A Study on Environmental Compliance of Indian Leather Industry its Far-reaching Impact on Leather Exports

Roy, Chandan

Kaliyaganj College, West Bengal, India

May 2012

A Study on Environmental Compliance of Indian Leather Industry & its Far-reaching Impact on Leather Exports

Chandan Roy
Department of Economics, Kaliyaganj College
Kaliyaganj, Uttar Dinajpur- 733134
West Bengal, India
Contact Number: 9932395130
Email : chandanroy70@gmail.com

A preliminary version of this paper was presented in a UGC Sponsored National Seminar, namely "Environmental Audit" organized by the Department of Commerce, Kaliyaganj College, West Bengal, during 22-23 March, 2012.

Abstract

Indian Leather industry is recognized as one of the most promising foreign exchange earning sectors since early '70s of the previous century. The industry was hard hit by two consecutive foreign environment-bans since 1989. Along with that, few domestic environmental regulations also resulted into closure down of a number of leather tanneries in this period. However, the government intervention and the successive compliance measures adopted by the firms ultimately helped the industry to gain momentum in its export sector. This paper analyses the far reaching impact of these environmental regulations on export sector of Indian Leather Industry. Whether this boost in leather export marks a trade off relation between environmental quality and volume of exports is a matter of debate, attempted to be resolved here. This paper, within the limitations of data availability regarding environmental statistics, has determined a positive relation between environmental quality and volume of leather exports and justified that instead of Pollution Haven Hypothesis, Indian Leather Industry rather confirms Porter's Hypothesis.

Keywords**:** *Leather Exports, Environmental Regulations, Compliance, Pollution Haven, Porter's Hypothesis, BOD, CETP, ETP.*

A Study on Environmental Compliance of Indian Leather Industry & its Far-reaching Impact on Leather Exports

1. Introduction

Indian Leather industry is recognized as the most promising foreign exchange earning sector since early '70s of the previous century. In terms of percentage share, leather export earnings accounted for 7% of the total foreign exchange earning sector (and occupying the 5th place in terms of export earnings) in 1989-90, when the first environmental ban was imposed by its major export absorbing country, Germany. However, even after ten years (CLE, 2008-09) with annual earnings of 7 billion USD, the Industry has reached such a stupendous height of success, which made it the 6th largest foreign exchange earning country in the world. On one side, the export generating potential to boost the growth rate of the economy and on the other side the pollution intensive nature of the industry – has made this sector distinct, specially when the 'pollution haven' hypothesis emphasizes that under free trade the exports of dirty industries increases (Copeland and Taylor, 2003)in the developing countries. The Indian Leather Industry has been hit by several foreign environmental bans and domestic environmental regulations since'90s. The ways of compliance adopted by the firms and interventions made by the government have helped the industry in restructuring its technology and perhaps as a consequence an apparent growth in exports sector has been experienced. This again challenged many so called hypotheses which show a trade-off between environmental compliance and export competitiveness (Chakraborty, 2011) and supports Porter's Hypothesis (1991), which states strict environmental regulations do not inevitably hinder comparative advantage against foreign rivals, rather often enhance it.

On the other hand, Sankar(2006) showed that if a country is required to meet an environmental standard which is higher than that appropriate for the country, the social cost

of compliance becomes higher too. In fact the situation turns into worse compared to that under autarchy with existing domestic environmental regime. In fact, Chakraborty & Chakraborty (2007) explain that efficiency level of firms have decreased in the post 1998 period, using the all India farm level data for leather sector during 1995-2003. This suggests that adoption of higher environment standard requirement erodes the technical efficiency and thereby the export competitiveness of the firm. However, the non-deniable fact is that export earning of the Indian Leather and Leather Manufacture has almost quadrupled from 1987-88 to 2010-11. From 964.4million US$, the export earning reached to 3789million US$ during this period.

On one hand, the apparently bright export scenario (as cited by Council of Leather Exports), on the other hand change in environmental quality due to compliance measures adopted by this dirty industry, have motivated the author to priorities this issue for analysis. This paper will trace few relevant matters of environmental standards imposed on Leather Industry and the consequential impact on export prospect of Indian Leather Industry, highlighting on different polluting stages of the industry and examining whether this impact of compliance measure on exports has evidenced 'Porter's Hypothesis' or 'Pollution Haven Hypothesis 'or none of these in Indian Leather Industry. Thus the far reaching impact on the export sector of Indian Leather Industry in respect to environmental compliance will be studied.

2. International Environmental Bans & Domestic Compliance

In 1989, Germany had imposed a ban on all items in which the PCP (pentachlorophenol) content is more than 5ppm (mg/kg), as PCP, which was widely used as an anti-fungal preservative in different industries including Leather industry, was suspected to be carcinogenic. Instead of making it a stringent international imposition, Germany passed this

new standard as domestic legislation aimed at protecting the health of its own citizen. Thus under Article-20 of GATT/WTO this approved restriction had turned out an equivalence of environmental ban to all the exporting nations including India, which used to export 18% of its total leather export to this particular destination. German ban was supported by Denmark, Holland, Netherlands, Luxemburg, USA, Japan and most of the European countries besides France. PCP was the cheapest anti-fungal preservative which costs about Rs. 30/kg. According to many analysts, the alternative to PCP was TCTMB (Thiyocyano Methyl thiobenzo thiazole) and PCMC (Parachlorometacresal) which cost as much as Rs. 390/kg and Rs. 445/kg. According to secondary information, the world's largest manufacturers of these alternative chemicals are BASF, Hochest, Zschimmer and Schwarz, all of which are German companies. This clearly indicated a trade oriented approach which was masked by its health concern regulations.

After 5 years, the second ban on Azo-dye came into effect on 1994-95. A class of 22 Azo –amine dye was suspected to be carcinogenic by German Health Ministry and hence restriction was imposed on the products which use these dyes. Like PCP, Azo-amine Dyes is also an 'easy-to-produce' chemical that is widely used in dyeing industry. The PCP ban was narrower product related ban that involved the elimination of a single chemical for which substitutes were locally available (may be at a higher cost); but the devastating and broader was Azo dyes ban, because the substitute was not available and it affected a multiple allied sectors. It has been argued that the Azo dyes ban was not compatible with WTO framework (Mohanty and Manoharan, 2002).However, after announcing these bans, Germany gave all parties (here, read exporting countries) one year to adjust to new regulations. But to speed up the compliance, German port authorities began testing the consignments of leather and textiles and rejected them which contain PCP (in 1990s) and later for Azo dye in 1995-96.

These environmental standards arrived at the same time when Indian Leather Industry was coping with domestic crisis triggered by the Indian Supreme Court's ruling against effluent discharge by tanneries. In 1995, the Supreme Court had ordered to shut nearly 37% of India's Leather tanneries for their failure to treat effluent discharge as required by law. It was followed by another Supreme Court legislation in 1996 which made compulsory attachment of the Lather tanneries either to a Common Effluent Treatment Plant (CETP) or Individual Effluent Treatment Plan (IETP) to continue production.

2.1 Domestic Compliance

Indian Ministry of Commerce and Environment & Forests passed a ban on production of PCPs in 1991, (just two years after the German ban on PCP) and on 112 Azo Dyes that had the potential to generate the banned 22 dyes in 1997 (three years after the German ban on Azo dyes). As a matter of fact, Indian domestic bans were wider than German. India did not ban only the products that use PCP and Azo Dyes, but also those products which had the potential to generate those. In case of Azo Dyes, Indian bans were passed despite strong opposition from Dye Manufacturers Association of India (DMAI), the apex industry association of chemical companies which would be directly affected by the ban. However, Indian Government was capable to tackle those situations.

By 2002 the first ISO 17205 certified leather testing laboratory in Asia was established in India which was founded by GTZ, a German Government funded development Agency. It helped a large number of domestic firms to have an access in world class leather testing centre. Along with that new certification technologies (specified under the ISO and DIN systems) were accessible to the common producers of leather commodities in India. This undoubtedly brought down the real cost of environmental compliance to a large extent and helped the industry to gain advantage in export frontier. Thus the whole industry has come

under the arena of environmental compliance, which was assumed to upgrade the so called poor 'brand image' of leather industry in international market as well.

2.2 Bilateral Agreement

Indian Government has bilaterally negotiated with Germany for one additional year of transition after the latter allowed one year of adjustment following the environment ban. This eased some of the losses of the Indian exporters by reinstating rejected shipment. This short run measure gave some time to readjust and restructure the industry in desired direction. The strategies chosen by the Government in the long run were lowering cost of compliance through technology transfer and policy readjustment. Indian Ministry of Commerce reduced import duties on dyes and Chemicals from a high of 150-200% to a base rate of 20%. This relieved the critical situations of those Chemical industries which came under the arena of such domestic environmental ban. Council of Leather Exports (CLE) made a list of international chemical companies – dominated by a dozen of German Firms (many with subsidiaries in India) whose products were PCP and Azo Dye free. The Government also negotiated extensive technology transfer from Germany and thus the world class testing centre was established in India in 2002. Following are some structural readjustment measures that helped the leather industry to regain its intrinsic strength.

