GIDR Occasional Paper Series No. 5

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April -2021

Gujarat Institute of Development Research
Gota, Ahmedabad 380 060

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First Published April 2021
ISBN 978 – 81– 955331 – 0 – 7
Price ₹.125

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Acknowledgement

My heartfelt gratitude goes to each of the respondents participated in this study, the officials at Gujarat Pollution Control Board (GPCB), Gujarat Chamber of Commerce (GCC), Gujarat Dyes Manufacturers' Association (GMDA), Gujarat Industrial Development Corporation (GIDC) and Ahmedabad Textile Industry's Research Association (ATIRA). I am thankful particularly to Mr. Hardik Shah, Mr. Rajan Trivedi and Mr. Deepak Davda for their continuous support at various stages of this study. This research work would not have been possible without the support of South Asian Network for Development and Environmental Economics (SANDEE) and Gujarat Institute of Development Research (GIDR). I am extremely thankful to my mentor Dr. Celine Nauges who enriched this work with her constant academic inputs from the inception until the end of this project. In the same note, I would like to thank Dr. PriyaShyamsundar, Prof. E. Somanathan, Prof. EnamulHaque, Prof. Jeffry Vincent, Prof. PranabMukhopadhyay, Prof. Santa Das and Dr. Mani Nepal for their invaluable comments and suggestions from time to time. My senior colleagues at GIDR particularly Prof. R. Parthasarathy (Director), Prof. Amita Shah, Prof. Dinesh Awasthi, Prof. Keshab Das and Dr. Sunil Parikh are also remembered for their help that sometimes went beyond the academic needs only. Without their immense support it would not have been possible for me to pursue this research on such a politically driven topic in a new city with which I was completely unfamiliar. I am also thankful to Dr. Bejoy Thomas, Dr. Durba Biswas, Dr. Chandrasekhar Bahinipati, Dr. Sharad Lele, Prof.Joyashree Roy, Dr. ShyamasreeDasgupta and the participants during my presentation at the Global Change Programme, Jadavpur University and 8th biennial conference of INSEE in 2016 in Bangalore. Thanks are due to Mr. Bharat Bhati, Ms. Neha Choksi, Ms. Neesha and Ms. Malvika for their excellent assistance. I thank all those who have rendered their help directly or indirectly during various phases of this study.

The usual disclaimer holds.

Abstract

Environmental regulations have been assuming increasing recognition in designing and organizing industrial production in the textile sector. The issue is pertinent particularly because textile dyes and chemicals are one of the most polluting industries that account for a fairly large proportion of the industrial base. Most of the polluting industries have been facing a range of environmental regulations for a long period. However, the compliance has by and large remained limited owing to a number of factors ranging from administrative constraints to spatially dispersed pattern of industrial units, technology obsolesce, small scale and informal production organization with a number of vertically integrated agents involved across the value chain, citizens' awareness, and lastly the political will. The competitive pressure emanating from globalization of production and markets have added yet another dimension to the already complex scenario of environmental regulations in the country.

Given this backdrop, this paper seeks to i) understand the functioning of Common Effluent Treatment Plants (CETPs) along with other measures that dyes factories adopt in order to comply with the regulations; ii) ascertain the factors that influence firms' behavior towards compliance with the environmental regulations.

The findings imply that the performance of dyes industry in generating highly polluting water effluent is ambiguous. The environment management practices at the micro (factory) as well as meso levels (CETP) are influenced by not only the institutional factors such as monitoring and enforcement of regulatory laws but also the economic factors including the cost of compliance and the linkages with global market.

Key words: Environment, Regulations, Dyes industry, Compliance, Ahmedabad

JEL classifications: Q50, Q52, L51, L59, L65

1. Introduction

Conducive institutional environment in combination with a heritage of textile production and trade from 16th century has led Gujarat to be known as one of the most popular textile hubs in India. Growth of textile industry has also led the growth of dyes and dyes intermediaries industry that provides one of the most crucial raw materials for all kinds of textile products. Textile industry in Gujarat is scattered in many clusters such as Ahmedabad, Surat, Rajkot and Vapi. While Surat, Rajkot and Vapi are famous mainly for processing of synthetic and cotton textile products, Ahmedabad is famous for both dyeing and processing. Besides, industrial cluster of Ahmedabad has major three industrial estates wherein dyes and dyes intermediaries industry takes a major share contributing to the share of over 67 percent of country's total dyes production. These dyes and chemical products are largely used in processing of final textile products. The dyeing activity therefore causes pollution at two stages: first, when they are produced at the dyes and dyes intermediaries units and second, when textile processing units use those dyestuffs for manufacturing final textile products. Management of effluent discharge containing hazardous chemicals at alarming levels is matter of concern for the units involved in both of these stages of activities.

Ahmedabad cluster has three major estates viz. Vatva, Naroda and Odhav wherein these dyes and dyes intermediaries units are concentrated. In addition, Narolhas also emerged as another important cluster of dyes factories. The Ahmedabad cluster has experienced grave situations in pollution of water, land and air that invoked community pressures and litigations leading to closures of many units in 1996, after which there are set of environmental regulations started putting in place. However, it is still difficult to manage the waste and effluent water generated by units in each of these estates. The difficulties remain partly with the technological limitation and economic constraints and largely with the larger operating environment that works hand in glove with the industrial sector over the ages.

Given this backdrop, this paper discusses a) the institutional and organizational rules that drive the relationships between the factories and the CETP; and b) the regulations that are applied to the factories as well as CETPs in terms of environmental pollution and wastewater discharge.

The review of literature is discussed in brief in the next section 2,followed by methodology in section 3; analyses on organizational structures that determine the relationship between CETP and factories in section 4; the regulations that are applied to factories as well as CETPsin section 5; the effectiveness of CETP as well as overall status of the dyes and dyes and intermediaries industry in Ahmedabad in section 6; the factories' behaviour toward environmental regulations in sections 7, 8, 9, and 10. Finally section 11 pens the concluding remarks.

2. Brief Review of Literature

There is a handful of literature that addresses the question of environmental standards and compliances, the factors leading to the compliances or over compliances and firm's decision or behaviour in response to environmental standards both theoretically and empirically. However, previous studies are conducted mostly in other countries as the concern about environmental regulations and its relation with the firm's performance started during late 1980s in developed countries. Therefore, studies in Indian context are scant in literature.

2.1. Theories

Studies on environmental regulations date back during early 1990s when some firms reported high-return and profitable abatement investment. The question of whether a well-crafted environmental standard can act as asset or liability to the companies has been answered both theoretically and empirically in the literature. The environmental regulation is often argued as liability (theory of global environmental standards as altruistic liability) for the company, though in contrast, it is also argued as an asset (theory of global environmental standards as value adding asset).

Global Environmental Standards as Altruistic Liability

It is widely documented that *ceteris paribus*, in countries where environmental regulation is not enforced or not stringent, the firm operation is cheaper compared to that in other countries where strict environmental regulations lead to incur costs in the form of fines, liabilities and administrative or legal action against polluters (Stewart, 1993). It is found that annual cost of complying with the environmental regulations in USA has been approximately 2.1 percent of GDP, whereas for developing countries this amounts to a fraction of 1 percent of GDP (Jaffe, et al., 1995). In another study (Gray and Shardbegian, 1993), strict environmental regulations are found to have negative impact on productivity, as it requires companies to employ resources and man power for non-productive activities such as environmental auditing, waste treatment and litigation (Haveman and Christiansen, 1981). The advantage in operating in countries with less stringent or poorly enforced environmental regulations lies in the fact that it leads to reduction in costs. This also enables firms to continue with old equipments which are not used otherwise in more regulated markets, thereby reducing costs even further. Continual production of banned products in countries where environmental regulation is lax may also extend product life cycles and revenue streams (Vernon, 1992; Korten, 1995). The studies moreover argue that defaulting to local environmental standards is cost-saving. In the countries where environmental standards are either lax or not enforced, the altruistic behaviour of a firm targeting to achieve high environmental standards does not often interest the shareholders; this behaviour rather may hurt market value reflecting the managerial idiosyncrasies (Dowellet al.,1999).

