Can Green Innovations lead to Sustainable Development? A Case Study on the Knitwear Cluster of Tirupur, India

Ponnammal K Pandian\textsuperscript{a}, Savitha Nair\textsuperscript{b}, B. Raja Rajeswari\textsuperscript{c}

Abstract

Environmentally sustainable industrial development is an essential precondition in today’s globalized world. This can preserve the long term interests of the communities who depend on the industry as well as the societies whose livelihood are affected by the operations of the industry. This paper attempts to discuss the core aspects of sustainable development and green challenges with special reference to the SMEs (Small and Medium Enterprises) operating in the knitwear cluster of Tirupur, in south India. The cluster accounts for almost 40\% of India’s cotton knitwear exports contributing significantly to the foreign exchange earnings of the country. However, the insensitivity towards environmental degradation due to

\textsuperscript{a} Director, RVS Institute of Management Studies and Research, Sulur, Coimbatore, Tamil Nadu, India 641402, e mail:ponni@rvsgroup.com

\textsuperscript{b} Assistant professor, RVS Institute of Management Studies and Research, Sulur, Coimbatore, Tamil Nadu, India 641402, e mail:savithanair@rvsgroup.com

\textsuperscript{c} Assistant Professor, RVS Institute of Management Studies and Research, Sulur, Coimbatore, Tamil Nadu, India 641402, e mail:rajarajeswari@rvsgroup.com
industrial pollution has led the compulsory closure of the majority of wet processing units in the cluster recently. This has also brought the entire cluster operations almost to a standstill. Hence the major challenge faced by the cluster today is to ensure industrial development in a sustainable manner through a proper trade-off between environment and development, cost and benefit. In this context, a study addressing the problems of sustainability faced by the cluster is found necessary. Relevant literature review and expert opinions are discussed to propose the means to ensure balanced development that ensures industrial as well as environmental viability.

**Key Words:** Knitwear Industry, SMEs, Environmental Issues, Green Innovations, Sustainable Development

**Introduction**

The concept of ‘sustainable development’ was popularized by the World Commission on Environment and Development (WCED) in its 1987 report entitled ‘Our Common Future’. According to the report, sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. The inability to promote sustainable development is often due to relative neglect of social and economic justice. Business plays a very important role in sustainable development process, as its activities influence every stage of our daily value chain. Several businesses engage themselves directly or indirectly in the lion’s share of resource exhaustion, energy use and hazardous emissions that generate environmental concerns. Sustainable development has to be incorporated in the value system of organizations especially when they use resources from the environment extensively.
Environmentally sustainable industrial development is an essential precondition in today’s globalized world. Integrating economic growth, social issues and environmental concerns ensures that all the stakeholders are beneficiaries in the overall development process of the society concerned (Visvanathan et al, 2005). The effective management of industries without harming the ecology can lead to market competitiveness and economic performance in the long run. Managerial decision making therefore should integrate social and economic considerations to ensure sustainability. Though these considerations are not in opposition to each other, their integration into the business world is often lost due to concentrating more on personal and group gains.

Failure to recognize the linkages between the industry, society and the environment at large, and the impact of one on the other, may lead to distant consequences endangering all the components in the total system. Sustainable development strategy if properly planned and implemented can promote harmony among human beings and between humanity and environment. Hence the need of the hour is to have a production system that respects the commitment to safeguard the ecological base for development. Although awareness towards the need to integrate environment and development priorities into policy and decisions on business is increasing, significant obstacles remain.

This case study attempts to discuss the environment management issues of the Knitwear manufacturing cluster of Tirupur in the state of Tamil Nadu, India. An internationally acclaimed knitwear cluster, Tirupur, consists of thousands of small and medium firms involved and integrated in the production of world class knitwear. The industry that had started its operations as early as in 1870 has, however failed to perform on the frontier of sustainable development by way of environmental degradation. The case study is proposed to identify the core issues of environmental sustainability in the cluster and discuss
feasible green solutions advised by the industry experts and cluster members that can ensure industrial and environmental viability in long run.

