raise the need for good governance. In its pure nature, as a decentralised water programme, the approach also contradicts the decentralisation efforts of many countries, as VW Trade requires centrally controlled food delivery. It must also be assured that government decision-makers, as is usually the case with food assistance, should not, for geopolitical purposes, use this control to facilitate corruption and clientelism for instance. Strong institutions and good governance, therefore, are crucial to the growth of VW Trade.

(f) The concept defies economic facts and rules of the planet market:

Current trade in financial services, including agricultural goods, does not take place due to water shortages. It is largely compatible with the principles of significant cost advantages for variables such as manpower, land and capital, also regardless of the

supply and demand for economic goods. Water prices also tend to be the sole way of regulating the global food supply market and the flow of agricultural goods. If the pricing gives water an economic benefit, it becomes an essential cost consideration, and so, it gives an opinion on trade decisions.

CONCLUSION

Global Scope and status of VW trade:

It has been projected that 2615 million tonnes of grain will be produced worldwide in the year 2025, causing 2981 Km³ of crop water to be exhausted. 337 Km³ of crop water would be drained by exporters, an increase of 24% compared to 1995. It is projected that if the planet's trade rises at an equal rate, global crop water savings will double from 164 km³ to 358 km³ and irrigation water savings from 111 km³ to 191 km³ will rise by 70%.

National Impact:

VW has a strategic dimension at the country and state level, both for the importer and the exporter. It is important for water scarce nations and states to distribute their water supplies as effectively as possible, taking into account water productivity, the market price of the crops they grow and consume, and therefore the food markets to which they need access, because water productivity varies quite a lot. VW trade should be promoted to market water savings, and improve food protection through suitable and fair-trade agreements.

Factors Enhancing VWT Implementation Feasibility:

The research has found factors which directly affect the VWT. There is a requirement to strategically implement, monitor and control these factors to urge the long sustainable VWT model.

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