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India, Factor 2: Water Scarcity

The massive impact caused by water scarcity on people living in the largest democracy and the urgent need to take corrective measures

India is the second most populous country in the world with a staggering population of 1.2 billion people (Nagarajan). The country has varied languages, cultures and religions, yet the agricultural practices are strikingly similar throughout the country. In spite of its recent good economic and technological growth, India is plagued by the water scarcity which threatens the agricultural, industrial and personal spheres (A.A.K.). To make things worse, for the past two years the country has had dry spells. In India, usage of available water is as follows - agriculture use 82%, industrial use 10% and domestic use 10%. India has 16% of the world's population, yet it has only 4% of world's water resources. Currently, 300 million people in India are facing water shortage (A.A.K.). Also, about 600 million people in India depend on agriculture and two thirds of the land under cultivation has no irrigation and has to rely on rain water. Besides, inefficient agricultural practices, water pollution, corruption, deforestation, and improper use of surface water make things worse. Climate change resulting in droughts, heavy rain falls and floods doesn't help the matter either. Prime Minister Narendra Modi, noticing the problems faced by the farmers, has pledged to double their income by year 2022. In reality, water scarcity is a global issue. We will also see that the potential impact on the small farming family is huge. Globally, 15-35% of irrigation water withdrawals are estimated to be unsustainable.

A family that lives in rural areas in India is most likely to utilize a subsistence agriculture lifestyle. A typical subsistence family owns 2.5 acres of land. The most common crops farmed are rice, wheat, and sugarcane. Since most farm families are poor, they do not utilize advanced technologies, such as tractors. Most of the work done on the field is by utilizing manual labor. The level of education among farmers' families is quite low, as it is not seen as a necessity. Children help the family on the fields, and tend to miss school. As a result, the literacy rate in rural India is about 68%. There is inadequate healthcare in rural parts of India because rural citizens do not have easy access to healthcare compared to urban citizens.

In subsistence agriculture, farmers tend to grow enough food to just feed their families. Farming practices in subsistence family farms are traditional. Due to poverty and small farm size, there is little to no access to mechanization. Most jobs worked on the field are labor intensive, and farmers own their land. However, some lease the land from the land lords and pay them compensation by sharing their crops. If any surplus is found, then the crops are sold in the market. It is these factors that cause about 60% of Indians living in rural India to live on less than 120 rupees a day, which is about \$2 (Weblog). So, poverty is a leading factor in slowing agriculture production in India. Small farmers cannot afford big machinery, so they stick to traditional farming methods such as using cattle plows. These methods are time consuming and labor intensive. Moreover, these farmers cannot afford quality seeds and fertilizers. Lack of proper storage facilities for their crops makes it hard for them to store and sell them at optimal time, thereby putting them at a disadvantage in terms of adequate income. Availability of water storage is also an issue for timely access to water the crops. Some families finance their capital through loan sharks who charge as much as 100% interest (Water) and often, up to 20% of their income goes just to pay the interest. This drives them deeper into debt and poverty.

The water scarcity is defined as the lack of enough quantity of water, as well as it's usability in terms of

quality. The major barrier in improving the agriculture productivity is the water shortage. The average income levels are proportional to irrigation intensity which in turn is related to the availability of the water. For example, if 20% of the area is irrigated, per capita income would be at about Rs.500 and if the irrigated area is 80%, the per capita income would be about Rs.2400 (Technology). It is well documented that women and children have to walk long distances to fetch water. Other factors affecting productivity are inefficient agricultural practices such as cattle plowing, outdated irrigation practices, and the lack of availability of quality seeds. Also, malnutrition and infectious diseases related to poor quality of water result in decreased productivity. Lack of infrastructure in rural areas prevents storage, transport and distribution of the crops. Lack of water also affects the energy sector as evidenced by recent shut down of hydroelectric plants in some areas.