(i) More than 95% of the tanneries in India have been equipped with pollution control devices. The clustered manufacturing has resulted in Common Effluent Treatment Plants (CETP). Thus there are 19 CETP operational in India, of which 14 are in Tamil Nadu. This spatial concentration has helped them to make a consolidated effort in achieving their goal.

(ii) In Tamil Nadu Rs. 225 crores have been invested in pollution control devices since 1990s.

(iii) In order to comply with legal compliance, the tanneries in Tamil Nadu had attempted to meet zero liquid discharge norms which were even not enforced in industrialized nations. This raised the cost of production around 12%.

(iv) Government of India started assisting the CETP (Common Effluent Treatment Plant) by providing capital grants up to 75% level of investment cost which would meet the environmental compliance.

However, whether these structural adjustments were sufficient enough to sustain the export access to the industrialized nations is a matter of debate. We would analyze the situation of Indian Leather Industry compared to its larger foreign competitor, China. We will attempt to analyze whether Indian compliance measures could upgrade its export status in the subsequent sections. But before that, we will show how the pollution takes place in several leather processing stages and how effective was the abatement measure.

3. Pollution in Leather Processing Stages & Abatement Measures

From raw hides to finished leather there exist three gross stages of leather processing. First stage (pre-tanning stage) involves production of hides and skins which depends on domestic stock of bovine animals, sheep and goats. The second stage includes conversion of raw hides into leather. This tanning stage is the most polluting stage and 80% of industry pollution occurs at this stage. However, actual pollution loads depend upon the levels of environmental standard and the extent of compliance attached with it. The third stage (post tanning) is a less polluting, labour intensive and high value added segment.

3.1 Pre-tanning Stage

There are six subsequent stages, e.g., desalting, soaking, limimg, deliming, bating and pickling under the Pre-tanning Stage.

In desalting stage, hides are cured by salt to remove excess water from them. In soaking, the hides are soaked in clean water to remove salt and increase of moisture enable the skin for further treatment. After soaking, liming is done, which primarily removes the hairs, nails and other keratinous matters. After liming, deliming is done; where the pH factor of the collagens is brought down to a lower level so that enzymes can act on it.

Depending on the end use of the leather, hides may be treated with enzymes to soften them in a process called 'baiting'. Then hides and skins are treated with a mixture of common salt and sulphuric acid so that mineral tanning can be done. This stage is known as pickling. The pollutants are different in each stage of processing (See Table 1).

Table 1: Pre- Tanning Stage & Pollutants

Pre-tanning Stages of Production	Pollutants
Salting & Soaking	Salt, hide surface impurities, dirt, globular protein, substances dissolved in water
Liming	Suspended solids, sulphides, nitrogenous metals
Deliming & Baiting	Calcium salt, sulphides residuals, degraded proteins & residuals, proteolytic enzymatic agents
Pickling	Chrome, Chloride & Sulphates

Source: Central Pollution Control Board

3.2 Tanning Stage

This stage is known as the highest pollution creating zone. The pollution load from tanning activity has been estimated to be 50% more in weight than that of the hides processed (Gjerdaker, 1998). The tanning in India was done mostly through mineral tanning methods. In mineral tanning, chromium (chromium sulphate) is used after pickling. Once the desired level of penetration of chrome into substance is achieved, the pH of the material is raised again to facilitate the process, known as "basification". In chromium tanning all the chemicals are water soluble but not all are absorbed by hide. Thus the effluent contains a lot of chrome and other fixing chemicals. Apart from that, hexavalent form of chemical (chrome VI) is known to be carcinogenic. Even though most tanneries use chrome III, it can transform into Chrome VI when reacting with oxygen under high temperature (Tewari & Pillai, 2004). On the other hand the alternative method i.e., Vegetable tanning, where tannin presents in bark and leaves of many plants are used, deposits solid wastes as effluent. Tannins bind to collagen proteins in the hide and coat causing them to become less water soluble and more resistant to bacterial attack. Vegetable tanned hide is also flexible and used in luggage and furniture. Thus the organic process of production is also a pollution creating activity but of less harmful in nature. Table2 depicts the average pollution load imposed by the tanneries in India (see Rajamani, 2001), where the cleaner technologies could reduce the pollution load in the range between 40-75 percent.

Table 2: Average Pollution Load in Indian Tanneries

Pollution Parameters	Pollution Load/ kg	% reduction due to cleaner technologies
Biological Oxygen Demand (BOD) 5 days@ 20C	70	50-60
Chemical Oxygen Demand	180	60-75
Chloride	270	40-50
Dissolved Solids	600	40-45
Suspended Solids	100	NA
Sulphides	4	50-60
Total Chromium in terms of BCS	40	45-50

Source : Rajamani S (2001)

3.3 Post Tanning Stage

After tanning, the hides are split horizontally into an upper layer called, the grain and a layer from the flesh side called the split. These layers are separately processed further, sometimes re -tanned and then pressed for water, stretched and dried. Depending on finishing desired, the hide may be waxed , rolled, lubricated, injected with oil, split, shaved and dried and given surface treatment to give texture, look and shape to finished leather. The post tanning stage does not involve pollution level at an alarming level.

3.4 Environmental Measures taken in Indian Tanning Industry

The Central Pollution Control Board (CPCB) has delegated its authorities to the State Pollution Control Boards (SPCB) in each state so that the national environmental laws and environmental standard can be strictly adhered. The SPCB could make enquiries to any industries about the compliance of the Act. Not only that, SPCB can punish any industry in case of non-compliance, which can be a monetary penalty of Rs. 10,000 or imprisonment of 3years. In case of continued non-compliance, an additional daily fine of Rs 5000 could be imposed. Until 1988, the only enforcement tool of SPCB was criminal prosecution, which was revised by 1988 amendment. The State Pollution Control Boards has got the authority to shutdown the companies in case of non compliance. In 1990s Supreme Court has been involved in large scale environment related measures several times. In April 1995, the apex court of our country has ordered rehabilitation of 538 tanneries located in 3 clusters in Calcutta, which used to generate around 30mld (milliliters per day) effluent. Calcutta Leather Complex, Bantala was formed accordingly and four CETP was installed to treat the effluent from the complex. However, West Bengal Pollution Control Board did not issue their NOC (no objection certificate) as their desired plants six effluent treatment plant is required to trate the industrial waste. In Tamil Nadu, Supreme Court has ordered the closure of all tanneries in 1996 that had not set up pollution control system. All these types of state intervention in compliance measure has ultimately helped the industry to tackle its dirtiness.

The distribution of tanneries in India reflects some spatial concentration in few states like Tamil Nadu, West Bengal, Uttar Pradesh, Punjab, Haryana and Maharashtra. Since tanneries are the sources of pollution, these states also become the sources of pollution. The spatial concentration of the tanning firms help them to derive scale advantage incase of initiating any environment related measures. It gains the advantage of mobilizing raw hides from entire country with the powers of technology and resources. Table-3 illustrates the

concentration of tanning industries in few states of India and the associated leather goods industries have natural correlation with that. These establishments were initiated from the British Period in India and connection of ports or river-based transportation had another point of justification behind this establishment. The state-level current production statistics (2008-09) in export prospective sectors like, Leather Footwear and Leather Garments and Leather Goods against corresponding contribution in export earning can help us to understand nature of spatial concentration in export contribution, too.

Table 3: State-wise Tanneries & Production units in Indian Leather Industry (2008-09)

States	Numbers of Tanneries	% of Tanneries	% share in total Export Earning	Production Places	Leather Foot wear Units	Leather garments & leather goods Units
Tamil Nadu	934	44.6	34.88	Chennai, Amber, Ranipet, Vaniyambadi, Trichi, Dindigal	160	598
West Bengal	538	25.7	15.76	Kolkata	230	436
Uttar Pradesh	378	18.0	28.25	Kanpur, Agra, Noida	268	22
Maharashtra	33	1.60	5.21	Mumbai	20	48
Karnataka	16	0.80	1.61	Bangalore	48	40

AP	24	1.15	0.06	Hyderabad	128	10
Punjab	79	3.8	1.25	Jalandhar	163	08
Haryana	18	0.8	4.86	Ambala, Karnal, Guragaoun, Panchkula,	30	01

Source: Central Pollution Control Board, Council of Leather Exports(2008-09);

Table-3 reveals major spatial concentration of tanneries and production units in three states namely, Tamil Nadu, Uttar Pradesh and West Bengal. Tamil Nadu has the highest export generating capacity (34.88%), followed by Uttar Pradesh (28.25%) and West Bengal (15.76%). However, the management of environmental norms can be better illustrated by per tannery export generation ratio. The tannery export generation ratio is however highest in Uttar Pradesh (1.99), followed by Tamil Nadu (0.99) and West Bengal (1.99). The export – plant ratio also follows the same trend, highest in Uttar Pradesh (2.6), followed by Tamil Nadu (1.2) and West Bengal (0.6). Though most of the success analysis and discussion in Indian tanneries centered on Tamil Nadu, Uttar Pradesh has shown efficiency in 'tannery export ratio' and 'export -plant ratio'. The remedial actions against environmental pollution in tanning industries as adopted by the Government are hereby summarized:

(i) Chrome Recovery: Chrome has been extracted from the chrome liquor produced during chroming process and the residual water was used for other purposes apart from drinking. 20% of the extracted chrome was also reused under this plan of action.