The Indian Textile and Clothing Industry

The textile and clothing industry is one of the most important economic activities in India in terms of output, employment generation and export earnings. During 2009-10, the industry contributed 4% to the country’s GDP and 14% to the country’s industrial production. With US$ 20.94 billion of textile exports in 2008-09, the industry contributed 17% to the foreign exchange earnings of the country. The industry provided direct employment to 35 million people. Indian textiles are exported to more than a hundred countries all over the world. However, the two third shares of exports are to USA and EU. The textile export basket of India comprises of a wide variety of textile items such as cotton and man-made yarn and fabric, wool and silk fabric, made-ups and a variety of garments (MOT, 2010).

Readymade garments accounts for approximately 42 % of India’s total textile exports. The year 2009-10 was a challenging year for Indian textile industry due to the global recession, inflationary trends and volatility in commodity prices. Despite of these, the textile exports during the period April 2009-January 2010, amounted to US$17.37 billion, of which the share of ready-made garments was a recorded US$8139.23 million. Between April-December, 2010-11, India’s apparel exports amounted to US$ 11163 million, recording an increase of 4.2% over the exports during the corresponding previous period (AEPC, 2011). The US and Western Europe are the largest importers of knitwear, with China being the largest exporter and India serving as the 7th largest exporter of knitwear (Arun Trivikram et al, 2011).
Table 1: Key Competing Knitwear Clusters in the South-Asia/Far-East region

<table>
<thead>
<tr>
<th>Location</th>
<th>Main competitive advantages</th>
<th>Major Weakness</th>
<th>Overall Trend</th>
<th>2009 Cluster Exports (Billions)</th>
<th>2010 Country Textile Exports (Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China - Guandong (Shaxi, Xintang, Xiqiao clusters)</td>
<td>Strong infrastructure; higher duty drawback</td>
<td>Few IFCs; rising labour costs; IP violation</td>
<td>↑</td>
<td>$21.9</td>
<td>$206</td>
</tr>
<tr>
<td>India – Tamil Nadu (Tirupur cluster)</td>
<td>Access to raw materials; strong IFCs; entrepreneurial talent; short lead-time</td>
<td>Poor infrastructure; pollution; low R&amp;D</td>
<td>↑</td>
<td>$2.25</td>
<td>20</td>
</tr>
<tr>
<td>Bangladesh (Chittagong, Dhaka, Gazipur and Narayanganj)</td>
<td>Duty free exports to EU and Canada</td>
<td>Pollution; Low R&amp;D</td>
<td>↑</td>
<td>$6.2</td>
<td>$12.1</td>
</tr>
<tr>
<td>Vietnam (North Vietnam)</td>
<td>High workmanship; product quality; Localization of raw materials; Low-cost labour</td>
<td>Productivity level is not adequately competitive</td>
<td>↑</td>
<td>$3.97</td>
<td>$11.2</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Availability of raw materials; low-cost labour</td>
<td>Outdated machinery, technology; Low skill level; Poor quality fibre</td>
<td>⇩</td>
<td>No specific cluster</td>
<td>$10</td>
</tr>
</tbody>
</table>

Source: (The microeconomics of Competitiveness: Tirupur Knitwear Cluster, Harvard University, 2011)
The Knitwear Clusters in India

A cluster is a geographically proximate group of companies and associated institutions in a particular field, linked by commonalities and complementarities (Porter, 1998). A Cluster is a group of producers making the same or similar things in close vicinity to each other (Schmitz, 1992). Clusters are geographic concentrations of interconnected companies engaged in similar or highly related economic activities (UNIDO, 2005). The above definitions show that geographic concentration, historic events, institutional framework and sectoral specialization are the factors that are strongly connected to the development of any industrial cluster. Combination of various economies available from clusters leads firms to reap what is often called “agglomeration economies” (Bellandi, 1989).

