WATER GOVERNANCE: ISSUES AND CHALLENGES IN TIRUPUR TEXTILE HUB OF INDIA

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ABSTRACT:

Water is one of the most essential materials in day to day life is becoming scarce due to various reasons including reduction in infiltration rates, higher rates of runoff, uneconomical use and overexploitation of the groundwater resources etc. The need to conserve water and its resources assumes more importance than ever before in the present scenario. Due to the rapid growth of population, urbanization and industrialization, the demand for water is increasing day by day worldwide. Global change, and climate change, pose considerable challenges to water management and governance. This paper highlights the water resource and its major anthropogenic and scientific impacts as well as Environmental degradation. It shows the detailed case study of Tirupur district of Tamil Nadu in India and its challenges facing towards Water Scarcity and pollution. It indicates the predominance of anthropogenic influences especially through water use (population growth or shrinkage and pollution) but also through river training, reservoir construction, land use change (biofuel production) and water governance (its development or weakness). Tirupur, textile hub of India with an estimated export of more than USD 1.50 billion annually, houses nearly about 3000 sewing units, 450 knitting units, hundreds of dyeing and ancillary units. The effluent generated from the numerous textile units across Tirupur, was let out in the river Noyyal, which resulted in mass pollution of the river. The wastewater was acidic and contained dissolved solids, which increased the biological and chemical oxygen demand in water. However, the textile manufacturing process, which is highly water intensive, use about 425,000,000 gallons of water every day. There is a growing concern that the potable water sources are getting deteriorated day by day. The ground water quality was less desirable for consumption in the places of Tirupur town. It is suggested that the deterioration of ground water quality was mainly due to contamination by man-made sources, like household let-outs and effluents from dyeing industries. Therefore, it shows principle steps *and governing policy need to be taken urgently to ensure effective water resource management in Tirupur. As a general conclusion, it reveals the study of the key immediate opportunities and guidelines towards a scientific and sustainable path of water resources and its interest in the Tirupur people's welfare and promote global tranquility.*

The Background of study area

Tirupur city is in between the latitudes 11000'10"N to 11013'31"N and longitudes 77013'10"E to 77029'31"E (Fig. 1) with geographical extension of 455 km2 . It is an undulated topography with the height range from 291 m to 323 meters above the mean sea level and sloping gradually towards east direction. Temperatures vary between 220C and 430C with a mean rainfall of 630 mm. The study region is located at 52 km east of Coimbatore city. The study region is an industrial centre for the textile sectors. Tirupur accounts for 90% of India's yarn knitwear and it is referred as textile valley of India. There are about 2100 producing units manufacturing different varieties of textile goods. The textile industrial units in the study region use a variety of chemicals which are likely to be from the red list cluster which are said to be destructive and unhealthy for all living beings [8]. The Noyyal river runs across the study region, almost separating it into two halves. It has been linked with groundwater quality evils and the general practice of discharging the untreated industrial effluents into the tributary of Noyyal river has been alarming. The quality of groundwater in Tirupur region deteriorated rapidly during the last decade. The characteristic of surface and subsurface formation is due to drainage pattern of the area. More runoff is possible in more drainage density area. Dentritic type of drainage pattern is in the study location. A variety of geomorphic units such as pediments, shallow pediments, duri crust, shallow buried pediments etc are in the region. In nature, the area is with wide range metamorphic rocks of gneiss.

Growth of Tirupur Most of Tirupur's industrialists came from very modest background and were basically farmers who owned well-irrigated farms. Being essentially innovative, they managed to learn the basics of textile production as employees in knitwear firms. Though it was begun in 1920's, textile production took a drastic turn when sophisticated machines were imported from Japan and Taiwan in 1948. In late 60's, the number of garment industries in Tirupur increased to 250 units, and very soon the city emerged as hosiery 45 centre of India and at present the number of units is about 6250. Till 1924, Tirupur was not known for its knitting factories. The first garment factory was started in 1925. In 1931, more knitting and weaving factories came into existence. Initially, all knitting machines were imported from Germany, Japan and New York. By 1942, there were about 34 Hosiery factories in Tirupur. After the Second World War, due to financial assistance from banks, availability of cheap labour, hosiery yarn and electric power, more factories came into existence in Tirupur. Today, Tirupur has become an important and active cluster of knitwear industry in India. Almost every household in Tirupur town undertakes some activity related to knitwear industry in residence-cum-factory setting. The initial growth of knitwear industry began in 1970's, when the production of knitted garments for local and national market began in a small scale. In the middle of 1980's, the capital accumulation and development of skills enabled some of the larger units to start producing for export, and within 20 years the modest industrial city had grown into an industrial centre that produced more than 50% of India's total export of hosiery garments (TEA 2009).