(ii) CETP – Common Effluent Treatment Plants was established in the entire tannery cluster. The total dissolved solids in Tannery effluent was high because common

salt was widely used for processing raw hides and skins. There were 19 CETPs operational in India and out of that 14 were operational in Tamil Nadu. More than 150 Individual Effluent Treatment Plant (IETP) was operational in isolated tanneries and locations, where the common facilities were not possible.

(iii) Zero Liquid Discharge Technology: By implementing the reverse osmosis system of recovery of water from tannery effluent, this technology was adopted in 120 south Indian tannery plants and 14 effluent treatment plant.

(iv) Water Conservation & other Pollution Control Methods :

a. All the tanneries have installed water meters and flow meters to measure actual consumption and waste water discharge.
b. Consumption of water reduced to 22m³/ tones of hides/skins.
c. Ground water quality being monitored to strengthen wherever the treated effluents are applied on land for irrigation.
d. Deployment of qualified and well trained staff for observation and monitoring of ETPs/ CETPs.
e. Separate energy meter for ETPs/CETPs have been adopted.
f. Replacement of open anaerobic lagoons was done with cleaner technology options.
g. All the large tanners units (processing more than 5 tones/day of hides & skins) have undertaken environmental audit on annual basis.
h. Central Leather Research Institute is attempting to create a database for the resource and terms of transfer of technology for reusing the tannery waste.

The major limitations of these environmental regulations were that main focus centered on water pollution, ignoring the problems of air pollution and solid wastes. Moreover, environmental regulations imposed on tanning industry are all domestic and thereby having a

weak governance and surveillance nature. This weak enforcement has accelerated fraudulent activities in Indian tanning industry (Schjolden, 2000). There are certain domestic standard for pH, total suspended solids, sulphides and chrome that the tannery effluent shall not exceed, which takes care of the negative externalities generated by the tanning industry within the domestic territory. Tanneries are required to treat their effluent before letting it out either to their sewer system or to a river. Compared to the foreign environmental standard to be kept for the discharged effluent of tanneries, India's regulations are almost at par, though less stringent of German restriction incase of total chrome, and Italian restriction in case of sulphides , but degrees of weakness lies in enforcement measures (Schjolden, 2000).

Table 4: Environmental Standard for Tannery Effluent imposed by Leather Producing Countries

Countries	pH	COD	Suspended Solids	Sulphides	Total Chrome
	mg/litre	mg/litre	mg/litre	mg/litre	Mg/litre
Argentina	5.5-10	250	NA	1	0.5
Brazil	5.0-9.0	NA	NA	0.2	2.5
China	6.0-9.0	300	200	1	1.5
Denmark	6.5-8.5	NA	30	2	0.2
Germany	6.5-10	250	NA	1-2	0.5-1
India	**6.5-9.0**	**250**	**100**	**2**	**2**
Italy	5.5-9.5	160	40-80	1	2
Poland	5.5-9.0	150	35	0.2	NA

Source: UNIDO (1999)

4. Impact of Environmental Compliance on Export Prospects

Export prospects of Indian leather exports will be studied in this section in perspective of two environmental bans imposed by Germany in 1989 and 1994 and the corresponding environmental compliance implemented by the Government in India. In section 2, we have analyzed in details how the domestic adjustment had taken place in successive ways after imposition of the German ban. In this section, we will analyze the consequential and far reaching impacts of that compliance on the export prospects of Indian Leather Industry. A brief literature review in this section will be followed export-performance analysis and pollution intensities as well as environmental damage measurement of the industries. Derivation of interlink between successive export performance after the regulatory compliance and resultant change in environment quality due to adopted compliance measure is the specific contribution field of this paper.

4.1 Literature Review

Environmental Regulation, Quality Standard and Stiff foreign competitions are the three major external factors which substantially influence the export prospects of the firms of Indian leather industry (Roy, 2000). Among the others, environmental regulation becomes the most significant "non-tariff barrier" for the leather industry in 1990s. But whether the domestic firm will accept this environmental compliance in this era of cut throat competitions depends upon several issues. Henrique & Sadorsky (1996) indicate that a firm's decision to comply with regulation is connected to non-compliance threat perceived by the firm. Rugman and Verbeke (1998) also pointed out that decision of how to respond environmental regulation is based on a consideration of the potential economic benefit or disadvantages of complying and not complying. The firm will only choose to comply when the economic sanctions associated with non-compliance is greater than cost of compliance of the firm.

Along with that, the regulators must have the administrative capacity to enforce regulations. Heyes (1998) supports both these arguments and says that the cost of non-compliance must be larger than the cost of compliance before the firm will choose to comply. Risk of being caught in non compliance should also be included in the measurement of the cost of non-complying.

Bansal and Gangopadhyay (2003) show that in a Bertrand duopoly and in presence of environmentally aware consumers, the clean up levels chosen by the firms are strategic complements, i.e., if firm-1 increases its clean up, the consumers who was indifferent with firm -1 and firm-2, would prefer firm-1. Ceteris paribus that would enhance the level of profit earned by firm-1 at the cost of firm-2. To win back the marginal consumers, firm-2 increases its clean-up level.

Roberts and Spence (1976) and Kwerel (1977) explained models where the regulators are uncertain about firms' clean up costs. Roberts and Spence suggest that a mixed pollution control plan involving licenses and effluent charges minimizes the expected total costs of pollution. Kwerel proposes that the mixed pollution control plan induces firms to reveal their true clean –up cost functions to the regulators. Thus the problems of observing clean-up costs can be overcome by employing mixed instrument. Arora and Gangopadhyay (1995) said that adopting minimum environmental standard may result into over compliance by the firms. A minimum standard binding on the dirty firm has the effect of improving the performance of the cleaner firm and a subsidy obtains the same competitive outcome.

Bansal & Gangopadhy (2003) also explained how a uniform subsidy unambiguously improves the average environmental quality compared to uniform tax policy and

discriminatory subsidy reduces the pollution and enhances the welfare level in comparison to discriminatory taxation. However, a discriminatory subsidy ultimately increases the profit of the dirty firm and results in ambiguous change in the profit of clean firm. Therefore it is ultimately the cleaner firm who may object to such policy and the Government may find more universal support for a uniform policy that subsidizes a dirty firm along with a clean firm.

Literature also gives a wide variation of discussion regarding compliance cost and export competitiveness. Much of the existing literature focused on 'pollution haven', where openness intensifies trade in dirty industries while very little literature is found which critically examine how small firms in the developing countries cope with stringent global standard(Nadvi, 1999; Kennedy, 1999; O' Rourke 2000). The literature portrays three factors that make it difficult to comply with environmental standards without compromising their competitiveness. (i) High cost of compliance, (ii) Conflicted Motivations of State, (iii) Fragmented Capacity of Environmental Institutions;

(i) High Cost of Compliance: Mandatory regulations impose economic costs on firms that can reduce the competitive edge of the firms in global market. Expressing concerns for the firms and the policy makers in the developing country, the literature argues that imposition of external standards impede trade because developing countries generally lack the scientific exercise and technical infrastructure to comply stringent new standards (Chaturvedi and Nagpal, 2003; Gopalan, 2002; Fengzhong 1999; Abdel- Latif and Nugent 1999, Anderson, 19996)

(ii) Conflicted motivations of State: In developing countries, the government faces too many conflicting pressures to push for broader compliance. Under the global competitions and freer trade the Government fails to compromise with the competitiveness of domestic firms by raising its production cost. So the developing country governments are slightly hesitant in keeping up regulations and environmental norms.