The important centers of knitwear industry in India are; Ludhiana in Punjab for woollen and synthetic knitwear, Ahemadabad in Gujarat for cotton and synthetic knitwear, Tirupur in Tamil Nadu for cotton knitwear, Delhi (Gurgaon & Noida) for synthetic knitwear, Bangalore for cotton and synthetic knitwear; and Mumbai for cotton and synthetic knitwear. Though, Kolkata is the origin of Hosiery in India and in particular to Tirupur, it has not been developed to the status of a full- fledged knitwear cluster. It is noteworthy that major portion of knitwear garments manufactured in India are being made in the state of Tamil Nadu (the knitwear cluster of Tirupur being the prominent one) followed by others. The cluster accounts for more than 50 % of cotton knitwear exports from India (SMEFDP-SIDBI, 2009). The cluster’s exports during the year 2010 was US$2.5 billion corresponding to 66% of its total value and over 40% of India’s total knitwear exports (iMaCS, 2009)

Background of Tirupur Knitwear Cluster

A knitwear cluster is a geographically adjoining group of interconnected companies and associated institutions involved in the knitwear value chain. Tirupur, a newly formed
district in the state of Tamil Nadu, India is probably the hallmark of the success stories of Indian clusters (UNIDO CDP, 1997). The origin of the knitwear cluster of Tirupur can be traced back to the pre independence era. The cluster that had started its operations as early as in 1870 undertook the production and local sales of low priced cotton hosiery mainly the undergarments during the 1920’s and started international operations from 1974. The cluster which is ideally located in the middle of a cotton farming belt has the advantage of easy and ready access to cotton in abundance. The cluster provides direct and indirect employment to nearly three lakh people in all the skilled, semi-skilled and un-skilled categories.

Tirupur is Natural Cluster nourished and developed by the entrepreneurship of the business people here. UNIDO attempted to create a Forced Custer at Hyderabad in the state of Andra Pradesh, but it failed miserably. The Majority of the units operating in Tirupur Knitwear Custer are small and medium firms owned by the local residents here on sole proprietorship or partnership basis. Majority of these SMEs manufacture for the leading brands in the industry globally. Only very few units manufacture and sell garments in their own brand name. According to the Tirupur Cluster Study (2009), the industry is estimated to have 6250 units and the composition is as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knitting / Stitching Units</td>
<td>2500</td>
</tr>
<tr>
<td>Dyeing and Bleaching</td>
<td>750</td>
</tr>
<tr>
<td>Fabric Printing</td>
<td>350</td>
</tr>
<tr>
<td>Embroidery</td>
<td>150</td>
</tr>
<tr>
<td>Other ancillary units</td>
<td>250</td>
</tr>
<tr>
<td>Compacting and Calendaring</td>
<td>200</td>
</tr>
<tr>
<td>Exporters</td>
<td>700</td>
</tr>
<tr>
<td>Domestic Garment Manufacturers</td>
<td>1700</td>
</tr>
</tbody>
</table>
The Knitwear Value Chain

The knitwear value chain of Tirupur comprises of thousands of small firms starting from spinning and knitting through wet processing to embroidery, stitching and finishing supported by several ancillary units. There is high degree of integration, both vertical and horizontal, resulting in a highly flexible production competence among the manufacturers in the cluster, allowing them to produce quality garments at the most competitive prices. The factors contributing to this had always been the cluster’s export culture, easy availability of raw materials and hosiery yarn, cheap and skilled labors, and entrepreneurial spirit of its residents (FWF, 2004). The cluster however suffers from several weaknesses on account of poor infrastructure support, low research and development, industrial pollution and relatively higher logistics costs.

The production of knitwear involves various stages. The grey or dyed yarn from the spinning mills has to be knitted to make the fabric. This knitted fabric then goes to dyeing, bleaching and processing. The processed fabric goes for calendaring or compacting. Thereafter the fabric goes for cutting, stitching and finishing. Sometimes, as per the buyer’s demand, printing or embroidery work is also done on the fabric. The finished garments are then sold to the final customers.

Figure 1: The Knitwear Value Chain

![The Knitwear Value Chain Diagram](image-url)
The Modus Operandi of Wet Processing Units in the Cluster

Wet processing (bleaching and dyeing) is a sub-sector of the knitwear industry. The cluster has nearly 729 wet processing units. Most of the units are located on both sides of the Noyyal river which makes it convenient for the firms to discharge the effluent directly into the river. Low investment, bright future of colouring in clothing industry, good profit margins and prior experience in textile processing, are some of the factors which encouraged the entrepreneurs to select textile processing from other segments of the industry (Prakash Nelliyath, 2007).

