



R E S E A R C H R E P O R T

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Greening the Leather Tanning Industry in Vietnam

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The leather tanning sector in Vietnam is currently growing fast and is becoming an increasingly significant cause of environmental pollution. Now a new EEPSEA study has assessed the environmental impact of the tanning industry in the country, the effectiveness of some of the environmental regulations that govern it and the factors that affect compliance. The study is the work of Le Ha Thanh from the National Economics University, Hanoi, Vietnam.

The study finds that the environmental regulations it focuses on are not very effective at safeguarding the environment - 100% of the tanneries that complied with the environmental regulations had violated wastewater and air quality standards. It finds that inspections, production capacity, location of firms, and type of tannery are significant factors that affect compliance. It concludes that improving the environmental performance of Vietnamese tanneries is crucial and makes a number of specific recommendations on how this can be done. These include strengthening regulatory capacity and increasing fines for non-compliance.

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October, 2011

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All opinions expressed in this report as well as any errors and omissions are solely those of the author.

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LIST OF ABBREVIATIONS

BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DONRE	Department of Natural Resources and Environment
FDI	Foreign Direct Investment
IPs/IZs	Industrial Parks/Industrial zones
EIA	Environmental Impact Assessment
EM	Environmental Monitoring
HCMC	Hochiminh City
LEFASO	Vietnam Leather and Footwear Association
LEP	Law on Environmental Protection
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
MOI	Ministry of Industry
MOIT	Ministry of Industry and Trade
MOST	Ministry of Science and Technology
MOT	Ministry of Trade
MPI	Ministry of Planning and Investment
SLA	Shoes and Leather Association HCMC
TCVN	Vietnamese Standards
TSS	Total Suspended Solids
VEA	Vietnam Environment Administration
VOC	Volatile Organic Compound
WWTS	Wastewater Treatment System

GREENING THE LEATHER TANNING INDUSTRY IN VIETNAM

LE HA THANH

EXECUTIVE SUMMARY

Vietnam's rapidly increasing leather and footwear export trade has made a significant contribution to the country's economic development over recent years. Currently, leather and footwear products are one of Vietnam's four major export items in terms of value. Success, however, has brought with it new challenges. Leather is the most important material for the production of footwear. Experts note that in recent years, the rapid growth of the leather industry causes considerable pollution, which poses increased risks to the environment and human health. A number of policies have been introduced by the government of Vietnam to mitigate the environmental pollution from the tanning industry. They include requirements for tanneries to (i) submit environmental impact assessment reports, (ii) install wastewater treatment systems, and (iii) pay wastewater fees. The primary objective of this research was to investigate the compliance of Vietnam's tanneries with environmental regulations. A survey of tanning firms in the provinces of Hanoi, Hochiminh City and Quangnam was conducted in 2010 to understand how tanneries perceived the impacts of environmental regulations and other factors on their environmental performance. The results showed that medium-sized and large tanneries responded positively to environmental regulations while none of the small household tanneries surveyed were found to comply. The main reasons for the latter's non-compliance were found to be the lack of technical and financial capacity and low level of awareness. Nonetheless, the compliance rate of tanneries in general was found to be much higher than that of other industrial sectors in Vietnam. Inspections, production capacity, location of firms, and type of tannery were found to be significant factors affecting compliance. This study also measured the costs of compliance and non-compliance by tanning firms. This report also cites policy recommendations such as raising the penalties for non-compliance, increasing monitoring activities to detect offenders, and employing a multi-stakeholder and collective action approach to bring about the greening of the tanning industry.

1.0 INTRODUCTION

1.1 Problem Statement

The Vietnamese economy grew rapidly at an average rate of 7.6% from 1991-2006. This growth has continued to date and it has greatly elevated Vietnam's international standing from its former placing in 1990 when the country was amongst the world's poorest with a GDP per capita of US\$ 98 (ADB 2008). By 2007, its GDP per capita reached around US\$ 836 and Vietnam approached the status of a lower middle income country by World Bank standards. Its export base also shifted from primary

commodities to manufactured goods such as electronics, garments and footwear. The ratio of manufactured exports to total exports, which hovered around 28% in the second half of the 1980s, increased to approximately 50% by 2007. Also, during the last decade, Vietnam's exports have increased by 20% annually. Export turnover in 2010 reached US\$ 68 billion, five times more than in 2000 and 2.5 times that in 2005 (MOIT and LEFASO 2010).