“India is in the grip its worst hydrological crisis ever” says the water expert Himanshu Thakkar(The Editorial). Rainfall deficits in Marathwada have been as high as 40 and 42 per cent in the last two years. Rain-fed kharif crops in many parts have failed for the last two years. The situation is so bad that in some places armed guards are protecting water reservoirs. Trains loaded with water are being moved across the country, but farmers’ wells are drying up and drinking water is being rationed (A.A.K.). Reservoirs and wells are now running dry. The satellite images from National Aeronautics and Space Administration showed a sharp decrease in groundwater levels under northern India’s irrigated fields of wheat, rice, and barley (The Editorial). A lack of sanitation and available clean water often results in infection diarrhea. This causes about 1600 deaths a day. About 1.8 million people die every year from diarrheal diseases (including cholera) – the equivalent of 15 killer tsunamis each year or 12 Boeing 747 crashes every day (Snyder). India’s so called Sand Mafia, operating in collusion with local officials, has also contributed to the problem by illegally removing sand - important to allow water to percolate into underground aquifers (The Editorial).

Reducing the water scarcity helps India to become more food secure by increasing the crop yield which in turn reduces hunger and poverty. Women and children do not have to spend their time fetching water, and instead, the time can be spent on education. Women can then use that time to increase their earnings with another job. As stated, improving water availability increases agricultural production, which then increases the median household income. This also improves nutrition and reduces infant and child mortality rate. Also, providing clean drinking water reduces the incidence of water borne diseases such as cholera, dysentery and amoebiasis. Adequate water availability also optimizes the use of fertilizers to maximize the crop yield. Improving water availability helps to improve soil quality and preserves bio diversion. Mr. Gavin Wall from the Food and Agricultural Organization (FAO) states, “Agriculture water management is key to food security” (Andhra). Water lies at the core of sustainable development concern and it’s efficient and equitable management is crucial for human survival. For more than 10 years FAO has advocated for better recognition of the role of water in ensuring food for all, eradicating rural poverty, and constantly reminding world leaders about the strategic importance of this sector.

The water crisis in India is only worsening. The water table is falling on average by 0.3 meters and by as much as 4 meters in some places (A.A.K.). Also, satellite images show that major rivers that serve as a water source, like the Ganges, Godavari, Krishna and Netravali Rivers have dried up at several locations, which has never happened before. Groundwater levels are at a record low. In many places hand pumps have dried up completely (Phadnis). A report counted more than 20 million boreholes in India, up from tens of thousands in the 1960s (A.A.K.). Groundwater levels across 4,000 wells have receded by 54% in the last 7 years (Dutta). As population increases, situations like this will exacerbate. Lack of water also affects the energy sector as some of the hydroelectric plants were recently closed because the water shortage (The Editorial).

The climate change which is set to disturb the hydrological water cycle has added a new dimension to water related challenges (Andhra). Climate change has adversely affected the weather volatility resulting in severe droughts, flooding, heavy unpredictable rain falls and rise in the average temperature. Floods result in large wet lands and can flush the fertile soil and cause runoff of the fertilizers and pesticides. This results in decreased production of crops thus negatively impacting the food security. Also, rise in temperatures causes rivers to dry. Increased evaporation of water due to high temperatures also increases the water needs of the crops.

Population growth has put the country into water stress. India's population is projected to increase to 1.6 billion by 2050 (Snyder). This will put enormous demand for water needs. Population growth also increases the industrialization and urbanization which are known to increase the demand for water. The industries will compete for the available water. The projected population growth will decrease per capita availability to 1,341 m³ from the current 1,820 m³. Pollution of water is a major concern. The rivers are used as a dumping ground for sanitation, pumping industrial waste and discarding of corpses. This causes severe ecological disturbance. Also, the lack of infrastructure is causing fertilizers and pesticides to be washed off into the rivers and oceans threatening marine and fresh water lives. Fish cannot sustain the pollution of the water (water facts). This is adversely affecting the food security. The lack of available clean water results in the consumption of contaminated water. This causes water borne illnesses such as cholera, dysentery and amoebiasis. As the water resources are shrinking and the population is growing, the available per capita water will be dangerously low. This adversely affects the food security.