Most of the wet processing units follow traditional processing technology, which is not environment friendly. The conventional textile wet processing requires lot of water and energy as inputs. The techniques that are mainly employed to dye and finish knitwear requires a dyeing cycle of nearly 8 hours, consisting of several dye baths at high and low temperatures. The water consumption is approximately 100 liters per kilogram of fabric. So the energy consumption to heat the required water and thereafter drying the dyed fabric is enormous. The boilers used for this purpose usually use natural gas, wood and furnace oil. Since textile processing is highly water consuming, water scarcity is a severe threat to the industry. A look into the history shows that these units used to extract considerable quantity of ground water from the peripheral areas and discharge the effluents from the process untreated. However, the deterioration of the surface and ground water has compelled these industry people to buy water transported from peripheral areas.

Once the dyeing process gets over, the resultant water is heavily polluted, coloured with chemicals and often toxic. This water, if let out untreated causes serious damage to the ecological balance of the surrounding areas. Most of these dyeing units have not been treating their effluents properly and the untreated or partially treated effluents were discharged into
water bodies or on to the land for decades. The water in the river and soil in the downstream areas have been polluted with toxic chemicals making it unsuitable for domestic and agricultural use, in that way having negative externalities on the local communities.

The Underlying Issues of Sustainability of the Cluster

The Industry Ecology Study conducted by Suren Erkman and Ramesh Ramaswamy(2003) revealed that the industrial system of Tirupur is not sustainable. It is characterized by heavy pollution, misuse and depletion of critical resources like land/soil, firewood and water. Water pollution by way of effluent discharge as well as pollution of the ground water affecting the society at large is the major concerns on account of the unbalanced development.

The textile industry is one of the most chemically intensive industries globally. It is often treated as one of the largest offenders in terms of pollution as it utilizes chemicals and water in large quantities. Estimated wastewater generation from industrial cluster in Tirupur is around 102 million litres per day (Rangarajan, 2005). The bleaching and dyeing process are the main causes of pollutants which include caustic soda, hydrochloric acid, sodium hydrosulphate, hypochlorites and peroxides.
Table 2: Status of Dyeing Units

<table>
<thead>
<tr>
<th>Details</th>
<th>Number of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Numbers of Bleaching and Dyeing Units</td>
<td>729</td>
</tr>
<tr>
<td>Individual units having zero effluent discharge system</td>
<td></td>
</tr>
<tr>
<td>Implemented complete zero effluent discharge facilities</td>
<td>73</td>
</tr>
<tr>
<td>Installed RO plant but have inadequate reject management facility</td>
<td>70</td>
</tr>
<tr>
<td>Installation and commissioning of RO plants or nano-filtration system incomplete</td>
<td>13</td>
</tr>
<tr>
<td>No initiation for installation of RO plant</td>
<td>2</td>
</tr>
<tr>
<td>Under Closure</td>
<td>73</td>
</tr>
<tr>
<td>Members of existing 8 CETPs</td>
<td>262</td>
</tr>
<tr>
<td>Members of proposed 11 CETPs</td>
<td>233</td>
</tr>
<tr>
<td>Combined ETP</td>
<td>3</td>
</tr>
</tbody>
</table>

(Source: National Environmental Engineering Research Institute Report, 2011)

Tirupur being a dry, water-scarce region had rapid industrial expansion in an unplanned manner, with no associated development of supporting infrastructure or institutional capacity. The condition of dyeing units in the Tirupur knitwear cluster is pathetic due to redundant dyeing and bleaching techniques, inadequate technology adoption, and upgradation, poor yarn quality testing facility, water scarcity etc.

A very difficult aspect with respect to the waste water of the knitwear industry is the high salt concentration that can be removed only with very expensive and sensitive treatment technique called Reverse Osmosis (RO). There is also a dearth of trained and skilled professionals to manage the high technology equipments such as the RO plant for waste water treatment.