Global Environmental Standards as Value-Adding Asset

Contrary to the argument above, this theory suggests that defaulting to lower or poorly enforced local environmental standards may be perceived as counterproductive in the long run to value-seeking investors. The cost-saving hypothesis as argued before may be over reported or does not exist in reality. The firms often perceive that specification of single standard may lead to reduction in performance monitoring and evaluation costs, as a single set of values, specifications, and procedures can be uniformly deployed throughout the world without any local deviation from the norm (Dowellet al.,1993). A single set of standards also makes product improvement in one place easily transferable to all subsidiaries. Basically,it has been shown that a single stringent environmental standard is consistent with pursuit of global competitive strategies by companies (Dowellet al.,1993; Christmann and Taylor, 2001; Bartlett and Ghoshal, 1989). Environmental standards and concern about it are expected to increase with the increase in income as experienced in some countries such as Taiwan, Singapore and Korea (Grossman and Krueger, 1995). In addition to these, there may be fringe benefits associated with compliance with higher environmental standards which is often linked with high employee morale and productivity (Romm, 1993). Moreover, adhering to higher environmental standards convey a positive reputation of the firm improving its public image as compared to the competitors.

It is assumed that firms operating inside their efficiency frontier prior to regulations may move closer to the frontier or may experience a net cost saving after regulations. Theoretically, environmental policies are “win-win” policies the hypothesis of which rests on three conditions: a) the existence of systematic and unrealized inefficiencies in firms; b) the capacity of outcome-aimed environmental regulations to expand the cost-saving opportunities; and c) the cost-saving opportunities are large enough to outweigh any costs associated with regulation compliance (Isaksson, 2005). The validity of “win-win” hypothesis, is however suffers from criticism not only because it lacks in empirical support, but also because firms in general suffer from extensive inefficiencies and therefore tend to overlook opportunities to improve profit (Oats et. Al., 1993; Palmer, et al.,1995; Jaffe, et al., 1995; Gabel and Sinclair-Desgagné, 1998;). The inefficiencies arise because any operation that involves a large number of individuals with their own objectives, time constraints and limited information sets, reasonably tend to suffer from some degree of failure to maximize profit (Isaksson, 2005). In the process of identifying the least costly way to comply with the environmental regulations, the firm also finds a few other improvements that can be carried out at zero cost or even at a profit (Isaksson, 2005), which is often referred to as “low-hanging fruit” in the literature (Gabel and Sinclair-Desgagné, 1998). Picking of a “low-hanging fruit” often leads to reduce inefficiencies that have been present otherwise before regulations. However, contrary to the “win-win” hypothesis it is argued (Gabel and Sinclair-Desgagné, 1998) that the cost of compliance and necessary restructuring may outweigh the efficiency gains and leave the firm worse off after regulation.

2.2. Empirical studies

It is widely known that the relationship between environmental goals and industrial competitiveness involve a social benefit and private costs (Porter and Linde, 1995). However, this tradeoff between ecology and the economy emerges from a static view of environmental regulation wherein technology, products, processes and customer needs – everything is considered for a particular point of time and hence fixed. Drifting from this static concept, if one considers the dynamism in firm's decision making process over the period, compliances with the environmental regulations may be found to increase with the competitiveness through innovations and reliability thus benefitting the competitiveness (Porter and Linde, 1995). In a study (Porter and Linde, 1995) it is evident that firms can benefit from properly formulated stringent environmental regulations by stimulating innovations. Indian economy is still inexperienced in dealing creatively with environmental issues; environment has not been a principal area of corporate or technological emphasis; customers are unaware of the costs of resource inefficiency "in the packaging they discard, the scrap value they forego and the disposal cost they bear. Given this scenario, regulations can play an instrumental role in triggering innovation. It is well documented (Porter and Linde, 1995) that properly designed environmental regulations can serve six purposes: a) it may signal companies about likely resource inefficiencies and potential technological improvements; b)it may raise corporate awareness; c) it may reduce the uncertainty and encourages investment to address the environmental issues; d) it may create pressures that motivate innovation and progress; e) it may level the transitional playing field by providing a buffer until new technologies become proven and learning effects reduce their costs; and f)it is useful in case of incomplete offsets. In the short run, before learning can reduce the cost of innovation-based solutions, regulation is necessary to improve or maintain the environmental quality.

Compliance with environmental regulations may act through innovations, which, in turn, may be through product offsets or process offsets[1]. However, this often suffers from criticisms as many argue that the innovation offsets, though theoretically possible, are rarely evident in practice; or, compliance with environmental regulations may ask for high costs (Jaffe, 1995; Oates, et al., 1993; Palmer and Simpson, 1993). But these second type of criticisms is not very definite since the cost estimates are often self-reported by the industries who oppose the rule and hence exaggerated. Empirical studies based on econometric modeling are often found to suffer from biases as net compliance costs are over estimated without considering benefits of innovation in the models (Jorgensen and Wilcoxen, 1990; Gray, 1987). Evidently environmental costs are negatively associated with trade performance, as well (Kalt, 1988). It is also argued that regulation though fosters innovation is at times detrimental to the competitiveness as it crowds out other potentially more productive investments or avenues for innovation (Porter and Linde, 1995).

[1] "Product offsets occur when environmental regulation produces not just less pollution, but also creates better-performing or higher-quality products, safer products, lower product costs (perhaps from material substitution or less packaging), products with higher resale or scrap value (because of ease in recycling or disassembly) or lower costs of product disposal for users. Process offsets occur when environmental regulation not only lead to reduced pollution, but also results in higher resource productivity such as higher process yields, less downtime through more careful monitoring and maintenance, materials savings (due to substitution, reuse or recycling of production inputs), better utilization of bi-products, lower energy consumption during the production process, reduced material storage and handling costs, conversion of waste into valuable forms, reduced waste disposal costs or safer workplace conditions. These offsets are frequently related, so that achieving one can lead to realization of several others." (Porter and Linde, 1995).

Compliance with environmental regulations often depends on environment management system. Empirically, environmental management has been found to have a strong, independent effect on compliance (Dasgupta, et al., 2000). Following the econometric analysis based on "equilibrium pollution" model of Pargal and Wheeler (1996) in two ways with the help of survey data in case of Mexican manufacturing sector a set of factors is found to determine the environmental compliance. Various institutional factors such as process of internal management, mainstreaming in terms of providing training for all plant personnel, assigning environmental tasks to general managers, regulatory inspection and public scrutiny are important in determining the compliance. In addition to that other factors such as size of the plant and education of the plant workers are found to have significantly greater environmental management effort and compliance. Interestingly, OECD does not have a significant influence on pollution control; and new technology had not been found to ensure a cleaner and better environmental performance. This goes in line with another study that shows evidence in favour of positive impact of environmental management system on the emission (Khanna and Kumar, 2011). However, this study differs methodologically as it examines the effects of an environment management system (EMS) on environmental performance by measuring environmental efficiency. The directional distance function has been considered to estimate firm-specific environment efficiency. In the absence of direct data on the costs of abatement, the costs of pollution reduction for firms have been estimated using the notion of environmental efficiency (EE) developed by Färe et al. (1996). EE is measured using non-parametric approach – DEA. On one hand it is found that adoption of a more comprehensive environmental management system leads to a statistically significant decline in toxic pollution per unit output (Khanna and Anton, 2002). On the other hand, in another study it has been found that the adoption of codes of environment management of the Responsible Care Programme of the Chemical Manufacturers Association has had an insignificant and negative impact on the absolute and relative rate of environmental improvement, measured in terms of toxic releases.

There is a link between proactive environmental management and superior stock performance (Dowell, et al., 1999). A gamut of studies ascertains that news of high levels of toxic emissions impedes the reputationof the firm resulting in the decline of its stock prices and significant negative abnormal returns whereas firms with strong environmental management practices have better stock price returns than those with poor practices especially after major environmental disasters (Hamilton, 1995;Klassen and McLaughlin, 1996).

3. Methodology

The study follows methodology of qualitative analysis including in-depth interviews and case studies. In-depth interviews with the regulators (Gujarat Pollution Control Board or GPCB), the regulatees (Common Effluent Treatment Plant or CETP); the industrial association namely Gujarat Chamber of Commerce and Industries (GCCI); and the technical experts who are closely associated with the industry as technical consultants or advisers but do not exercise direct stake with the industry's performance have been conducted. Although the interviews have been qualitative in nature, an interview schedule was followed to collect information more precisely. The interview schedule is enclosed as Appendix 1.

The interviews mainly aim to understand the context within which CETPs in Gujarat particularly in Ahmedabad were established; how they operate currently; the bottlenecks in their functioning; the achievements and limitations of CETPs, and the norms that the CETPs impose on their member factories.

A method of case-study has been followed to identify a particular case that explains whether the regulations and their compliance are low hanging fruits or burden to the firms. We have a list of registered dyes and dyes intermediaries firms in Ahmedabad clusters distributed in Vatva, Naroda and Odhav industrial estates. Two large units are selected at random from Vatva and Odhav, while eight MSMEs have been selected at random from the three industrial estates. Thus, ten factories belonging to ten different dyes firms have been visited for the purpose of case studies.The selected factoriesmanufacture dyes products that are used largely in cotton textile products particularly cotton clothes. A structured questionnaire has been followed to conduct interviews at the factories. The questionnaire is enclosed at the end of this paper as Appendix 2.