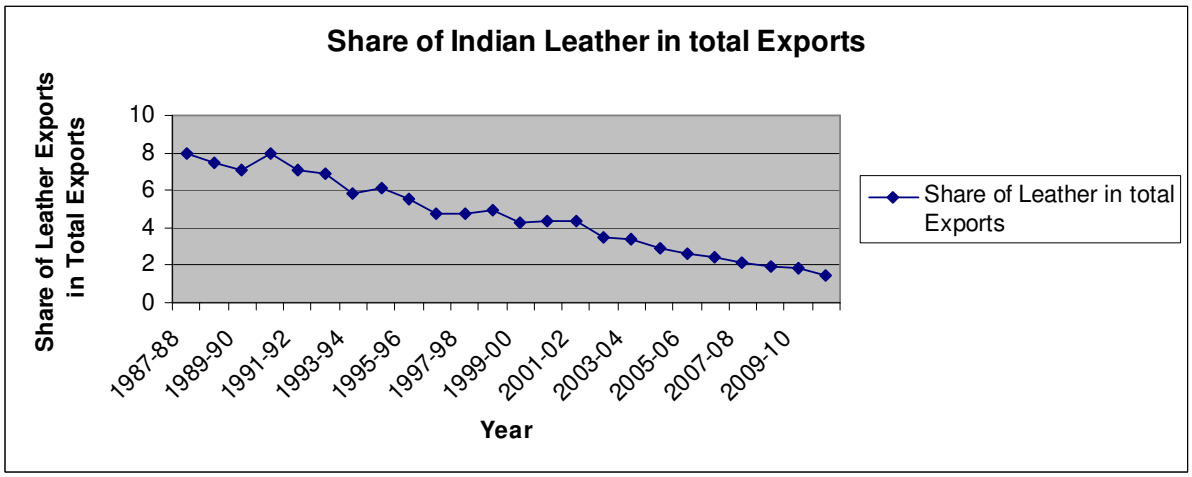
(iii) Fragmented capacity of Environmental Institutions: The political weakness of the typical environmental agency and its limited administrative and technical capacity would hinder the effective diffusion of new environmental norms and standard (Dasgupta, 2000 and O' Rourke, 2002). In sectors dominated by small firms, the high costs of coordination and monitoring scores of small enterprise would make enforcement even more unsustainable, especially for cash strapped implementation in many developing countries (Saparu, 1998).

Indian Leather industry is dominated by large numbers of small and tiny producers and therefore the availability of finance turn out to be a major constraint for them to follow the stringent environmental norm. The share of environmental compliance cost is 2-5% of Export Value (FOB) of leather and 1-3% of export value (FOB) of footwear and other leather product. These pollution control measure has been found to be inadequate and that resulted into closure of a number of tanneries due to failure of compliance.

4.2 Export Performance of Indian Leather Industry in Post-Ban Period

Leather and Leather Manufacture exports have a significant contribution in India's total export basket in 1987-88, i.e., in the pre- ban situations. The consecutive environmental bans imposed by Germany were in 1989 and 1994. It has been observed that Indian Leather has started losing its position in the domestic export basket in the post 1989 period. From a percentage share of 7.9% in 1987-88, the domestic export share has drastically fallen down to 4.8% in 1996-97 and then to 1.5% in 2010-11. Thus the significance of Leather in the domestic export basket is on the wane during this post banned period. (See Graph: 1)

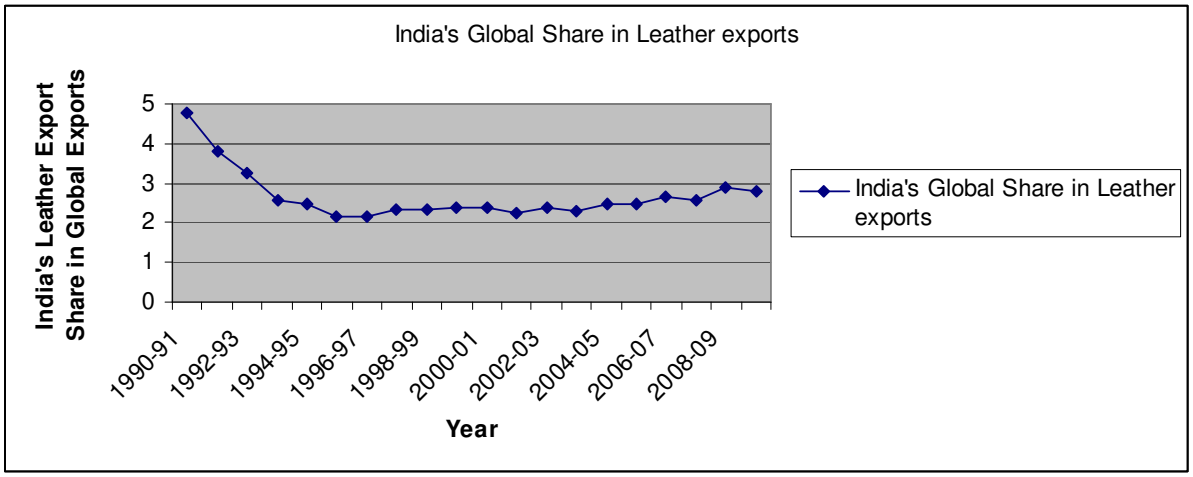
Graph: 1 Declining Share of Leather in Indian Export Basket (1987-2010)



Source: RBI bulletin (http://www.rbi.org.in/, http://www.leatherindia.org/exports)

India's share of exports has also followed a consistently downward slope in the world share of leather exports since 1991. From 4.75% share of global leather exports, Indian leather exports' share drastically falls to 2.15% of global leather exports in 1997 and then marginally upgrades to 2.9% of global leather exports in 2009 (See Graph 2).

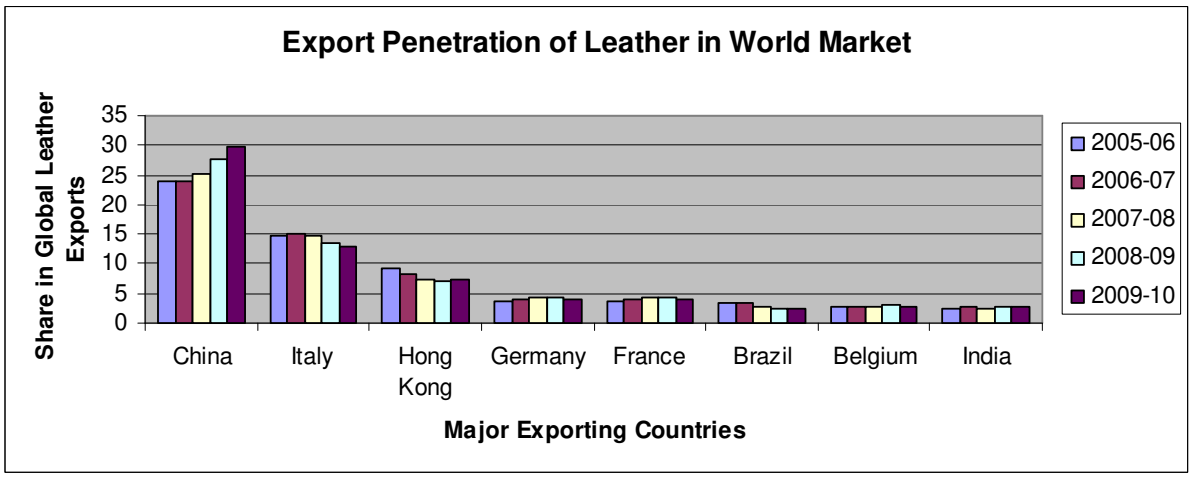
Graph 2: India's Leather Exports Percentage Share in Global Leather Exports



Source:(http://www.rbi.org.in/, http://www.leatherindia.org/exports,WITS database comtrade,)

India's leather exports share consistently declines till 1996-97 and then it follows a consistent steady trend. This indicates at a time the failure of export oriented units of Leather Industry to comply with international environmental standard along with other quality standard and speedier progress of its giant foreign competitor China in keeping those standards. India, consistently lost its export market during the phase while China started grasping those market with accelerated pace. However, besides China and India the global trend of leather exports is being influenced by few other countries, like Italy, Hong Kong, Germany, France, Brazil, Belgium, though China remains the dominant player .