In India, the regulatory framework for environmental standards for textile manufacturing units has been in place for many years. But compliance by the industry
operators (especially processing units) has overall been rather poor. Though, the Central Pollution Control Board and the State Pollution Control Board has implemented numerous policies and regulations to prevent and control water pollution, their enforcement and policing has always been an ineffective mechanism. This is primarily because the costs have gone up but price realization has not kept pace, making investing in greener technology and processes unviable, especially for producer groups and manufacturers whose operations are either small or medium scale (Switchasia, 2010).

Cleaner production (CP) technology like soft flow machines has a lot of scope in textile processing. However, since the soft flow machine is ten times costlier than the traditional winch, it is not affordable by the small units. In order to meet the standards set by the Pollution Control Boards, textile production units have to make large investments in technology upgradation and expertise. Likewise, they also have to pay to obtain certifications and to avail of testing and accreditation services.

**The Steps already taken**

The contamination of groundwater and over-exploitation of the ground water resources has led to a serious shortfall of water for farmers for irrigation, prompting court cases and local protests. Poor enforcement of environmental regulations has led to citizen campaigns, judicial action to close non-complying firms and measures to install common effluent treatment plants and locate new sources of water supply. In 1991, the Tiruppur Dyers’ Association formed a company, the Tiruppur Effluent Treatment Company (P) Ltd and initiated certain attempts towards the construction of effluent treatment plants. Unfortunately, progress towards the effluent treatment programme was negligible till 1996. Subsequently in 1997, following the Order of the High Court, industries which did not have effluent treatment facilities had to close and the remaining units decided to construct effluent
treatment plants. From then, units were treating their effluents either through Individual Effluent Treatment Plants (IETPs) or Common Effluent Treatment Plants (CETPs).

Table 3 Characteristics of Waste Water form Bleaching and Dyeing Units of Tirupur

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Bleaching</th>
<th>Dyeing</th>
<th>Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>10</td>
<td>9.5</td>
<td>8.8</td>
</tr>
<tr>
<td>Biological Oxygen Demand (mg/L)</td>
<td>300</td>
<td>380</td>
<td>330</td>
</tr>
<tr>
<td>Chemical Oxygen Demand (mg/L)</td>
<td>650</td>
<td>700</td>
<td>660</td>
</tr>
<tr>
<td>Total Suspended solids</td>
<td>300</td>
<td>350</td>
<td>300</td>
</tr>
<tr>
<td>TDS (mg/L)</td>
<td>6560</td>
<td>9000-10000</td>
<td>8620</td>
</tr>
<tr>
<td>Colour</td>
<td>Whitish</td>
<td>Intense Colour</td>
<td>Intense Colour</td>
</tr>
</tbody>
</table>

(Source: Case Study of Tirupur, UNIDO, 2005)

When the Noyyal River Ayacutdars Protection Association moved the Madras High Court in 2006 against the polluters indicating the fact that the water quality of Noyyal river is unfit for domestic purpose or for irrigation due to the presence of high concentration of dissolved salts, colour and organic matter, the dyers gave an assurance that there would be zero discharge into the river. The CETPs adapted to this and were approved by the Tamil Nadu Pollution Control Board. But they failed to ensure zero discharge and pollution continued.

The Current Scenario

The Madras High Court stepped in January 2011 again, when a contempt of court petition was filed by those fighting for a clean Noyyal. In cognizance of all aspects involved in the case, the court directed the compulsory closure of the majority of wet processing units in the cluster with immediate effect. Further, the directive is to ensure zero discharge by the
dyeing units to resume operations which, according to the industry sources, is highly impossible.

The closure of the dyeing units has brought the entire cluster operations almost to a standstill. The shut down has resulted in a loss of about Rs. 120 billion of foreign exchange to the country. This has also created tremendous hardships to the cluster members dependent on the local dyeing units for their order processing, necessitating them to look out for processing outside the cluster, mostly located in Ludhiana, Kolkata etc., This has led to increase in the cost of dyeing, difficulty in follow up and severe time delays. All these have affected the overall competitiveness of these exporters who are in tight competition globally with their Chinese and Bangladeshi counterparts. It is estimated that nearly 4 lakh people would have lost their job due to the closure of units. Majority of the cluster members feel that the current scenario is not conducive for the industry to perform well.