In addition to in-depth interviews conducted in the selected factories we have also interviewed the NGO viz. *ParyavaranMitra*that works toward the objective of building awareness about environment and people's right to the clean environment, conservation and protection of environment particularly the issues of pollution, climate change and carbon trading. The questionnaire used for interviewing NGOs is also enclosed at the end of this paper (Appendix 3).

4. History and status of CETPs in Ahmedabad cluster

Industrial cluster of Ahmedabad has major three industrial estates where dyes and dyes intermediaries industry takes a major share contributing around 70 percent of country's total dyes production. These dyes and chemical products are largely used in processing of final textile products. The dyeing activity therefore causes pollution at two stages: first, when they are produced at the dyes and dyes intermediaries units and second, when textile processing units use those dyestuffs for manufacturing final textile products. Management of effluent discharge containing hazardous chemicals at alarming levels is matter of concern for the units involved in both of these stages of activities.

The causes of environmental pollution associated with industrial production date back in 1964 when Gujarat Industrial Development Corporation (GIDC) developed Naroda industrial estate 22 km away from Ahmedabad city with the prime objective of encouraging and spreading entrepreneurship

attitude among the Trading Sector, particularly in Small Scale Industries (SSI) Sector. Later on industrial estates were established in Vatva and Odhav in 1967 in the surrounding areas of Ahmedabad city. The establishment of these estates lacks in farsightedness, as there were no infrastructural provisions catering to the need for waste management and control of other environmental hazards. The land was allotted randomly and abruptly following no planning. The industrial estates especially Naroda and Odhavhave been primarily established for chemical industries. The GIDC initially assured to provide the support in terms of provisions of infrastructural requirements such as road and electricity except machines.

The industrial effluent, generated from these industries, discharged earlier through open kachha drain in the estates leading finally into the Kharicut canal passing nearby villages such as Navagam, Lali etc. Thus, the ground water as well as surface water – both started to be polluted. As a result contaminations of drinking water as well as damages to the crops were reported. The situation was so grave that in 1995 Public Interest Litigations (PILs) were filed. As an outcome, not only many firms shut down, but the idea of cooperative effluent management in the form of common effluent treatment facility also conceived. The unplanned layout of factories coupled with the small sizes of them both physically and financially accentuated the need to set up common effluent treatment plant (CETP)jointly. The main objective of the concept of CETP was to abate pollution in order to achieve a sustainable growth and development path.

During the initial period of industrial establishments, the rules and regulations were not well specified, thereby developing lack of concern for environment and labour standards. The unplanned industrial development combined with political and governmental support reinforced a flexible regime of regulations and their compliance. Thus,despitethe environmental laws came in place way back in the year 1974, firms often find it difficult to accept the mandates prescribed by the regulatory authorities even now.

4.1. CETP and its organizational structure

As it is documented “Common Effluent Treatment Plant is the concept of treating effluents by means of a collective effort mainly for a cluster of small scale industrial units” (Maheswari and Dubey, 2000). Uncontrolled waste disposal and resulting environmental pollution combined with the need to support large number of small and micro units that are financially incapable of treating their liquid effluent paves the road towards establishment of Common Effluent Treatment Plants in Ahmedabad industrial cluster during early 1990s. Though it was decided under the Water (Prevention and Control of Pollution) Act, way back in 1974, that ‘every industry has to provide adequate treatment of its effluents before disposal, irrespective of whether it is in stream, land, sewerage system or sea’(Ministry of Environment and Forests guidelines).The Micro and Small Scale industrial units, which have major contribution to the total industrial pollution load of the country, are often incapable of taking necessary and adequate measures to treat their effluent water. The CETP is established to help these small and micro units in achieving end-of-pipe treatment of combined waste water at much lower cost. In addition to helping the industrial units it also facilitates better monitoring by GPCB and Pollution Control Committees (PCCs).

Assistance from Central Government for CETPs is not only for establishment of new CETP, but also for up-gradation or modernization of the existing ones. The financial support includes various aspects of running a CETP, such as costs for plant and machinery for primary, secondary and tertiary treatments, on-site laboratory with standard equipment, technologies related to zero liquid discharge, etc. However, the assistance from central government is restricted to 50% of the total CETP's project cost; specifically, the ratio proposed in respect of Central share: State share: Project Proponent's share will be 50:25:25. The individual industrial units are supposed to undertake primary treatment in order to fulfill the techno-economic viability of a CETP by maintaining the stipulated hydraulic load.

While the central assistance is to cover the capital costs, the subsidies aiming to support the cost of a CETP project depend on the availability of state subsidy to the CETP as well as bank's guarantee for an equivalent amount procured by the pollution control board of Gujarat (GPCB). There is no provision for rendering support to cover the recurring or maintenance costs and retrospective funding by the central government.

State government is supposed to provide with the land for establishment of the CETP along with the financial support to cover 25% of the capital costs. It also plays key role in marinating forward-backward linkages to cover proper conveyance system from individual units to CETP and the discharge of treated waste water through the outlet. State government also reserves the right to review and control the progress of the CETP from time to time.

There are two other agencies viz. Gujarat Pollution Control Board and Central Pollution Control Board(CPCB) that control and monitor CETP from time to time. The GPCB is the concerned authority that appraises the project proposal and forwards it to the Ministry along with its technical recommendations and consent to operate the CETP. The GPCB also approves the level ofpollutants' load at the outlet of factories in order to ensure the synergy between outlet parameters of each factory and inlets parameters of CETP.

As far as physical technicalities are concerned the conveyance system has to be a piped one connecting the individual industrial units to the CETP. In case it is not techno-economically feasible to connect through pipelines, the GPCB may use a tanker system to connect them. The GPCB also ensures that the required bank guarantee has been procured thereby the State subsidy is available in advance for the CETP project. Installments of the central govt subsidies also depend on GPCB's physical and financial progress reports and audited endorsement regarding utilization certificate or Expenditure Statement.

Though the selected members of industries manage CETPs,GPCB is entitled to bring in new professional management in case of repeated violation of regulations. CETP operators are responsible for compliance of inlet effluent quality and maintaining the flow from the contributing industries; therefore,CEPTscan identify non-complying units and inform GPCB for necessary action every month. The CETP is supposed to pay for the cost of environmental audit and financial audit, while these two types of audits are suggested to be linked with each other. Thus, CETP can monitor the

quality of specified parameters in outlet and the flow rate daily and submit the monitoring data to the GPCB accordingly.

Although CPCB was involved primarily at the establishment of CETP, a three tier monitoring mechanism viz. at industry level, at the level of government (by GPCB) and at the level of third party is often undertaken thereafter. CPCB in association with MoEF and a technical institution monitors CETP hardly once a year.