Graph 3: Global Export Share of Major Leather Exporting Countries (2006-10)



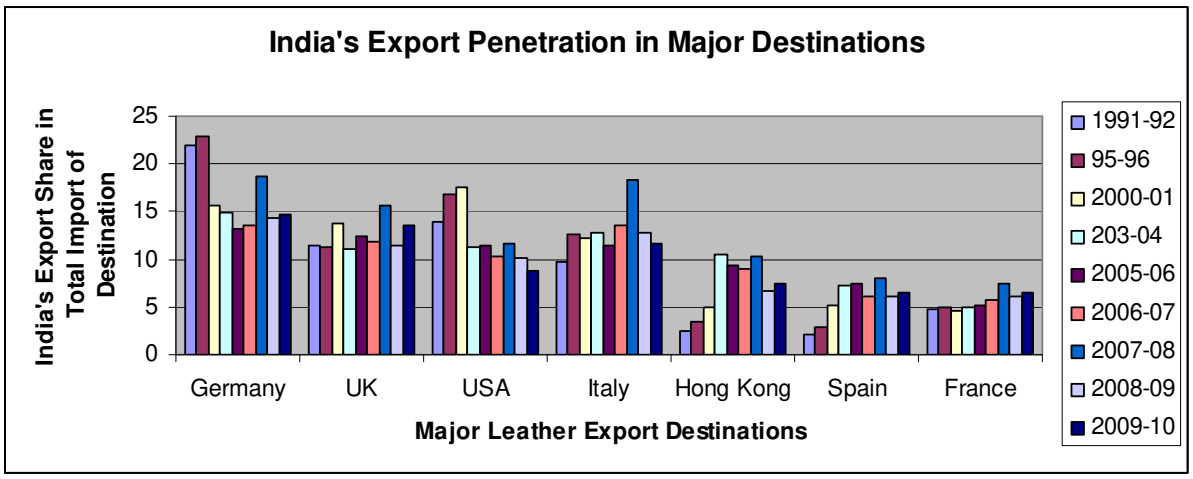
Speedy Environmental compliance is one of the major factors behind the accelerated and excellent performance of China which also pushed the export prospect of Indian leather export in jeopardy. Trends in export share of major developing countries in leather and leather product reveals China's export share in the global imports have risen from 23.58% to 29.9% during 2005-2010, while India has just maintained a marginal upward trend, i.e., from 2.46% to 2.79% during 2005-2010. Italy, Brazil and Hong Kong have shown a declining trend, which solely can be explained by Chinese aggression in global export market.(See Graph 3)

The success of China's export partially hinges on its way of treating the environmental standard. China imposes a pollution charges to those who contravenes the environmental standard of stipulated discharge norm. Again 80% of these charges are going back to those enterprises for pollution control (Wang, 2001).In addition to that, China had internationally registered the certification of trade mark (i.e., Genuine Leather Mark) with 14 countries in 1994. From July 2003, it has pushed for Genuine Leather Mark Eco Leather. The GLM Eco Leather requires few conditions, which the Chinese Leather sector has committed to meet, e.g., (i) to enable the domestic leather industry to adapt international rule; (ii) to adopt the national standard for testing of physical and chemical indexes and (iii) German standard for testing of special chemicals.

However, India's policy response to the challenges of environmental standard was reactive rather than pro-active, lacking long-run perspective. The speed of response was relatively slower in realizing the potential supply of raw hides, tannery modernization and restructuring of manufacturing units. Compared to India, China was quick to grasp the international market by exploiting its export opportunities. India's export access to leading

destinations like, Germany, USA and Italy has declined during 1991-2000, which ensures the lack of environmental compliance by the large number of domestic firms.

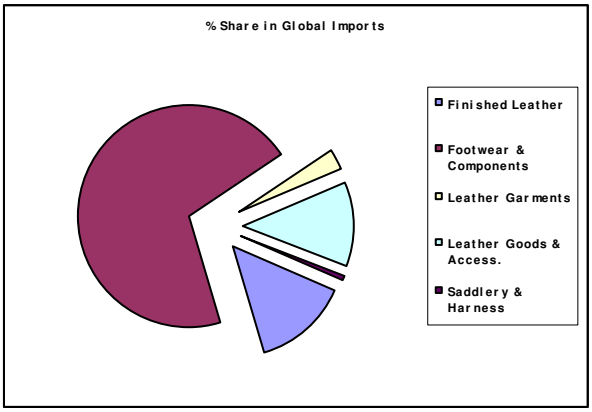
Graph 4: India's Export Share of Leather & Leather Manufacture to Different Destinations



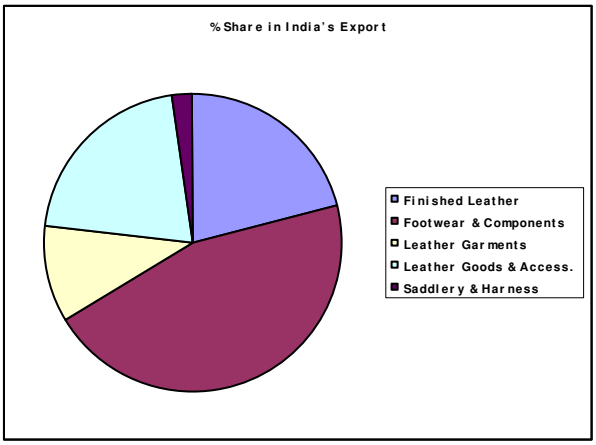
Source: Foreign Trade & Balance of payments, CMIE (various issues), Annual Report, DIPP, Ministry of Commerce & Industry(Various issues)

However, the chronic debt crisis of European Union in recent past makes the buyers reducing their orders from the developing nations. As US and EU are the major buyers for Indian Leather and Leather manufacture, therefore the export prospect of the industry is expected to face another major blow in the coming years. The supply side standard-related issue is expected to convert into demand deficit difficulty. On one hand, the very recent depreciation of domestic currency and the associated rise in import cost, on the other hand this demand shrinkage uncertainty- these twin problems could damage the growth of Indian Leather exports in coming days. China, (the highest leather exporting country) has started exploring emerging markets in Asian, African and Latin American countries, where stringent environmental standard is not yet a major trade barrier.

Graph 5: Global Leather Imports vis-à-vis India's Exports (2006)



(a) Global Share of Imports of different components of Leather



(b) India's Share of Exports of different components of Leather

Source: http://www.leatherindia.org/exports/global-trade-leather-products-2006-2010.asp

Among different components of Leather export, Leather Footwear and Footwear Component capture the highest share of export earnings in global imports as well as India's export earnings. India's export performances during last five years in different leather components can briefly give an idea of its relevant status in the world market. The major destinations of Indian Leather exports during 2006-10 are Germany (14.34%), UK(12.80%), Italy(11.52%), US (8.72%), Hong Kong (8.11%), France(6.52%) Spain (6.31%), Netherlands (3.98%) and Belgium (2.02). Thus USA and EU together absorb 74.32 % of Indian Leather exports. Since

penetration in both these markets in post WTO situations require fulfillment of environmental as well as other standards (i.e., quality, labour etc.), the higher growth of leather exports in these destinations can help us to infer about favorable impact of environmental compliance of Indian Leather industry on foreign markets.

Table 5: Growth of Indian Leather Exports in Major Destinations (2006-2010)

Countries	Finished Leather	Leather Footwear	Footwear Components	Leather Garments	Leather Goods &Gloves	S & H	Total
Germany	-6.43	**2.81**	**37.66**	13.25	25.67	36.28	19.78
UK	Neg	**-7.10**	**Neg**	-10.17	12.67	13.43	9.91
Italy	-12.59	**15.67**	**-14.37**	1.25	16.45	40.26	6.21
USA	-31.5	**-9.59**	**10.23**	-50.82	-0.50	2.92	3.78
Hong Kong	-24.46	**-3.15**	**13.65**	6.79	44.72	Neg	-4.65
France	12.54	**6.98**	**-15.44**	28.64	32.53	28.49	21.34
Spain	-8.13	**7.99**	**NEG**	-11.38	15.0	36.42	22.78
Netherlands	Neg	**26.52**	**Neg**	24.34	Neg	44.09	35.18
Belgium	Neg	**13.99**	**Neg**	4.92	Neg	31.94	19.85
China	-5.41	**NEG**	**-17.03**	-	188.67	Neg	13.36
WORLD	-13.26	21.88		38.30	6.48	1.28	

Source: CLE (online, available at :http://www.leatherindia.org/about-council/industryatGlance.asp)

Table-5 portrays India's export growth in several Leather components to all the major destinations according to their merit of export absorption. Among ten major export absorbing destinations, the growth rates are rather meager in top five ranking destinations. Leather Footwear and Footwear components are the principal sectors in India's export basket. During

last five years Indian leather footwear industry has shown a negative growth in export markets like, USA, Hong Kong, UK. In most significant export destination, i.e., Germany, the export growth rate is also very sluggish during this period. The average annual growth of component wise Leather exports reveals that Footwear sector experiences an average annual growth of 8% during 2006-2011., while overall export growth of Leather has shown some ups and down. (See Table 6)

Table 6: India's Exports of Leather and Leather Products during 2006-11

	(Value in Million US$)					
	2006-07	2007-08	2008-09	2009-10	2010-11	**CAGR 06-10**
Finished Leather	724.00	807.19	673.37	627.95	810.92	**2.85%**
Footwear	1236.91	1489.35	1534.32	1507.59	1732.04	**8.78%**
Leather Garments	309.91	345.34	426.17	428.62	400.83	**6.73%**
Leather Goods	706.28	800.46	873.44	757.02	814.91	**3.65%**
Saddlery & Harness	82.33	106.18	92.15	83.39	86.15	**1.14%**
Total	3059.43	3548.51	3599.46	3404.57	3844.86	**5.88 %**
% Growth	11.15%	15.99%	1.44%	-5.41%	12.93%	
Source: DGCI&S (2006-2011)						

Our major intention in this paper is to study the trends of export growth at the back drop of changed pollution intensity of the industry so that the empirical justification of either of

Pollution Haven Hypothesis (PHH) or Porter's Hypothesis can be substantiated through Indian Leather Industry.