Environmental Degradation- The Reasons Behind

Tirupur is not a professionally developed cluster. It is a natural cluster that originated its operation due to the entrepreneurial spirit of the residents here. The original entrepreneurs of the cluster are cotton producing farmers who later on set up spinning mills to convert cotton into yarn and then knitting units to manufacture fabric from yarn. Later they started processing and set up manufacturing units and in due course, vertically integrated operations led this cluster create history by manufacturing top quality cotton knitwear for international customers. Since the cluster is a naturally born cluster, generations after generations, the entrepreneurs followed the same format of operating their business. Their lack of technical qualification and skills made them take business decisions based on their instinct.

Majority of the units in the cluster, especially the wet processing units, do not engage in continuous skill development to keep pace with the technological updating and
environmental aspects. Some of the roots of the water crisis lie in inefficient processing techniques. Tirupur lacks high quality, modern dyeing and finishing technology, and producers have traditionally given insufficient attention to developing consistent processes that ensure high quality. Consequently, re-dyeing is common and washing fastness is poor.

Even the selection of machineries required for the operations and engagement of labor is not done professionally. Most of these decisions are based on references received from other cluster members. The dyeing masters and operators are not given professional training to sensitize them on the harmful effects of effluent discharge. Hence they followed the conventional method of dyeing and engaged in irresponsible effluent discharge without taking into account the parameters to be maintained in the waste water to be released into the river. Even though Government of India runs the Skill Updation Programme through the Textile Committee, it is neither seriously taken nor rigorously followed by the entrepreneurs. Poaching of skilled labor is prominent in the industry. The fear of labour turnover also discourages these entrepreneurs in imparting special skills to their employees.

Hence the need of the hour is to create awareness among the entrepreneurs and other stake holders affected by the industrial pollution and the society at large. As the entire industrial operation of the cluster has come to a standstill, immediate solutions need to be worked out to save the industry from dying out. It is saddening to understand that there are no good wet processing units available in the country. Laborers and their families dependent on the industry feel the insecurity regarding their livelihood. Many laborers have already lost their jobs and have relocated themselves to other parts of the country. Lack of employment also worsens the law and order situation in the district and people tend to engage themselves in illegal activities.

The manufacturing units, to continue in the business, are currently doing the processing at Kolkata, Delhi and other centres in India. This is leading to time delays and
difficulty in managing the operations. The transportation cost has also increased due to this. The increased cost of dyeing, the added transportation cost and the delays in production due to the difficulty in managing the distance all reflect in increased price of the garments manufactured which again reduce the competitiveness of the cluster. As there is stiff competition for knitwear from China and Bangladesh, this hike in price reduces the attractiveness of the cluster at the international level.

**Green Solutions to Ensure Sustainable Development**

There are interesting yet contradictory and confusing opinions about the sustainability of Tirupur Knitwear Cluster. While trade unions, environmentalists and workers express hopelessness, the entrepreneurs see a ray of hope for the revival of the cluster and its future growth. As per order of the High Court of Madras, the wet processing units have to adopt technologies to ensure zero liquid effluent discharge to protect the surface and ground water quality in Tirupur. Presently, some units have either installed membrane technology (Reverse Osmosis) followed by evaporator system (MEE) or are in the process of installation to attain zero discharge.

However, no major efforts have been taken in this direction for selection of appropriate technologies for the recycle of the treated effluent, and disposal of membrane rejects. In light of the above critical situation, certain solutions have been proposed by the Government, industry experts as well as the cluster members that can ensure the survival and development of the industry in the long run without compromising the environmental standards. These are briefly outlined below:

To provide environmentally safe treatment of toxic water and to dispose off this treated effluent deep into the sea is often quoted as a long term solution to the effluent disposal issue. Under the proposed Marine Disposal Project by the State Government of Tamil Nadu, it is
anticipated to treat the effluent as per the standards, take the treated effluent water away from the cluster in pipelines to the sea and release it into the non fishing zones of sea. The pipeline is proposed to be laid from Tirupur, right bank of Noyyal river till it confluences with Palk Bay. The effluent has to be treated in compliance with the marine standards. It is a long term project, its proper planning and implementation will surely provide a permanent solution to the sustainability issue of the industry, remove the restrictions on expansion of existing units, and allow establishment of new units in the cluster. If properly implemented, this can also lead to generation of employment opportunities, bringing in economic and social development in conformity with the environmental standards. The project will also prevent any possibility of pollution of land and underground water. The Tirupur Exporters Association (TEA) has sought government help to set up a marine discharge project with an overall estimated investment of Rs 1,000 crores to solve the dye effluent problem clouding the industry. The project will be based on the successful model Bharuch Eco-Aqua Infrastructure Limited (BEAIL) already in operation in the state of Gujarat from the year 2000 (http://www.beail.org)