My recommendations to combat the problem of water scarcity include water conservation and efficient usage of water.

Starting at the fundamental level, outdated agricultural practices have to be changed. Flood irrigation, which is still widely used, is known to be very inefficient (Snyder). Flood irrigation results in pipe leaks, erosion of soils with run offs, evaporation and excess use of fertilizers and pesticides. Instead, sub surface irrigation (drip irrigation) especially root irrigation practices should be encouraged. This practice not only reduces the water wastage but also preserves the nutrients in the soil. When this is not feasible, at least controlled sprinkler system should be used. Farmers must be educated on running the water pumps judiciously.

At community and village level, water conservative practices must be encouraged. Building water reservoirs and farm ponds will help watering the crops when needed rather than depending on the rainfall. This will optimize the timing of watering the crops. Organic farming ensures sustainable agriculture while minimizing the water and ground pollution. Use of drought resistant hybrid seeds will reduce the water needs. Even in urban areas, steps to save water can lead to giving a helping hand to rural families. People should let their family know about leaks in their house. Leaks are easily fixable, helping save water and money. Citizens living in affluent homes should be aware of high-efficiency washers, faucets, and toilets. They should be knowledgeable in the efficient use of dishwashers and washing machines, should be in the habit of turning off the faucet when brushing teeth or shaving, and be used to taking shorter showers

At the state level, water efficient practices such as agro-sylviculture (where trees and crops are planted together to increase the water retention) must be encouraged. Phytoremediation techniques (phytoremediation is the direct use of living green plants for in situ, or in place, for the removal, degradation, or containment of contaminants in soils, sludge's, sediments, surface water and groundwater) can help to clean up the soil and ground water.(Technology).

At the national level, water retention practices for rain water have to be instituted. Most of the rain water in India is wasted (Snyder). UN estimates that up to 80% of the rain water is wasted. Water catchment techniques can tap into this huge potential. Concurrently, water pollution practices must be discouraged. Education in sanitation and providing working toilets will reduce the water contamination significantly and reduce the incidence of water borne illness. Also, Industrial wastes must be properly treated before they are discarded. Water treatment plants must be built to recycle the water and to purify the waste water. Desalination techniques are available but currently they are prohibitively expensive. Building of dams conserve most of the river water and prevent floods. Water appropriation methods must be agreed to by various states in a timely and peaceful manner. Deforestation practices must be strictly prohibited. Afforestation should be encouraged. Interlinking the rivers will help reduce flooding from overflows and reduce droughts in the water deficit areas. The role of technology in water conservation cannot be ignored. With the availability of high speed personal computers, computer software has been developed to assist in the management of irrigated agriculture systems. These include soft wares for estimating crop water requirements, designing surface irrigation methods, designing sprinkler and drip irrigation systems, designing drainage systems, estimating irrigation return flows, and water delivery estimations in large irrigation systems. Geological information systems (GIS) which are useful in mapping the irrigation command areas or watersheds also assist in efficient management of the irrigated agricultural systems (Andhra).

In the current globalization of trade, various water conservation practices can also be implemented across the globe. In virtual water flows, crops are grown according to the water availability in a given country and the water needs of a particular crop. The crops are then imported or exported after they are grown. Studies have shown that this practice can save enormous amount of water. Countries can then share their best successful practices of water conservation with one another.