4.2 Indian Leather Industry: Pollution Intensities & Environmental Damage

Leather industry has been unambiguously treated as a polluting industry through out the world and almost equivalent pollution norms have been universally implemented by all the major leather producing nations of the world to save their economies from environmental damages (See Table 4). However, very little specific pollution intensity measurements have been estimated so far to fathom the level of damage created by this particular sector in the world. Hettige, Martin, Singh and Wheeler (1995) constructed a Pollution Index while developing Industrial Pollution Projection System (IPPS) of 1,500 product categories produced in 200,000 factories inn all regions of United States. According to this research report, Pollution Index can be interpreted as a ratio of pollution per unit of manufacturing activity.

i.e., *Pollution Index = Waste Output / Total Manufacturing Activity*

While manufacturing activity can be defined either in terms of Physical Volume of Output or, (ii) Employment, or, (iii) Real Values of Output.

Applying the IPPS definition of Pollution Index and using only water pollution load, Pandey and Ghosh (2002) estimated industrial pollution of different industries in India. Computing the pollution load of sixteen pollutive industries, they have shown Leather industry ranks 14th according to PI (in terms of output intensities) and 2nd (in terms of employment intensities). Central Pollution Control Board (2009) has developed a new pollution index namely, Comprehensive Environmental Pollution Index (CEPI), which captures the a range of health

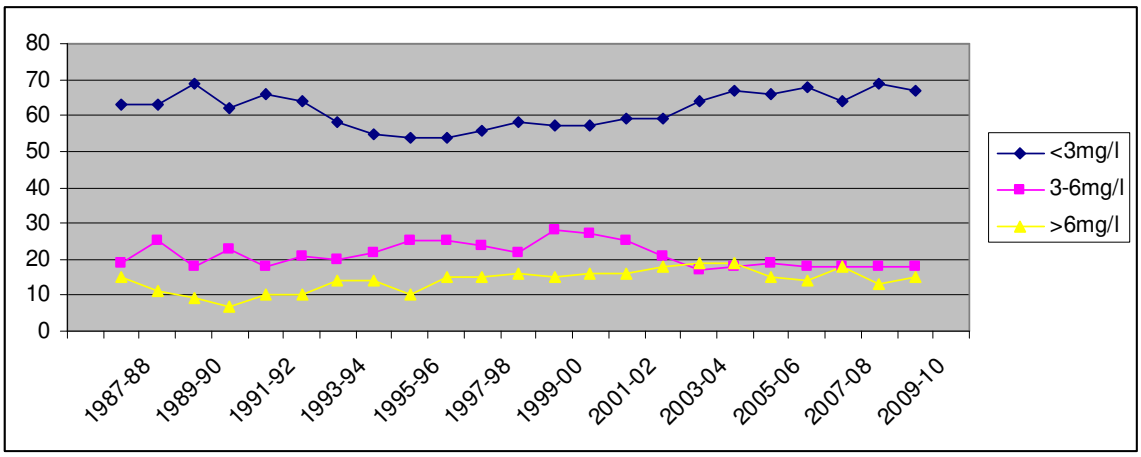
dimension of environment including land, air and water. Application of CEPI has been done on 88 selected industrial clusters/ areas. Among the major leather producing towns/cities, CEPI of only four cites namely, Kanpur (78.09), Agra (76.48), Noida (78.90), Jalandhar (64.98) have been found. If these four cities have been considered as the representatives of Leather Producing Centers in India, then the environmental status of these areas are severely critical. An index level score above 60 refers to critical level of pollution irrespective of environmental component. Therefore, it indirectly reveals that despite implementation of so many environmental compliances, the pollution index of the leather producing areas have not improved to significant extent, though the partial impact possibility of other pollutive industries in these respective centers cannot be undermined.

In this section we plan to study the changes in pollution intensity of this industry in India due to implementation of environmental compliance by the State. In absence of any readily reckoning statistics on these, we will try to measure the changes in ambient qualities through analyzing the quality of water over time. Our objective is to find out whether the industry is becoming cleaner with the adoption of cleaner technologies and how that affect the export prospect of the industry in course of time. Pollution Haven Hypothesis (PHH) always emphasizes a location-shift of the dirtier industries from North to South which results into dirtier environment in the latter and the respective rise of its export trends at the cost of dirtier environment. Therefore if the rising trend in leather exports corresponds with decline in the level of pollution supposed to be generated from the industry (along with others), then we would be able to reject the application of the PHH in Indian economy. Therefore our motto in this section is to deduce the change in pollution level over-time.

In leather industry pollution is created mainly due to tannery effluent. The discharged effluent from the processing units are stored in a large lagoons and pollution occurs as the dissolved

salts percolate into surrounding soil and pollute the water in significant extent. To assess the change in "quality of water", Bio-chemical Oxygen Demand (BOD) can be used as a proxy variable. BOD can be used as a pollution-load parameter in three ranges (i) Less than 3mg/liter, (ii) 3-6mg/liter; (iii) More than 6mg/liter; Higher number of observation under 3mg/liter denotes higher quality of water, while higher number of observation in the range of higher than 3 or 6 mg/liter observation denote higher level of pollution. A range of data regarding BOD can help us to infer about the trend of the pollution created by those water polluting industries, though the marginal contribution of leather industry is difficult to assess specifically.

Graph 6: Trends in Water Quality through BOD Measurement (1987-2009)



Graph-6 plots the trends of observations during 1987-2009 in different levels of pollution with respect to BOD. Increasing trend in percentages of observations having BOD below 3mg/liter indicates a gradual improvement in water quality. However, increasing trends in BOD more than 6mg/liter could be due to shifting of moderately polluted water bodies to higher level of pollution as clear from the decreasing trend in percentage of observation between 3mg-6mg/liter.At the backdrop of this change in environmental quality, the trends of leather exports can be studied, as leather industry is one of the pollutive industry which

degrades the ambient quality of water. The far-reaching impact of environmental standard on exports can be analyzed thereof. Graph-7 shows a consistent rising trend in leather exports. The growth was distinctly observable in during 2002- 2009 period, which can be partially contributed to cleaner technologies adopted by the tanneries.

Graph 7: Trends of Leather Exports (1986-2010)

Source: RBI Bulletin

Table 7: Correlation between BOD parameters & Leather Exports

Association between Leather Exports	Pearson's Correlation Coefficient	Spearman's Rank correlation coefficient
& Observations with BOD (<3mg/l)	0.449*	0.327
& Observations with BOD (3-6mg/l)	-0.463*	-0.385
& Observations with BOD (>6mg/l)	0.430*	0.582**

* significant at 0.05 level, ** significant at 0.01 level

Greater number of observations with lower level of BOD is indicative of rise in quality of water and greater rate of observations with higher level of BOD is reflection of derogation of water quality.

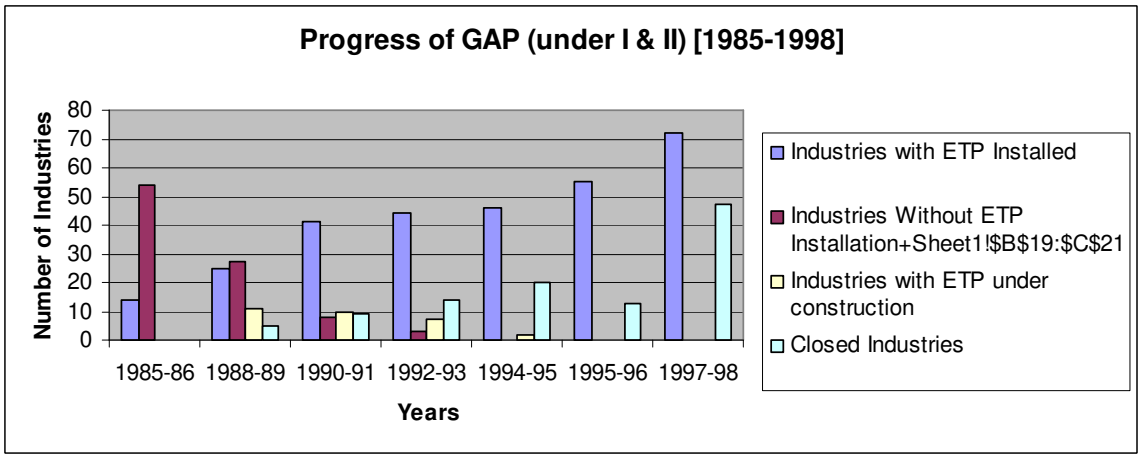
Table-7 comprehensively reveals that against the consistent rise in the level of leather exports, the number of observations with BOD at different level (indicating quality of water) changes in different manner. When the low BOD level(<3mg/liter, i.e., clean water) and exports level (leather) shows a significantly weak positive association(as the number is less than 0.5), it indicates rise in quality of water is positively associated with the level of leather exports, but the positive association is not of a very high degree.