4.2. Role of the Member Industrial Units

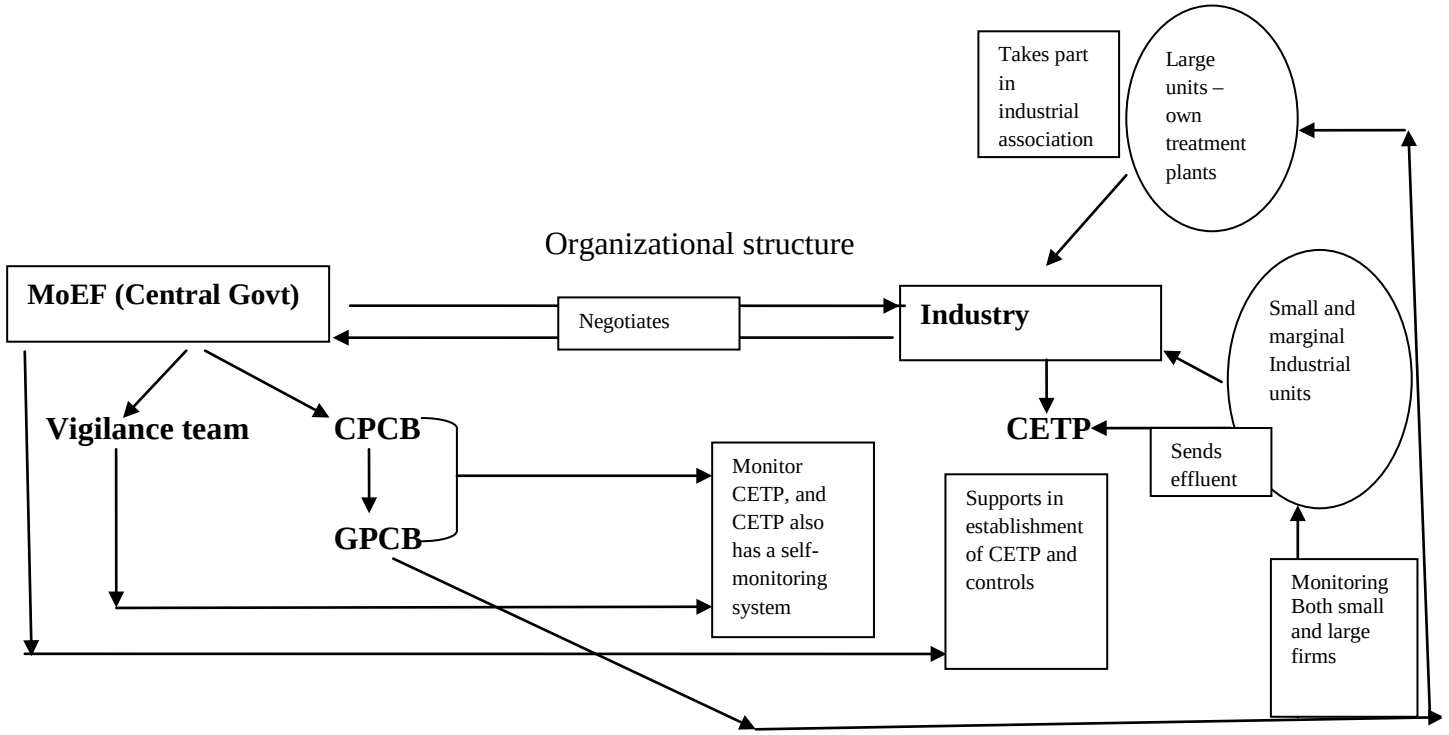
The CETP and its member industrial units are liable to follow a Memorandum of Association (MoA) that states: a) Member industries of a CETP will undertake the required primary treatment to meet inlet quality standards or quality parameters of inlet design of CETP; b) Member industries of a CETP will not only monitor quality of specific parameters and flow rate of the effluent on daily basis but also submit the monitoring data to the CETP regularly; and c) Member industries of a CETP will pay their share towards meeting the treatment cost and operation and maintenance of a CETP.

On violation of any of the clauses ofMoA the CETP may convey warnings, charge penalty, or refuse to provide its service to the particular member industrial unit.

Although World Bank still promotes and supports CETP as an effective instrument in controlling industrial pollution there are some concepts under the larger umbrella of 'clean production' that goes beyond the idea of meager pollution control. Despite being concerned for the environmental issues Ahmedabad industrial cluster still seems to be lacking in implementing each components of clean production into its larger policy formulation[2].
The allover organizational structure is depicted in chart1.

[2] "Clean production concept comprises of four main elements:
The precautionary principle: Under this principle, the burden is to proponent of an activity to prove there is no safer way to proceed, rather than on victims or potential victims of the victims to prove it will be harmful.
The Preventive Principle: Prevention requires examining the entire product life cycle, from raw material extraction to ultimate disposal.
The Democratic Principle: Clean production involves all those affected by industrial activities, including workers, consumers, and communities. Access to information and involvement in decision making, coupled with power and resources are also important in democratic principle.
The Holistic Principle: There is a need to take an integrated approach to environmental resource use and consumption. We should be careful not to create a new problem while addressing old ones or shift the problems from one sector to another" Toxics Link (2000).

Chart1: Organizational structure between Government and Dyes and dyes intermediaries industry



5. Regulations applied to CETP and individual units

As it is documented with the GPCB, the key regulations that are applied to CETP include quantitative and qualitative criteria. The criteria are mentioned hereunder:

a) Total quantity of the industrial effluent to be discharged by CETP should not exceed 1600 m^3/day.
b) The quantity of sewage effluent should not exceed 100m^3/day.
c) The industrial effluent shall maintain the standard mentioned hereunder (Table 1):
d) The effluent after being treated in the CETP and conforming to the standards mentioned above should be conveyed to the Pirana Sewage treatment plant of Ahmedabad Municipal Corporation through closed pipeline. Thus, concentration of total dissolved solids remains below 2100 mg/liters before disposal into river Sabarmati.
e) The CETP society must be able to identify the defaulting unit in case the prescribed quality of the effluent at the outlet of CETP is not achieved. The CETP society must have a system or arrangement so that it continuously and regularly ascertains the quality of effluent from member industrial units and bring it to the required norms.

Table 1:Permissible limits for outlet of CETP

Parameters	Permissible limit
PH	6.5 to 8.5
Temperature	40^0c
Colour (pt. on scale) in units	100 units
Insecticides/pesticides	Absent
Sodium absorption ratio (SAR)	26
Bio-assay test	90% survival of fish after 96 hours in 100 effluent
(in mg/l)	
Suspended solids	100
Oil and grease	10
Phenolic compounds	1
Cyanides	0.2
Fluorides	2
Sulphides	2
Ammonical nitrogen	50
Arsenic	0.2
Total chromium	2
Hexavalent chromium	0.1
Copper	3
Lead	0.1
Mercury	0.001
Nickel	3
Zinc	5
Cadmium	2
BOD (5 days at 20^0C)	30
COD	250
Selenium	0.05
Boron	2
Total residual chlorine	1
Total Kieldahl Nitrogen	100

GPCB, 2012

f) In case of failure in achieving the quality of treated effluent at the CETP outlet, the CETP must arrange for bringing the entire quantity of effluent to inlet of CETP and retreat it to achieve the required quality of effluent.

g) The CETP must develop a system so that the treated water that maintains the prescribed standard may be used for toilet flushing, washing and/or any such other purposes.

h) The CETP has to submit every month the analysis report of the samples of effluent got discharged.

i) The society shall always ensure that the quality of effluent being discharged after treatment is in line with the standards as mentioned in table 1.

j) The magnetic flow meters shall be installed at the various stages of inlet and outlet of the CETP to measure the quantity of effluent at each stage of effluent treatment plant. The CETP society is also supposed to provide this meter at the final outlet of CETP within 7 days from the date of receipt of the consent and authorization order issued by GPCB.

k) The CETP society will make it sure that every member builds storage facilities to store the effluent at least for 24 hours in an impervious acid proof brick lining tank.
l) The CETP should have power back up enough to meet the need when there is a power failure.
m) The society must inform GPCB immediately about the termination or suspension of membership of any member units.
n) In case of any interruption in the functioning of CETP there must not be any discharge of untreated effluent into the environment.

Similarly, the key regulations that are applied to individual units are mentioned hereunder:

a) The standards specified for inlets of individual industrial units based on their sizes. The standards are mentioned in table 2
b) The effluent should be conveyed through closed pipe lines to the CETP.
c) The CETP society ensures that all the member industries are discharging the effluent as per the inlet norms. No unit is allowed to discharge their effluent into GIDC drain.
d) In case any member industrial unit fails comply with ant standard the CETP is supposed to inform GPCB immediately.

Table 2:**Permissible limit for inlets to CETP**

Parameters Except pH &colour, all parameters are in mg/l	Permissible limit for inlet to CETP **Small unit**	Permissible limit for inlet to CETP **Large units**
pH	6.5 to 8.5	6.5 to 8.5
Temp	-	-
Colour	-	-
SS	300	300
Oil and Grease	20	20
Phenolic compound	1	1
Cyanide	0.2	0.2
Fluoride	2	2
Sulphides	2	2
Ammonical nitrogen	50	50
Arsenic	0.2	0.2
Total chromium	2	2
Hexavalent chromium	0.1	0.1
Copper	3	3
Lead	0.1	0.1
Mercury	0.01	0.01
Nickel	3	3
Zinc	5	5
Cadmium	2	2
BOD	1200	500
COD	3000	1200
Chlorides	-	-
Sulphates	-	-
TDS	-	-
Selenium	-	-
Boron	-	-
Total kjeldahl nitrogen	-	-
Total residual chlorine	-	-
Insecticide/pesticide	-	-
SAR	-	-
Bio-assay test	-	-

Source: GPCB,2012

The industry must:

e) Manage waste oil, grease, discarded containers, etc.
f) Submit annual report within 15 days and subsequently by 31st January every year.
g) Take all concrete measures to show tangible result in waste generation, reduction, voidance, reuse, and recycle. Actions taken in this regards will be submitted within three months.
h) Have to display the relevant information with regard to hazardous waste as indicated in the court's order in W.P.No.657 of 1995 dated 14th October 2003.

i) Have to keep disposal line outside the main factory gate. Quantity and nature of hazardous chemicals regarding waste water and air emissions and solid hazardous waste generated within the factory premises must be handled in the plant.