Bleaching and Dyeing

Bleaching process is to remove colouring matters from fabric. As a result, fabric becomes white. For this purpose, various bleaching agents like bleaching powder, sodium hypochlorite, hydrogen peroxide etc. are used. Treatment time varies depending upon fabric. Dyeing process consists of colouring fabrics with different dyes like reactive dyes, remozal dyes etc. This can be a batch or continuous process. In Tirupur, batch dyeing is being employed. Steam and electricity is used for the production of dyed fabric. Steam is generated by burning firewood in boiler. Steam generation pressure ranges from 4.5 to 7 kg/cm2 and boiler capacity varies from 2 TPH to 6 TPH. Two types of machines namely, winch and soft flow (jet dyeing) are used to dye knitted fabric. Yarn dyeing machines are also used to dye yarn. The number of stages in winch dyeing is about 15 while in soft flow dyeing, it is about 10. The material to liquor (m: l) ratios in winch and soft flow machines are about 1:12 to 1:15 and 1:6 to 1:8 respectively. The processing time is about 8 hours in soft flow machine and 12 hours in winch dyeing.

Water Exploitation Tirupur is in a dry, water-scarce region and the rapid expansion of the textile industry has taken place in an unplanned manner, with no associated development of supporting infrastructure or institutional capacity. As a result, the growth has led to the depletion of groundwater reserves and a serious deterioration in environmental quality of both surface and groundwater (Nick and Sarah 2000). The dyeing process (including peroxide bleaching) requires high quality water. About 40 litres of water per kg of processed fabric is needed for chlorine bleaching. Depending on shade, technique and chemicals used, the volume of water required to dye 1 kg of fabric varies between 70 to 240 litres. Also, about 42 to 80 kg of salts requires 15,000 litres of water.

Water Contamination Specific water consumption in Tirupur is around 200 to 400 litres per kg of finished product, compared with the international norm of 120 to 150 litres per kg (Nick and Sarah 2000). The estimated wastewater generation from the industrial cluster of Tirupur is around 102 million litres per day (Sivakumar 2001) and about 56,492 tonnes of solid waste is produced each year (Ramesh 2000). Though most modern machineries are used for wet processing, the majority of fabric dyeing is carried out in open winches, which requires more water. Effluents from bleaching and dyeing vary widely in colour and invariably are turbid. Traces of heavy metals such as copper, zinc, chromium, and cadmium are also seen. Lower stretches of the river Noyyal that is full with effluents have high pH. The electrical conductivity of the surface water samples ranged between 1940 and 21000 micro mhos/cm, again related to the quantity of discharge. Electrical conductivity of water for irrigation according to the Bureau of Indian Standards (BIS) is only 250 micro mhos/cm. The total solids (TS) in the water have crossed 10000 milligram per litre (mg/lit). The total dissolved solids (TDS) have also reached approximately the same level. TDS, inorganic in nature, is due to salts used in processing the fabric. In many places, alkalinity of the river water samples was about 800 mg/lit and total hardness about 4000 mg/lit. The sodium content in surface water is very high because of large-scale use of common salt. The level of chloride of the surface water samples reached up to 4360 mg/lit, while its BIS limit for irrigation is only 250 mg/lit. The high sodium in surface water combined with chloride makes the level of potassium very low. It ranged between 10 and 80 mg/lit. While biochemical oxygen demand (BOD) ranged up to 150 mg/lit, chemical oxygen demand (COD) reached 1260 mg/lit. High BOD and COD are expected to reduce dissolved oxygen in water. However, river Noyyal 64 being a shallow stream, the possibility of high oxygen exchange with atmosphere may offset the effect. Phosphate content, originating mostly from detergents, reached about 5 mg/lit in the river water. Nitrite ranged from 0.01 to 0.26 mg/lit. Concentration of dissolved fraction of copper in the surface water ranged from 0.08 to 2.76 microgram per litre (μg/lit). Chromium concentration ranged between 1.25 and 2.48 μg/lit, cadmium between below detection limit (BDL) and 0.20 μg/lit. Overall, in Tirupur, examined parameters of the surface water exceeded the BIS standards for drinking and irrigation purposes.