The negative correlation between moderate BOD (3mg-6mg/liter, i.e., moderately polluted water) and Leather exports also justifies our previous claim that quality degradation of water is inversely related with leather exports in significant manner, but the inverse association is not very strong.

However, the last result is bit confusing as it claims an opposite relation between water quality and level of exports, as we claimed in the previous two cases. It indicates high BOD level (>6mg/liter, i.e., severely polluted water) is positively associated with high level of exports. It exposes that gross water pollution level escalates with the rise in the level of leather exports. This anomalous expansion of pollution level with the corresponding change in the volume of leather exports may prevent us to draw any stable relation between water pollution and leather exports, but Bansal & Gangopadyay (2003) have theoretically justified this proposition in cases similar like this. They have explained that any pollution control measure may reduce the pollution per unit of output, but as the total volume of production rises, the aggregate pollution level always shoots up. Therefore, the relationship between water-quality (read environmental quality) and leather exports ultimately comes up with a "quasi-positive relation" which weakly confirms "Porter's Hypothesis".

In order to measure the dirtiness of the industry more accurately, we can analyze the performance of Ganga Action Plan, as this river basin meets the needs of four major leather producing states namely, Haryana, Delhi, Uttar Pradesh and West Bengal. Again pollution of the river quality by several other pollutive industries like engineering, paper mills, textile, and organic chemicals also occur in significant proportions and waste water generation by leather tanneries are much less significant than them. Keeping these exclusion problems into concern, the study can be progressed. These four states in together constitute 48% of tanneries and bear 19.5% of Water Pollution Load (BOD). The first large scale action plan namely Ganga Action Plan (GAP-Phase-I) oriented towards rehabilitation of water resources through installing Effluent Treatment Plant (ETP) was lunched in 1985. Out of 1340 MLD (millions per day) capacity which initially targeted for sewage treatment, only 873 MLD was actually setup. The number of industries with ETP rose to almost four times during 1985-1995. In 1995, no such industries were found in the bank of Ganges which does not have ETP. Under GAP (Phase II), the cleaning project started in the year 1993 and 119 grossly polluting industries were identified during 1997. Graph-6 comprehensively reveals how the ambient quality of the tannery industries improved at the bank of the river Ganges over the period 1985-98.

Graph-8 Ganga Action Plan I & II



Source: CPCB (Annual Reports), Indian Leather Industry, Italian Trade Commission, 2010

Assuming ETP installation as pollution control measure a degree of association with leather export trend is measured. That also shows a significantly positive correlation.

*Pearson's Correlation Coefficient (ETP Installation, Leather Exports) = 0.812**

*Spearman's Rank Correlation Coefficient (ETP Installation, Leather Exports) = 0.886**

* significant at 0.05 level

Status of pollution control in highly pollutive industries during 1994-95 and 2000-01 were reported by Central Pollution Control Board in their Annual Reports. The decline in the number of units incompetent to comply with environmental standards proves improvement in environmental situation of those producing regions. Though the data fail to capture specifically the cleaning endeavours of the Leather tanning industry, but indirectly it helps us to understand overall progressive trends of all the pollutive industries during that period. Besides, Uttar Pradesh and West Bengal, no other leather producing states possess any units having inadequate facilities to comply with standard. From institutional standpoint this obviously marks a significant achievement especially when most of the industries in developing countries are alleged with pollution industries/ dirty industries.

Table 8: Pollution Control in Leather Producing States in India during 1995-2001

States / Union Territories	Numbers of Highly Polluting Industrial Units Identified	Numbers of units not having adequate facilities to comply with standards	
		March 1995	Dec 2001
Tamil Nadu	119	8	0
Uttar Pradesh	224	40	03

West Bengal	58	27	03
Punjab	45	11	00
Haryana	43	07	00
Maharashtra	335	28	05
INDIA	1551	252	24

Source : CPCB, 1994-95, 2000-01

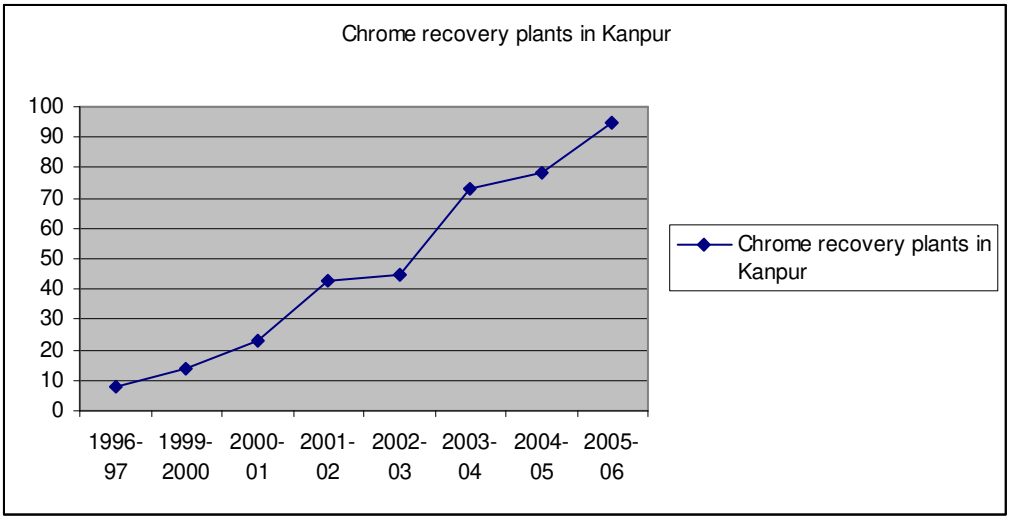
A substantial effort in cleaning the pollutive industry has been justified from the above tables and diagrams. Installation of chrome recovery plants have been adopted by leather tanning industries as a specific environmental compliance measure. In Kanpur, Uttar Pradesh more than 300 tanneries are in observations, while many of the large and medium plants installed chrome recovery plants. The rising trend in chrome recovery plant installation from 8 in 1996 to 95 in 2005 has revealed a progressive trend in ambient quality. The association between leather exports and Chrome Recovery Units(CRU) show a strong positive association between them over time (1996-2005).

*Pearson's Correlation Coefficient (CRU, Leather Exports) = 0.945***

*Spearman's Rank Correlation Coefficient (CRU, Leather Exports) = 0.881***

(** significant at 0.01 level)

Graph- 9 Rise in Chrome Recovery Plants in Kanpur



Thus a focused analysis on the relationship between pollution abatement measures and leather exports helps us to infer that rising level of pollution abatement measure actually associates with rise in the level of exports of the sector. Despite the obstruction of sector specific data availability in pollution intensities, the comprehensive portrayal help us to infer that Indian Leather Industry has upgraded its pollution intensities through several institutional environmental compliance and the surveillance measure by the CPCB (Central Pollution Control Board), SPCBs (State Pollution Control Boards) and Supreme Court.

Despite depicting a positive trend through association between higher level of BOD observations and exports trends, the possibility of application of Pollution Haven Hypothesis can be rejected in Indian Leather Industry, as the rest of the sector specific data substantiate in favour of a progress in ambient quality of leather overtime. This trend confirms a close association between strict environmental compliance and rising export trends of the industry. This is rather reinforcing the Porter's Hypothesis (1995) which states strict environmental compliance can induce efficiency of the firms for greater innovations and that would ultimately raise the competitiveness of the concerned industry.

5. Conclusion

Environmental standards in leather industry have been imposed by the developed nations as a non-tariff barrier in 1989, just five years before the birth of WTO, whose main goal was to knock down the trade barriers and expand multilateral trade. Impositions of environmental standard were taken by the Leather Industry in India as a major challenge. The institutional

supportive actions have helped the domestic industry to survive against one of the chief non-price barrier, environmental standard. Producing a pollutant free commodity is one challenge but producing through pollution free process was a greater challenge faced by the Indian Leather Sector. The former helped the sector to survive at the face of stiff competitions in the external sector. However, the latter challenge which was severe was successfully handled by the industry. CPCB emphasizes in their consecutive Annual Reports how Indian Leather tanning Industry has effectively controlled its effluent generation through common effluent treatment plants as well as few individual effluent treatment plants and is expected to meet the standard of zero discharged norms very soon. The rising trend in leather exports at the backdrop of successful environmental compliance substantiates the positive association between pollution cleaning efficiency and export level. Hence, increasing rate of adoption of cleaning technology is always expected to raise the level of exports of Leather industry for Indian firms.