6. Functions, operations and effectiveness of CETPs

The Gujarat Industrial Development Corporation established Naroda industrial estate in 1964 followed by Vatva and Odhav in 1967 whereas the environmental laws put in place in 1974. The establishment and expansion of these industrial estates wereunplanned with random allotments of land. Though initially the government ensured financial and infrastructural support to set up the CETPs and its operation for first five years during 1990s, the support actually reached industry in limited ways. Later on, support from the government receded over the period. As a result, the industrial units had to join their hands together and set up CETPs in 1995, 1996 and 1998 along with the development of infrastructure andsupply of electricity at their own cost. At present, these CETPs work on 'no profit, no loss' basis. The financial contribution during the time of establishment is explained in table 3.

Table 3: Financial contributions to CETPs

Source of subsidy	**Amount**
State government	25% of total project cost
Central government	25% of the total project cost
Entrepreneurs' contribution	20% of the total project cost
Loan from financial institutions	30% of the total project cost

Compiled from Odhav Enviro Projects Limited, 2013; Gujarat Industrial and Technical Consultancy Organization Limited (2013a; 2013b); EDI, 2011

The case-studies of CETPs are summarized in table 4.

Table 4: Summary of case-studies

Sl no	Major questions	CETP in Vatva (1 CETP)	CETP in Naroda (1 CETP)	CETP in Odhav (3 CETPs are situated and covered)	Remarks of the researcher/inference from the interview and observation
1	Total designed capacity	16 MLD	16 MLD	16 MLD	
2	Who are the members in the governing board?	Both industry and govt	Both industry and govt	Both industry and govt	There is a room for negotiation since both the regulators and regulates sit frequently for discussions. Given the political and historical business culture in Gujarat, this system strengthens the industry as the government and corporate often work hand in glove.
3	Current operating cost (monthly in Rs.)	1.75 crore	50000-55000	40-45,000000	Operating cost doubles in the presence of Multi stage evaporators which is so far the most effective technology to reduce the level of COD
4	How many dyes and dyes intermediaries firms are member?	529	52	150	
5	System of penalty/punishment mechanism in case of non-compliance by the member units	Grievance committee, GPCB – closure for few days, doesn't agree to receive the waste water, factories sent it through tankers	Don't have and specified and definite penalty, depends on committee's discretionary judgment and probes	Don't admit that firms may default!	A tendency to apply the committee's discretionary power and judgment in Naroda and the response of "no default" in Odhav indicates a protective and supporting operational environment for the dyes factories. Hence, it may be inferred that even if there is non-compliance the industry has its own mechanism to hide, support and sustain the production at least in the short run.
6	Is there any leakage in the system?	Yes	No	Can't say	This answer strengthens the inference from the previous question.
7	Is there any informal arrangement through which the member	Can't say	Yes, but it is to help the firm that defaults	No	Answers against 5, 6 and 7 clearly indicates that though there are establishments and measures put in place to control the quality of effluent discharged by the factories,

	units may escape the penalty?		unintentionally (kind of Robin Hood approach)		the system itself is pro-industry and hence one has to be careful in understanding the compliance behavior, different measures and their effectiveness at the firm level.
8	Presence of laboratory in the CETP	Yes	Yes	Yes	
9	Regular inspection by GPCB	Yes	Yes	Yes	This indicates fairly active role of the regulator or monitoring authority.
10	Visits by other monitoring authorities	Yes, by CPCB	Yes, by CPCB	Yes by CPCB, ATIRA, GITCO	This is important to note that all these authorities have representations from industries as well.
11	Internal monitoring system	Yes, every month, regular board meetings	Yes	Yes	Internal monitoring system if effective can be useful in controlling the quality of water discharged finally to the mega pipe line.
12	How does GPCB/CPCB penalize/punish CETP in case of non-compliance	Warning for fines/closures	Same	Same	Softness of regulators are reflected in this answer, as they normally are not known to send the closure notice or any strict penalties but to send the warnings.
13	Limitations	Financial – needs govt financial support in terms of subsidies	Needs govt financial supports by removing different taxes, VAT, Cess, etc	Needs govt financial support but didn't specify how	Unanimous requirement for financial support raises the question of feasibility to comply with the set standards.
Note: All the CETPs are found to satisfy with the indicators of compliance, viz. regular environment audit report, formation of committees for internal monitoring, installation of different monitoring devices and application of new technologies.					

Source: Primary visits to CETPs; The Green Environment Services Co-op. Society Ltd. (2013); Odhav Enviro Projects Limited, 2013; Gujarat Industrial and Technical Consultancy Organisation Limited (2013a; 2013b)

Despite having a set of regulations put in place performance of CETP in Ahmedabad industrial cluster of small and micro scale units is not very appreciative. The Comptroller and Auditor General (CAG) in its 2011-12 report indicates lackadaisical attitude of the state government as well as other responsible agencies such as Gujarat Pollution Control Board (GPCB) for ignoring the impact of water pollution in human well-being. Further the report blames that the presence of metals and other organic pollutants in rivers, lakes and groundwater have not been assessed by the government.

The CAG report not onlyraises concerns for the incidence of water-borne diseases due to heavy water pollution, but it also questions the performance of CETPs in Gujarat as it finds CETPs fail to treat industrial sludge properly. Besides thequality of wastewater, there is also problem of illegal discharging of "untreated, concentrated, acidic and hazardous waste water directly into the Gujarat Industrial Development Corporation (GIDC) manhole without primary or secondary treatment" (CAG, 2012). It is also evident that "due to the presence of high level of hydro carbons in wastewater" discharged by the large-scale hazardous industries, "large-scale death of aqua stock in the river was reported in the recent past" (CAG, 2012).

It is important here to note that the industry is mainly MSME in its type[3]. Other than the willingness, the presence of large number of small production units itself makes it difficult for the industry to face competition and adapt new expensive technology to fulfill environmental concerns. The treatment cost is aburden for both the individual units as well as CETPs. Though the preliminary and primary treatments[4] are mandatory for the units that generate over 25000 liters of effluent on daily basis, the industry often suffers from the problem of zero treatment.

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[3] The industry today comprises mostly of small and micro units whereas large units are very few in number. Today there are about 900 dyes and dyes intermediaries industrial units that officially operate in three industrial estates of Ahmedabad. While Vatva consists of the largest number (600) of small and micro scale dyes units, Naroda has about 230 and Odhav has around 70 dyes and dyes intermediaries industrial units.

[4] **Preliminary treatment -** These are mainly physical processes. This includes-

• **Grit chambers** use gravity to remove grit and dirt

• **Equalisation-** Equalisation is a process to equalise wastes by holding waste streams in a tank for a certain period of time prior to treatment in order to obtain a stable waste stream that is easier to treat. Equalisation helps in mixing smaller volumes of concentrated wastes with larger volumes at lower concentrations. It also controls the pH to prevent fluctuations that could upset the efficiency of treatment system, by mixing acid and alkaline wastes.

• **Pre-aeration or pre-chlorination-** This process helps in controlling odours if wastewater becomes oxygen deficient

Primary treatment- These are also mainly physical processes. These include-

• **Sedimentation-** Removal of inert and organic solids is accomplished in sedimentation. Fine screens may also be used in the treatment process. Sedimentation chambers may also include baffles and oil skimmers to remove grease and floatable solids and may include mechanical scrapers for removal of sludge at the bottom of the chamber.

• **Dissolved air floatation-** It is the process of using fine bubbles to induce suspended particles to rise to the surface tank where they can be collected and removed. Bubbles may be generated by

1) dispersing air mechanically

2) by drawing them from water using vacuum or

3) by forcing air into solution under elevated pressure followed by pressure release.

• **Flocculation-**It is physical- chemical process that encourages the aggregation of coagulated colloidal and finely divided suspended matter by physical mixing or chemical coagulant aids.

The quality of effluent discharged depends mainly on the type of dyestuff manufactured in any particular unit. The production of dyes and dyes intermediaries is heavily water intensive and depending on the nature of product the extent of highly toxic elements present in the effluent varies. Though the permissible level of COD is only 250 mg/l, it often goes at least 10 times more than this amount. The challenges in controlling toxic elements in the effluent water pertain to not only the financial viability of compliance measures, but also the competition with China in the global market. Although 80 percent of dyestuffs exported in recent times to many countries including China, Indonesia, Sri Lanka, Thailand, Bangladesh, and Europe, the industry lacks in both financial capacity and government pressure to adapt modern and technologically improved treatment processes. Contrary to the theoretical standpoint of "global environmental standards as the value adding asset", the global competition particularly in South and Southeast Asia prompts firms to dodge the strict compliance with the environmental regulations. The discussions with CEOs of CETPs reveal that the competition with China emphasizes "product standards" and not the "process standards". In a context wherein global competition does not emphasize the process standard much, the role of government assumes crucial importance. Any laxity from government and other regulatory bodies coupled with the global competition in terms of price and product standard drive the low level of compliance with the environmental regulations.