Effluent Treatment Plants (ETPs) Tirupur faced with the situation of excessive water use and pollution. Public pressure to improve the situation has been a powerful force for change, notably numerous actions by local farmers, labour, environmental and consumers' organisations. This pressure has helped to prompt the Tamil Nadu Pollution Control Board (TNPCB) to take action to enforce environmental regulations on water pollution. The authorities have been hampered by a lack of resources, compounded by the difficulty of controlling the discharge of hundreds of small producers. For this reason, the TNPCB has focused on the installation of common effluent treatment plants (CETPs) as the most effective solution (Nick and Sarah 2000). There are about 20 CETPs in Tirupur cluster (Revathy 2009). Despite setting up CETPs and the Federation of CETPs, the dyers in Tirupur could not resolve their water pollution related problems. The incoming TDS in the ETPs range between 6000 and 9000 mg/lit and there was a slight increase in the treated effluents, perhaps due to soluble fractions of coagulants during the treatment. As such CETPs remove only the 65 colour and other suspended organic matter. As against standard (2100 mg/lit) for TDS, the existing TDS levels above 5000 mg/lit is a gross violation. The Noyyal River and ground water survey in Tirupur shows that TDS has grossly contaminated the waters. As such the water is not fit for irrigation in the downstream stretches. The CETPs remove only 40% of the COD and BOD and most of the time the BOD of the treated waste waters is above 100 mg/lit as against limiting standard of 30 mg/lit for discharge into river waters. This is yet another non-compliance by the CETPs. It is generally seen that sodium (Na^+) and chloride (Cl^-) ions dominate in the wastewaters indicating the use of common salt (NaCl) in the dyeing processes. Relatively lower levels of sulphates (SO_4^{--}) indicate that sodium sulphate (Na_2SO_4) is used to a much lesser extent. Generally, sodium chloride is recoverable (50 to70%) from dye bath solutions using nano-filtration membranes, and recovered brine is reusable in dyeing processes along with low hardness water recovered through reverse osmosis (RO) processes. In order to reverse the ecological damages in the area, the existing CETPs require upgradation in terms of RO/nano systems followed by multi stage evaporator systems to constrain high TDS discharges into the river (CPCB 2005)

Governance

In the perspective of Industrial Ecology, planners could play a crucial role in preventing potential disasters. Research studies of different activity groups, aggregated to provide an overall picture of material flows in a region, would allow planners to consider promotion of industries in specific sectors that would optimize the use of critical resources, and guide the development of a region towards sustainability. Entrepreneurs are also looking at the possibility of setting up central steam units with solar preheating as a commercial proposition. This facility may also use the high heat value of the municipal solid waste in the town. Local entrepreneurs are looking at the possibility of using the municipal solid waste as a source of fuel to replace firewood as the waste has a high calorific value.

For the time being, pollution prevention and cleaner production approaches, such as cultivating colored cotton, natural dyes, and water minimization, have not been considered as immediate solutions. Although promising, these approaches are very unlikely to be adopted on a large scale by the industry soon. In developing countries like India, where both agriculture and industry tend to be carried out by fragmented small players, there is a great reluctance to try new methods which often require substantial capital investment and may be risky, even more so in the context of increasing competition from neighboring countries.

Conclusion

The Global Water System in the Anthropocene delivers the podium to contemporary global and regional viewpoints of world-wide knowledges on the replies of water management to global change to discourse matters such as inconsistency in supply, increasing demands for water, environmental flows and land use change. It aids to shape links among science and policy and exercise in the area of water properties supervision and supremacy, narrates recognized and scientific revolutions and categorizes in which ways exploration can support policy and practice in the field of supportable freshwater management. Until the industrial revolution, human beings and their activities played an insignificant role influencing the dynamics of the Earth system, the sum of our planet ‘s interacting physical, chemical, and biological processes. Today, humankind even surpasses nature in terms of changing the environment and touching all other facades of Earth system working. A mounting number of researchers argue that humankind has arrived a new environmental period that needs a corresponding name: the Anthropocene. Human activities impact the global water system as part of the Earth system and change the way water moves around the globe like never. Thus, managing freshwater use wisely in the planetary water cycle has become a key challenge to reach global environmental sustainability as well as industrial region like Tirupur In Tirupur textile cluster, garments production is being carried in knitting, dyeing and bleaching, fabric printing, garment making, embroidery, compacting, calendaring, and other ancillary units. Though modern machines are used, these are not utilized effectively. Electrical energy, firewood, furnace oil, and high-speed diesel are the primary energy sources used, while steam and hot thermic fluid are the secondary energy sources. There are more 71 potentials for improvements in both electrical and thermal energy utilization. Water requirement per kg of fabric is also high which results in more volume of effluent generation in the cluster. Improper equipment's and operations lead to increased CO2 emission. The overall observation suggests that the ground water quality was less desirable for consumption in these places of Tirupur town. It is suggested that the deterioration of ground water quality was mainly due to contamination by man-made sources, like household let-outs and effluents from dyeing industries. Therefore, steps need to be taken urgently to ensure effective water resource management in Tirupur.

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