Yet another proposed solution to compact with environment challenge is to set up natural evaporator plants that can help in evaporating the treated effluent and crystallizing them back. Natural evaporator would be a viable alternative to the mechanical evaporator for treating the RO reject of the textile industry and this could bring relief to the dyeing units in Tirupur, which are today fighting for survival. The conventional mechanical evaporator being used by individual and Common Effluent Treatment Plants (CETPs) was flawed and there were difficulties in evaporating the requisite quantity of effluents. Under the proposed solution, the effluent, instead of being boiled, is cascaded over a series of wooden structures, which breaks it into droplets and then dried naturally. The project has been developed by NIFT TEA Knitwear Institute of Fashion, Tirupur and is currently under testing at SIPCOT Industrial
Estate in Tirupur. Once it is proved to be successful, it can be implemented with immediate effect on a large scale and thus ensure sustainability.

Bioremediation has also been quoted as a sustainable solution for the treatment of industrial wastewater, a critical pain point being faced by industries worldwide. Bioremediation uses naturally occurring microorganisms (such as algae) and other aspects of the natural environment to treat wastewater of its nutrients (Oligae Guide, 2010). Currently there is no sewage treatment plant for treating the municipal waste of Tirupur. It is suggested that the sewage can be mixed with the industrial effluents and then commonly treated in RO to bring the TDS in the waste water below 2000.

Growing coloured cotton has also been proposed as a green solution to the dyeing issue of the knitwear cluster. Tamil Nadu Agriculture University (TNAU) will be taking up breeding work on colour cotton to develop viable colour cotton varieties, according to a top university official. Natural dyes are an eco-friendly substitute of synthetic dyes, and are less harmful. Adequate research can also be carried out to understand the economical application of natural dyes in the processing of different textiles.

Introduction of Cleaner Production technology in the manufacturing process may be an effective long range solution for reducing the pollution problems of textile industries. Even though soft flow machines are expensive, they are economical and environment friendly in the long run. Government and concerned agencies can take steps to create awareness regarding this among the wet processing operators.

At present, the pollution management cost is totally borne by the dyers. The textile processing management and issues should be the collective responsibility of the entire industry. The Dyer’s Association needs to be effectively supported by Tirupur Exporter’s Association and other agencies to mitigate the heavy burden of the cost involved. Though
exporters have been giving Rs.15 to 20 per kg as additional cost for the dyers in order to meet out their ETP/RO/MEE costs for effluent water treatment, it has not been fully utilized as per the requirement.

Compulsory training has to be imparted to dyeing masters and managers of the effluent treatment methods and concerned environmental issues. Government has to arrange for adequate knowledge and technology transfer on waste water treatment and cleaner production methods in wet processing. This together with the technological solutions can ensure strict compliance of the environmental standards and sustainability in the long run.

**Conclusion**

Sustainable manufacturing is increasingly becoming critical to today’s pioneering businesses. Business decisions, actions and their ultimate impact are influenced by societal expectations, competition and the health of business environment. These aspects can be brought together in the framework of responsible competitiveness that can help in achieving social and environmental improvements and economies of scale.

This case study on the sustainability issues of Tirupur Knitwear cluster discusses on the criticality of business development not in pace with environmental standards. The issue is serious and viable solutions need to be undertaken to save both the industry and the environment from losing out. The solutions as proposed by the Government authorities, industry experts and cluster members have been discussed elaborately. The ideal solution can be worked out only when all the Government departments, local administration, NGOs and society at large that have a link with hosiery industrial development and environmental aspects come forward and work together to bring in the sustainable development of Tiruppur.
References