The evidence from Ahmedabad cluster of dyes and dyes intermediaries firms is in line with developing countries such as Indonesia and China where in cost of production is cheap, compared to that in other countries where strict environmental regulations lead to incur costs in the form of fines, liabilities and administrative or legal action against polluters (Stewart, 1993). For instance, the annual cost of complying with the environmental regulations in USA has been approximately 2.1 percent of GDP, whereas for developing countries this amounts to a fraction of 1 percent of GDP (Jaffe, et al., 1995). While strict environmental regulations are found to have negative impact on productivity (Gray and Shardbegian, 1993) by requiring the employment of more resources and man power for non-productive activities such as environmental auditing, waste treatment and litigation (Haveman and Christiansen, 1981), the advantage in operating in countries with less stringent or poorly enforced environmental regulations lies in the reduced costs. Continual production of banned products in countries where environmental regulation is

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- **Emulsion breaking-** It involves addition of chemicals and/or heat to cause dispersed oil droplets to coalesce and separate from the wastewater. This process mainly used for pre-treatment of oily wastewater
- **Clarification-** Clarification system utilizes gravity to provide continuous, low cost separation and removal of particulate, flocculated impurities and precipitates from water and generally follow the processes which generate suspended solids such as biological treatment.
- **Granular media filtration-** Many processes fall under this category and the common element being the use of mineral particles as the filtration medium. It removes suspended solids by physical filtration, physical chemical sorption and biological decomposition.
  1) Sand filters are the most common type which consists of either a fixed or moving bed of media that traps and removes suspended solids from water passing through media.
  2) Dual or multimedia filtration consists of two or more media and it operates with the finer, denser media at the top and coarser, less dense media at the top.

Source: WPCF/WEF, 1980

lax may also extend product life cycles and revenue streams (Vernon, 1992; Korten, 1995). Thus, defaulting to local environmental standards is cost-saving even in the context of Ahmedabad, too.

Theoretically, environmental policies are "win-win" policies the hypothesis of which rests on three conditions: a) the existence of systematic and unrealized inefficiencies in firms; b) the capacity of outcome-aimed environmental regulations to expand the cost-saving opportunities; and c) the cost-saving opportunities are large enough to outweigh any costs associated with regulation compliance (Isaksson, 2005). However, the evident extensive inefficiencies existing in the informal nature of small and micro dyes production units the "win-win" hypothesis may not be valid, which is also evident in many other studies in various contexts (Oates, et al., 1993; Palmer, et al.,1995; Jaffe, et al., 1995; Gabel and Sinclair-Desgagné, 1998). As it is suggested we may expect to see that that the cost of compliance and necessary restructuring may outweigh the efficiency gains and leave the firm worse off after regulation (Gabel and Sinclair-Desgagné, 1998).

7. Dyes industry

The dyes and intermediaries industry is ranked 6th in the list of 17 categories of highly polluting industries. While environmental regulations administered uniformly across the industrial clusters in India the critical zones are restricted in expansion of production and variation of products. Ahmedabad industrial cluster is one of the first 10 clusters declared to be critical based on CEPI[5] score in IndiaAs we mentioned earlier the Ahmedabad cluster of dyes and intermediaries industries constitutes mainly small and medium firms.Evidently, some factors such assluggish overseas demand, stringent environmental regulations, high costs of infrastructure, marketing,energy and transportationto be the primary challenges that the industry has been facing since last five years (GCCI document, 2013).

As we have observed CETPs find environmental regulations as burden, it is interesting to understand whether environmental regulations act as a "low-hanging fruit" that leads to win-win solution for the factories. A brief description about the factories visited presented (Table 5). In section 8, we will make an attempt to understand why a firm takes measures toward compliance with the environmental regulations or in other words adopts environment management practices and why some other firms do not. A firm's behaviour toward the environmental regulations will primarily be indicated by its perception and attitude toward environmental regulations, its performance in domestic and international markets, and so on (section 9).

[5]Recently during 2012 the Central Pollution Control Board has come up with a Comprehensive Environmental Pollution Index (CEPI), which is a rational number to characterize the environmental quality at a given location following the algorithm of source, pathway and receptor have been developed. The index captures the various health dimensions of environment including air, water and land. Based on CEPI the industrial clusters have been identified as critical and non-critical zones.

Although 14 factories were visited we could complete interviews in 10 of them. We could not conduct complete interviews in four firms due to- non availability of CEO/Manager or the respondent was not willing to answer all the questions. We have classified those 10 firms into three categories: small, medium and large. This classification is based on the size of investment that they made during the time of establishment. There are six small firms, two medium firms andtwo large firmswho are also large exporters of dyes products (Table 5).

Table 5: Major features of the factories visited

Sr. No.	Area Of Visit	Size of Firm	Year	Production Capacity monthly (in Tonne)	Actual Production (in Tonne)	Monthly total expenditure (in Rs)	Monthly Exp H20 treatment (in Rs)	Share of Treatment exp to total exp (in %)	Monthly income (in Rs)
ssss	Vatva GIDC	Small Firm	1996	15	6000	60,900	16000	26.27	2160000
2		Small Firm		15	5000	34500	18000	52.17	450000
3		Small Firm	1987	200	197	1350000	169927	12.59	52020000
4		Medium Firm	1992	500	225000	3244500	875000	26.97	58050000
5		Large Firm	1989	1000	1000000	20126000	2900000	14.41	2950000000
6	Naroda GIDC	Small Firm	1982		21000	53500	10000	18.69	550000
7		Small Firm	2000	10	10000	122500	8000	6.53	2500000
8		Small Firm	2010	2	2000	407500	310000	76.07	800000
9	Odhav GIDC	Medium Firm	1976	75	40	25135000	15000000	59.68	47200000
10		Large Firm	1968	900	900000	18144926	2500000	13.8	2700000000

Source: Field visits by author.

It is important tonote that in the Ahmedabad cluster the units are mostly small and medium enterprises that supply dyes products for textile, mainly cotton textile products in India. The brief profile of factories is provided in table 6.

8. What makes a firm adopt and innovate Environment Management Practices (EMP)

There is a plethora of studies conducted in the contexts of developed countries and few developing countries on the understanding of a firm's decisions toward compliance with environmental regulations. The studies mostly identify traditional instruments of environmental protection such as command and control regulation and taxes on pollution. However, in some

cases, policy makers rely on voluntary environmental regulations (Arora and Cason, 1996). Although a regular monitoring system is put in placebehaviour of firms toward compliance varies from one to another. The attitude and perception about regulations and compliance also vary from one firm to the other.

The level of compliance is indicated not only by the results of parameters in waste water samples, but also set of measures taken at the factory level. For instance, in addition to the 'type' and 'quantity'of dyes products being produced along with the technical requirements about machinery, equipment, and factory design, it is mandatory for a small or medium firm to write the details about its product and effluent on a board outside of its boundary wall. It is also important to keep a tap in the pipeline that goes to CETP outside of factory premises, keep the factory well organized and clean. The tap in the effluent discharge pipe outside of the factory's boundary wall makes it easy for any individual to collect the sample of effluent. However, for a large firm it is important to ensure ETP operation according to GPCB norms, regular third party monitoring to comply with GPCB norms and legal compliance as Environment Protection Act, 1986. Therefore, even if a factory passes the test of its effluent sample, it may not be adjudged as fully compliant if it fails to keep all the required machines in function, a clean and well organized factory premises, or produces beyond the consented amount or types of dyes-stuffs, or possess an outdated license and consent from GPCB.

All the factories that we have visited are neither absolute non-compliant nor fully compliant. However, both the large factories and some small or medium factories are found to be adhering to the norms and regulations to a large extent. With the help of a designated engineer from GPCB,the technical aspectsof effluent management at the factory level have been understood in order to assess the level of compliance[6] – whether the factory is alow compliant moderatelycompliant or highly compliant– with the regulations regarding effluent discharge. The presence of Environment Management Practices (EMPs) or Environment Management System (EMS), as we found in the literature (Khanna and Kumar, 2011), is a requisite for a large factory.However, for a small or medium factory EMS is not a requisite, although they are supposed to follow set of norms and regulations set by GPCB. However, all these analyses are based on the technical observation along with an engineer of GPCB and self reported information collected from the owner/manager/CEO of the factory, and are not based on the scientific assessment of effluent samples.