My recommendations are targeted towards state, national, global government agencies and private organizations:

1. Provide grants to the villages for educating farmers in water conservation practices, personal hygiene and adult education.
2. Provide low interest loans to farmers to free them from the clutches of loan sharks.
3. Provide farmers with drought resistant seeds at low cost.
4. Let farmers' voices get heard, by providing them with a seat in the local and state legislature.
5. Develop policies in restricting excessive use of fertilizers and pesticides.
6. Timely resolution of water disputes between various states.
7. Organizations such as The World Bank, The World Food Program, The World Trade Organization, The Alliance for a Green Revolution in Africa, the U.S. Department of Agriculture, and some of the industrial giants like Yara Fertilizer, Archer Daniels Midland, Syngenta, DuPont must work together to address the problem of water scarcity.
8. Reduce the monopoly of food giants to reduce food cost inflation. The World Bank reported that global food prices rose 83% over the last three years and the FAO cited a 45% increase in their world food price index in over just nine months (Holt-Giménez).

9. Since ‘smart’ phones are widely available and in use, fund the development of apps that farmers can use to monitor weather conditions, obtain market data showing prices of crops, and the ability to easily apply for loans.

Mr. Modi’s (Prime Minister of India) most urgent task is to help those suffering from the drought. He must also place all water related issues at the center of his development agenda. A growing population means that India’s water needs will only increase, even as climate change will most likely make water scarcer (The Editorial).

The government should set a better example to the public than just what occurred recently:

When a minister visited Latur last month, local officials wasted 10,000 liters of water scrubbing the helipad for his arrival. Also, in the newly formed state of Andhra in India, the chief minister Mr. Naidu, in spite his good vision and administrative skills, acquired 35,000 acres of fertile and excellent crop yielding lands to build the capital. This will enormously reduce food production in that state. (I recently traveled to this area, and it was saddening to see green lands being replaced by lifeless brick and mortar).

A pilot project in Andhra Pradesh, “Successful Interventions for Water Equity Distribution in Nagarjuna Sagar Project Left Canal Command” on agriculture water management was done with the financial assistance from F.A.O and with technical collaboration from Alterra-ILRI, Wageningen University Research Center, and the Netherlands. The broad objective was to spread irrigation benefits to dry land areas and preserve the production capacity of agricultural lands in irrigation canal commands, with optimal utilization of water resources and control of water logging. This project involved pooling of technologies and involving farmers in the decision making process to achieve equitable water distribution, and to obtain every drop of available water. The results were encouraging: The inflows were enhanced from a maximum of 174 lit/s to 350 lit/s and increase in unit yield of Rice to 1 t/ha, and the area of coverage increased for Rice to 36 ha due to adequate and timely supply of irrigation water (Andhra).

Also, WaterCredit is a new way to apply smart thinking to the world’s water problem. It is the first program to put microfinance tools to work in the water, sanitation and hygiene sector (called WASH). WaterCredit puts the power of water directly in the hands of the people who need it. WaterCredit empowers the world’s poor with access to small loans, and use credit for household water connections and toilets. WaterCredit is breaking the cycle of poverty and creating a cycle of opportunity – an opportunity to enhance one’s health, education and economic position (Water).

There are agriculture based smart phone apps that allow to digitize field boundaries, soil sample, scout crops, check weather conditions and graph rainfall estimates per field. There are also instructions based on best-practice production processes for more than 60 crops. Some apps even include keeping inventory and maintenance records for all agriculture machines and attachments. Some of these apps are Sirius, Agrivi, and TractorPal (Hopkins).

Water scarcity has been and continues to be a global problem. It has been gradually getting worse. The climate change, population growth and urbanization have worsened the situation. The world’s population is expected to increase to 9 billion soon. To ensure the food security, we have to act now. Optimizing the water usage, minimizing the wastage and maximizing the water procurement are all important measures to keep up with the growing demand. Even though the effects are felt everywhere, its impact is more severe on the subsistence family. Highly vulnerable groups include those whose needs for ecosystem services already exceed the supply, such as people lacking adequate clean water supplies and people living in areas with declining per capita agricultural production (Millennium). We have to act at local, state, national and global levels to combat this issue to ensure food security in the future.

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