Note

This paper has been benefited greatly from the suggestions and comments made by Prof. Rajat Acharyya, Jadavpur University and Prof. Kunal Dasgupta, Toronto University. The author bears full responsibility for all the remaining errors.

References:

(1) Akbostanci, E, Tunc, G. I & Asik, S. T. (2004), Pollution Haven Hypothesis and the Role of Dirty Industries in Turkish Exports, *ERC Working Paper in Economics*, Middle East Technical University, Turkey.

(2) Arora, S and Gangopadhyay, S (1995), Towards a Theoretical Model of Voluntary Compliance, *Journal of Economic Behaviour & Organization*, Volume 28, Issue 3, Dec 1995, p-289-309.

(3) Bansal, Sangeeta & Gangopadhyay, Shubhashis, (2003), "Tax/subsidy policies in the presence of environmentally aware consumers," *Journal of Environmental Economics and Management, Elsevier*, vol. 45(2, Supple), pages 333-355, March.

(4) Bellisi, F., Lerher, D & Tal Alon (2005), Comparative Advantage – The Impact of ISO 14001 Environmental Certification on Exports, *Environment Science Technology*, Vol 39, No.7, 2005.

(5) Chakraborty, P. & Chakraborty, D. (2007), Environmental Regulation and Indian Leather Industry, *Economic & Political Weekly*, May 12, 2007, pp 1669-1671.

(6) Chakraborty, P.(2011), *Environmental Standard and Trade- Evidence from Indian Textile & Leather Industry,* Ph D Thesis, Graduate Institute, Geneva.

(7) CPCB (1999-00 to 2008-09), *Annual Report, Central Pollution Control Board*, Ministry of Environment & Forests, Government of India (online available at http://cpcb.nic.in/annualreport.php).

(8) CSO (2000), *CSO Staff Papers*, Vol. 1, No. 2 on Environmental Pollution.

(9) Dannish Technological Institute (1992), *Possibilities for a Reduction of Pollution Load from Tanneries*, Final Report, Nordic, Council of Ministers.

(10) EXIM Bank (2006): *Indian Leather Industry*- Perspective and Export Potential, Research Brief, No. 22, March ,2006.

(11) Fisher, H & Pearce, D.(2009), Salinity Reduction in Tannery Effluent in India & Australia, *ACIAR, Impact Assessment Series*, Report No. 61. http://aciar.gov.au/files/node/11131/IAS61.pdf.

(12) Henriques, I & Sadorsky (1996), The Determinants of An Environmentally Responsive Firm : An Empirical Approach , *Journal of Environmental Economics and Management*, Vol 30, No. 3, pp-381-395.

(13) Hettige H, Mani, M & Wheeler, D (1997), *Industrial Pollution in Economic Development – Kuznets Revisited*, Development Research Group, World Bank, Dec 1997.

(14) Hettige H, Martin P, Singh M and Wheeler D (1995), *The Industrial Pollution Projection System*, World Bank, Policy research Department, Working Paper, February.

(15) Heyes A G (1998), Making Things Stick: Enforcement and Compliance. *Oxford Review of Economic Policy,* Vol 14, No. 4, pp 50-63.
http://italiaindia.com/images/uploads/pdf/leather-industry-in-india-2010.pdf .

(16) IICI (2008), The Indian Leather Industry, *Indo Italian Chamber of Commerce & Industry*, Short Market Overview, June, 2008.

(17) IILF (2012), A Report, India International Leather Fair, Chennai Trade Centre, Jan 31-Feb 3, 2012,(http://www.clri.org/LERIG2012/Report%20on%20Theme%20pavilion_IILF%202012_1.pdf).

(18) India Leather Summit (2011), A Report, Indian Leather Summit, New Delhi (http://www.leatherindia.org/documents/pdf/Special-feature.pdf).

(19) Indian Standards Institutions (1977), *Guide for Treatment and Disposal Effluent of Tanning Industry*, New Delhi, India.

(20) Italian Trade Centre (2010), Indian Leather and Tanning Industry – *Profile 2010, ITALIA* .

(21) Karel Kubec (2000), Report on Recommendations on Cleaner Productions and Process and Improving the Quality of Leather, *UNIDO*, March 2000.

(22) Kwerel, E (1977), To Tell the Truth : Imperfect Information and Optimal Pollution Control, *Review of Economic Studies,* 44(3), 595-560.

(23) LERIG (2012) , A Report on the Annual Event , Jan 2012, CSIR-CLRI.

(24) Ludvik, J. (2000), The Scope for Decreasing Pollution Load in Leather Processing, UNIDO.

(25) Maria, A(2003), The Cost of Water Pollution in India, Paper presented at the conference on Market Development of Water & Waste Technologies, Environmental Economics, 30-31Oct, 2003.

(26) Mohanty and Manoharan (2002), "Analysis of Environment related Non-Tariff Measures in the European Union Implications for South Asian Exports", *RIS Working Paper*, No. 38, New Delhi, India.

(27) Nihila, M. (1993), Development Process and Status of Women: Tanning Industry in Tamil Nadu, *Economic & Political Weekly*, Oct 9, 1993, pp 2220 – 2228.

(28) NMCC (2010), Productivity & Competitiveness of Indian Manufacturing Sector – Leather and Leather Products, *National Manufacturing Competitive Council*, Government of India.

(29) Porter, M.E. & C Vander Linde (1995), Towards a New Conception of the Environment Competitive Relationship, *Journal of Economic Perspective*, Vol :9 (4), pp 97-118.

(30) Prasad, P. M. (2006), Environment Protection - Role of Regulatory System in India, *Economic & Political Weekly*, April 1, 2006, pp 1278-1288.

(31) Rajamani, S. (2001), Tannery Waste Management & Technological Options for Up gradation of Environment System for Tanneries in Kanpur, *Proceedings of Leather Research Industry Get-Together*, Kanpur, Chapter, Aug 22, 2001

(32) Roberts, M. & Spence, M. (1976), Effluent Charges and License under Uncertainty, *Journal of Public Economics*, 5, 193-208.

(33) Roy C (2000), *A Study on the Prospects of Indian Leather Exports*, M. Phil Dissertation (unpublished), Jadavpur University, 2000.

(34) Rugman A.M. & Verbeke (1998), Corporate Strategy and International Environmental Policy*, Journal of International Business Studies,* Vol: 29, No. 4, pp 819-833.

(35) Sankar U (2006), Trade Liberalization and Environmental Protection- Responses of Leather Industry in Brazil, China and India, *Economic & Political Weekly*, June 17, 2006.

(36) Sankar, U (2006), Trade and Environment- A Study of India's Leather Exports, *Oxford University Press.*

(37) Sanyal, S., Banerjee. S & Majumder S (2010), India's Leather in the World Market- Exploration of Recent Trends, *Trade and Development Review*, Jadavpur University Vol 3, Issue 1, 2010.

(38) Schjolden, A(2000), Leather Tanning in India- Environmental Regulation and Firm's Compliance, *FIL Working Paper,* No. 21, 2001.

(39) Staffin EB (1996), Trade Barrier Or Trade Boon ? A Critical Labeling and its Role in the Greening of World Trade, *Columbia Journal of Environmental Law*, Vol 21, No. 2, pp 205-286.

(40) Sujataha V (2002), Leather Processing- Role of Indigenous Technology, *Economic & Political Weekly*, Nov 23, 2002.

(41) Tewari, M & Pillai, P (2005), Global Standards and the Dynamics of Environmental Compliance in India's Leather Industry, *Oxford Development Studies*(http://iegindia.org/workpap/wp255.pdf).

(42) Thyagargan G, Srinivasan A V & Amudeswari (Eds) (1994), Indian Leather 2010: A Technology, Industry and Trade Forecast, *Central Leather Research Institute*, Madras.

(43) UNEP (1991), Tanneries & Environment – A Technical Guide to Reducing the Environmental Impact of Tannery Operations, United Nations Environment Programme.

(44) UNIDO (2000), Demonstrations and Propagations of Cleaner Technologies Aid Improvement of OSH Practices and Effluent Treatment Plant, *United Nations Industrial Development Organization*.

(45) World Bank, Environment Department (1996), Pollution Prevention and Abatement- Tanning and Leather Finishing, *Technical Background Document,* World Bank.