As we have discussed in the earlier sections, CETP analyzes the effluent sample from each factory daily whereas GPCB makes physical visits to the factories not only to collect the effluent

[6] Low compliant factories: Those who have been unable to follow over 50% of the norms prescribed by GPCB and/or have received warning notice regarding the effluent discharge.
Moderate compliant factories: Those who follow major requirements but still needs to improve in some minor requirements (e.g., repairing outlet pipeline, or posting stickers on each step of machines being used,etc) drawn by GPCB
Highly compliant factories: Those who follow almost all the major and minor requirements

samples but also to verify other parameters included in their list. If a factory fails to adhere to any norm both CETP and GPCB initially warn the management about it. However, subsequent failures in major points such as maintaining effluent quality lead to closure notice by GPCB and refusal to accept effluent water from CETP. For extreme cases of repeated non-compliance with the effluentstandards, they also impose fines based on the quantity of effluent mentioned in the consent formFor example,the GPCB also issues closure notice when a factory manufacturesproducts without prior approval; or manufactures the permitted products but to a large scale that is beyond the permitted figure mentioned in the consent form. GPCB also closely monitors whether a factory has all the necessary documents including the license and consent from GPCB.

The table 6 summarizes factories by various crucial characteristics.

Table 6: Factories by various characteristics

Sl No	Export>6 months	Export<6 months	Perception about regulations	Level of compliance	Major suggestion/ Bottlenecks in Export	Compliance behaviour	Countries export to	any investment in past five years	cost	benefit	own ETP	own R&D
1	No	Yes	Realistic and needed specially for export	Moderate	Being a small producer faces higher input prices	Forced by regulations	Dont know	No	NA	NA	No	No
2	No	No	Needed but difficult	Low	Input price competition	Forced by regulations	NA	No	NA	NA	No	No
3	Yes 40%	No	Difficult to comply with. It is expensive - financially challenging	Low	Regulations- difficult to achieve the standards	Force by regulations and pressure from international buyers	Switzerland, Netherlands, Pakistan	No	NA	NA	No	No
4	Yes	No	Needed, realistic but no idea about export, since it is through agent	Moderate to High	Restriction in product variation, R&D is not effective due to restrictive policy	Aware of environment and voluntarily ready to comply	Netherlands, Germany, Sweden, Turkey	Yes	2.5 crore	Better product 25-30% reduction in pollution load	Yes	Yes
5	Yes	90%	Very helpful in competition internationally	Very high	Problems are addressed in isolated manner. Need for integrated policies - environment, industry and trade.	Voluntary and to maintain rapport with international buyers	European and South Asian countries	Yes	2.15 crore	Helps in maintaining H_2O quality	Yes	Yes
6	Yes 20% through agent	No	Needed, realistic and important for export	Moderate to High	Raw materials are not in one place, lack of planning	Combination of awareness, willingness and environmental	Pakistan, Bangladesh, Sri Lanka					

						regulations						
7	No	No	Realistic and useful but need to be more flexible	Moderate to high	Ph is difficult to reduce, otherwise no problem	Aware of environment and voluntarily ready to comply	Until 3 yrs ago exported to European and south Asian countries	Yes	2100000		Yes	Yes
8	No	No	Regulations are good	High	Financial- tax and subsidy, lack of govt support, red tappism and bureaucracy, bribery, high input price, lack of planning	Aware of environment and voluntarily ready to comply	NA	Yes	200000	COD reduces from 15000 to 2500	Yes	Yes
9	Yes, 60%	No	Lack of perspective on larger goal of environmental protection and conservation	Very high	Price of raw material, complexity of tax, excise duties, trade policy	Voluntary and also to maintain rapport with international buyers	Any	Yes	2300000	reduced costs for drying, water saving, energy saving	Yes	Yes
10	Yes, almost 90%	No	Regulations are helpful to perform in international market	Very high	Result oriented common platform for industries to abatement of any kind of environmental issues	Voluntary and to maintain rapport with international buyers	Any	Yes	100000000	Helps in improving waste water quality	Yes	Yes

Source: Field visits by the author.

It is evident in the literature that firms,which are closer to final consumers, are more likely to participate in the voluntary environmental programmes (Arora and Cason, 1996). This study also finds that if firms are closer to the environment conscious buyers they are more likely to maintain process standards compared to those who sell their products through some agency or sell in the domestic market. All firms report that international customers from Europe and USA are always concerned for the environmental regulations and process standards whereas South Asian and Southeast Asian buyers from Pakistan, Bangladesh, Indonesia, etc. are interested in the process standard at the initial stage of contract. Once the rapport is developed, they do not pay much attention to the process standard although product standard remains important.

Table 7:Are adoption and innovate of EMPs voluntary?

Areas	Small firms (6)	Medium firms (2)	Large firms (2)
Vatva	Driven by the regulation regime.But feels it difficult to keep up with the standards.	NA	Voluntary, otherwise fear of losing market share
Naroda	Driven by the regulation regime, also feel that they are necessary.	Partially voluntary	NA
Odhav	NA	Voluntary and realizes the need to maintain process standard. Altruistic behavior.	Voluntary, otherwise fear of losing market share

Source: Case studies by the author.

Interestingly those firms, which export directly,have been completely aware and concern about the product as well as process standards (Table 8 and 9). The firms which receive regular visits by international buyers in the factories, regulationsseem to help in developing reliability of their products in international market. Although China is the primary competitor, India has better image regarding the quality of product largely due to the stringent regulations. On the contrary, those firms that export through some agent or big exporter in Mumbai are not well aware of the importance of regulations in international market mainly because they don't face frequent visits or queries placed by international buyers. These firms report that regulations are important at the initial stage of developing rapport, but once the rapport is built regulations may not matter much in their business. Those who are found to follow the regulations voluntarily are also the ones that export. Hence, it is difficult to disaggregate the reasons for complying with the regulations: whether it is due to pressure from international market or regulators or purely voluntary.

In the countries where environmental standards are either lax or not enforced, the altruistic behaviour of a firm targeting to achieve high environmental standards does not often interest the shareholders; this behaviour rather may hurt market value reflecting the managerial idiosyncrasies (Dowell, et al., 1999). Although firms in Ahmedabad cluster exhibit the similar experience, there is one medium firm at Odhav observed to show altruistic behavior in adopting EMPs. This makes a unique case wherein the CEO of the company is fund to be aware of advance technologies in the global market. Tables7, 8 and 9 suggest that firms that comply (either because of awareness about environmental regulations and need for environmental protection and/or because of international market pressure) are found to incur less burden of the effluent treatment expenditure compared to the ones who hardly export and follow the regulations in order to fulfill the legal requirements only.

Table 8:Voluntary participation in EMP by participation in international market

Categories	Export always	Export sometimes (less than 6 months a year)	Never exported
Firms follow norms voluntarily	Firmly yes	Yes but moderate to low and discusses problems about survival and competition	Low compliance

Source: Case studies by the author.

Table 9: Those who export and follow regulations, export directly or through some agency

	Export always and directly	Export sometimes but directly (l-6 months a year)	Export sometimes but through agent
Firms follow regulations voluntarily	Yes	Yes	Ambiguous

Source: Case studies by the author.

9. Problem at policy level: Where does the shoe pinch?

When at micro level large firms export to a large extent and also perform better in following regulations the small firms are found to be struggling with their survival. At the macro level the market share of Indian dyes and dyes intermediaries products is declined from 32% in 2012 to 20% in recent year. It has been observed that the small firms are often barely sustaining themselves hence regulations often make them spend a large share of their financial resources creating a burden for them. Even though CETP and common waste treatment facilities are at place, the price disadvantage in markets of raw material and credit, high transport and transaction costs make them suffer from expenditure burden. Regulations are therefore not a low hanging

fruit for such small firms whereas they are beneficial for large firms and medium or mall firms that take part in export.

The slow-down in dyes market is attributed to many components in the policy environment. In order to comprehend the subject of compliance behavior toward environmental regulations by the dyes industry we have identified three groups of stakeholders - factories, civil society or NGO and regulators or monitoring authorities. The role of NGOs/civil society and monitoring agencies are to drive the industries and create pressure on them by effective implementation, monitoring, raising voice and general awareness about the causes and consequences of environmental pollution. We have interviewed representatives from GIDC, GDMA, GPCB, industry (including CETP) and NGO to identify the problems that may be addressed at the policy level. Table 10 indicates that awareness about environmental regulations and/or need for environmental protection and conservation may not be an issue anymore.

However, the problem lies in larger perspectives of environmental and trade policies. Both trade policies and environmental policies often fail to address the context specific need of the small firms and successfully include the large firms under the policy umbrella. A cumbersome trade policy with many windows of operation increases the transaction costs which are often difficult to be borne by small firms. This transaction cost also involves bribery (which is reported to be 10% of the total cost) and hire charges of lawyers and auditors. Therefore, many small firms prefer to stay away from export business.

Contrary to China, in India raw materials and machinery are not available at one place; therefore the industry faces high transportation costs to gather raw materials, machines and equipment. The raw materials for dyes products are often not produced in India and are imported. They often do not reach the factory on time due to sluggish process of clearance at the port of their arrivals. There is also lack of unity and trust among the dyes producers. The producers often reduce their price quotation to the international buyer in order to capture the international market. But in the long run, this lack of unity in maintaining a market price of a particular dyes product results in downfall in price and loss for the industry (Bertrand model scenario). The pay-back period for credit on raw materials has been reduced from 90 days to 30 days. In some cases the firms even need to make advance payment for raw materials, whereas the dyes are sold on credit with a payment-duration of 20 days. Overall export incentives are reduced from 4-5% to 1.3-1.5%. All these create a scenario that is detrimental for the financial health of a small firm and discourage it to take part in international trade.

Table 10: Policy shortcoming

Agency	Awareness of environmental regulations	Awareness of environmental protection	Short-coming in trade policy	Short-coming in Environmental policies	Remarks
GIDC	Yesss	Yes	Yes	Yes, but minor	Cumbersome trade policy - one window operation and tariff relaxation needed. Procedures are time consuming. Non-mixing of industrial and municipal sewage
GDMA	Yes	Yes	Yes	Yes	Unfair price competition, lack of trust - Bertrand competition, problem in credit market. Procedures for getting consent and license at GPCB are time consuming - benefit of R&D is not fully realized. Non-mixing of industrial and municipal sewage
GPCB	Yes	Moderate	No idea	Yes, but minor	Not all firms understand the benefit of conservation of environment; environmental Acts should be better implemented keeping feasibility in mind. Non-mixing of industrial and municipal sewage
Industry	Yes	Yes	Yes	Yes	Cumbersome trade policy - one window operation and tariff relaxation needed.Lack of perspective on larger goal of environmental protection and conservation.Bureaucracy and red tap-ism, Bribery Inadequate protection for small firms Lack of coordination among different ministries and departments. Procedures for getting consent and license at GPCB are time onsuming - benefit of R&D is not fully realized.Non-mixing of industrial and municipal sewage.
NGO	Yes	Moderate	May be yes	Yes	Environmental laws to be implemented in better way More stringent stand by govt Bribery Lack of coordination among different departments sssCorruption at many levels.

Source: Interviews undertaken by the author with representative of different agencies/stakeholders

As far as environmental policies are concerned, they lack in addressing the larger goal of protection and conservation of environment and climate. As the interviews with different stakeholders in associations, civil society, government and industry suggest, the regulation fails to address the larger goal of protecting water resources of Ahmedabad and surrounding areas by putting too much restrictions at factory level activities. Firms even though have own R&D facility are not allowed to bring product variation or produce a new product without consent from GPCB; but GPCB takes minimum 3 to 6 months to issue consent for any new product. By the time firms receive consent, the product loses its importance in international market which needs regular and frequent product variation keeping up with the pace of technological changes. In this process the technologically advanced products which are also more efficient and environment friendly are not encouraged. Problem of innovation in product is prominent in Ahmedabad particularly because of the stringent regulatory policy for critical zones.

There is also lack of consensus between Municipal Corporation and Industrial Development Corporation about how to reduce the pollution load at the final discharge point that meets river Sabarmati at specific points. Although GPCB strictly monitors all the factories in those three industrial estates, the municipal effluent doesn't receive adequate treatment. Few Sewage Treatment Plants (STPs) in Ahmedabad works properly. Following the practices in developed countries in west it was suggested to dilute the effluent by mixing industrial waste water with the municipal ones, in which case the industry is also ready to pay for the per unit treatment costs as determined competitively through fair pricing.

While industries cause pollution to both surface and ground water, they also take part in ground water depletion. Medium and large scale industries use water supplied by GIDC and from their private bore-well. When they are ready to use recycled water from municipality there is no system at place ensuring the coordination and supply of treated waste water from domestic use to industrial use. With lack of innovative and cost-effective technologies, inventorisation of water usage and discharge, rapid urbanization and population pressure there is a need for planning and policy that integrates both environment and trade departments in one platform. Given the present scenario of volatile raw material prices in international market, lack of trust (price competition among sellers of homogeneous products), cumbersome policies, transaction costs and transportation costs in the domestic market regulations often posit burden to the small firms who choose either not to export or find it difficult to survive in the long run. However, the regulations, as they are more stringent compared to China and Indonesia, help large export houses in developing and maintaining rapport with the international buyers and are observed to be "low hanging fruit"for them.

10. Concluding remarks: Way forward

Though there are government and regulatory bodies present actively in the system on one hand, and industrial units have established CETPs to treat the effluent and control the level of toxicity in effluent discharge on the other hand, the performance of dyes industry in generating highly polluting water effluent still warrants attention. The reason attributes to many factors at institutional and operational level. The institutional factors pertain to interest of government and regulatory bodies in this matter, financial and other support from the government and the operational difficulties pertain to the production of dyestuffs in wide varieties, the economic viability of adopting expensive technologies and competition in both domestic and international markets. The altruistic behaviour may influence the EMPs at the micro level of firms, but at the meso level of CETPs, the economic viability found to be the major driver.

What is observed in the Ahmedabad cluster indicates that the textile dyes sector at this moment suffers from a sluggish global demand that in turn leads to reduced profit margins. In order to gain competitiveness in the global market the environmental regulations seem to be more stringent than that in the 1990s or early 2000s. The increasing costs including the ones for marketing, infrastructure, energy consumption and transportation also led many small players in this sector to exit the industry. In absence of a well-designed policy for integrated management of environment and domestic as well as international trade, the initiative of joining hands in treating only the effluent through CETPs falls short in mitigating the larger concern for a sustainable production and trade of textile dyes products. Since India shares experiences a substantially high share in both production and consumption of dyes products for the textile purpose, the challenges for textile sector itself complicate the overall business environment in this sector by means of limited control over raw materials, high transaction and transportation costs, and cumbersome bureaucratic process at various phases of production and trade. The inadequacy of cooperative management approach through CETPs continues to make stringent implementation of environmental regulations a burden to the small firms, whereas, the large firms continue to reap the benefit in the global market by maintaining their 'process standards' through the compliance of the regulations from time to time.

There could be two ways in addressing this issue of sustainability in the textile dyes industry. One is at the policy level. It is evident from the field that the integration of trade and environmental policies is much required not only to ease the business but it also has potential to be instrumental in designing arrangements that could help the small firms combat the adversities and grow. More such instruments such as arrangements for treating effluents and other pollutants jointlymay be devised as part of the integrated policy toward optimised environmental protection and sustenance of production or trade activities. The second way is to enhance the scientific knowledge of managing effluent other pollutants by learning from many other countries that have successfully developed low-cost mechanisms in meeting the environmental regulations as part of the process standards. As the interviews with the firms reveal, various schemes and government programmes aiming toward garnering the scientific knowledge of effluent

management along with the learning from other countries in the globe about how they manage effluents efficiently may help in reducing the costs of compliance in the long run.

11. Further scope of the study

This study is based on the qualitative understanding through in-depth interviews and case studies of the dyes factories, CETPs and NGOs in Ahmedabad. Studies with larger samples including factories from other parts of India will be more useful in addressing the question of compliance behaviour by the industries. Besides, a large sample survey will enable one to follow the quantitative and econometric analysis. In absence of water sample testing this study is not able to capture the quality of effluent at factories' outlets, CETPs inlets and outlets in different seasons and atvarious hours of the day.

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Research Areas

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Employment and Migration: Studies under this theme relate to employment, labour, diversification of economic activities and migration. International migration has emerged as an additional theme.

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Urban Services, Mobility & Economy: The Trust areas under this theme include urban housing, urban mobility and services. The newly established Metro Link express for Gandhinagar and Ahmedabad (MEGA) Centre focuses on urban transport system. The MEGA Centre acts as a resource centre for research and training in planning and management of rehabilitation and resettlement related activities for the urban infrastructure projects.

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ISBN 978-81-955331-0-7

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