Currently, leather and footwear products make up one of Vietnam's four major export items in terms of value. In the last ten years, this industry has developed drastically, making a strong contribution to industry sector exports and the country's GDP. In the year 2010, the export value of leather and footwear products was US\$ 6.19 billion accounting for 9.1% of Vietnam's total export value (MOIT and LEFASO 2010). Leather is the most important material for the production of footwear. However, leather production volume in Vietnam is still small and can presently meet only about 30% of the demand from local industry. This indicates that a strong increase in leather production in Vietnam is likely in the future.

However, success has come at a cost. The rapid growth of the leather industry has resulted in considerable pollution, which poses increased risks to the environment and human health. Leather tanning is a multi-step process in which raw hides or skins are converted into finished leather but which produces significant amounts of solid and liquid waste pollutants.

In Vietnam, leather tanning was long regarded as a low-tech industry with a small workforce, thus it was not seen as an industry that should be seriously considered from both social and environmental points of view. Recently, however, the fast growth of the leather industry and growing public awareness of the risk of pollution to human health and the environment have attracted increased attention from communities, local authorities, and environmental scientists. The leather tanning industry has been categorized as one of the most pollutant-causing industries in the country and was put on the list for relocation from a number of urban areas. The environmental problems are especially complicated with small and medium-sized tanneries because they are often located in highly populated areas where they can easily impact surrounding neighborhoods through their waste discharge.

Insofar as the Vietnam government continues to emphasize the role of industrialization to boost exports and increase the competitiveness of its leather and footwear products in the world market, so has its need to protect the environment also increased. Vietnam can nevertheless benefit from meeting environmental standards as its competitiveness will be strengthened and its natural resources will be used sustainably. In other words, environmental requirements pose both challenges and opportunities for the country.

This study assessed the present environmental impacts of the tanning industry in Vietnam and the effectiveness of the current environmental regulations governing it. It focused on the environmental compliance of the tanneries since this was a crucial factor in the sustainable development of the leather and footwear sector. A field survey of 54 tanneries in Vietnam was conducted to identify the factors affecting their behavior in

terms of environmental protection. Relevant statistical data, policy documents, literature reviews, and interview results are cited in this report.

1.2 Research Objectives

The overall objective of the study was to explore policy recommendations for improving the compliance of the tanning industry with environmental regulations from the stakeholders' perspective.

The specific objectives were as follows:

- i. To do an overview of the tanning industry and environmental regulations and institutions governing tanning enterprises in Vietnam.
- ii. To investigate the level of compliance of tanneries with environmental regulations and determine the costs of compliance.
- iii. To identify the factors affecting the environmental compliance of tanneries.
- iv. To draw policy implications and make recommendations to improve the compliance of tanneries in Vietnam with environmental regulations now and in the future.

1.3 Research Questions

The study sought to answer the following questions:

- i. What is the current environmental situation of the tanning industry in Vietnam?
- ii. What are the environmental regulations affecting the tanning industry?
- iii. Who are the main actors involved in the environmental management of tanning industry? What are their roles and motivations?
- iv. What have been the impacts of environmental regulations on the environmental performance of tanneries in Vietnam?
- v. What factors affect the compliance of tanneries with the regulations? What are the costs borne by tanneries in complying with the environmental regulations?
- vi. What policy options are likely to prove effective in greening the tanning industry in Vietnam?

1.4 Scope of the Study

1.4.1 Study sites

The research targeted all tanneries in Vietnam. According to the Vietnam Leather and Footwear Association (LEFASO), there are small scattered tanneries in the northern and central parts of the country including the Hanoi and Quangnam regions while the remaining enterprises are gathered in a major cluster in the Hochiminh City (HCMC)

region in southern Vietnam. There are about 60 companies and tanning units throughout the country¹ (Tran 2008). There are six tanneries with foreign capital while the rest are local private companies and small tanning units.



Figure 1. Locations of tannery clusters in Vietnam

1.4.2 Environmental policies

According to a review done by the author, more than 600 regulations directly or indirectly related to environmental protection have been approved in Vietnam in the last 10 years. These include requirements to comply with waste material concentration standards, to properly manage all kinds of waste from production processes, and to compensate for environmental damage caused by business activities. However, in this study, the main focus was paid to environmental regulations that directly affected the tanning industry namely, those requiring tanneries to: (i) submit environmental impact

¹ The exact number of tanneries in Vietnam is unknown. The General Statistical Office (GSO) survey recorded only 33 companies which were officially registered and which ran their businesses in accordance with the enterprise laws of Vietnam. The traditional leather craft villages were not included in the GSO survey. These individual household enterprises are not registered and have a quite free hand in running their businesses. The number of household enterprises in leather craft villages total 27.

assessment (EIA) reports, (ii) install wastewater treatment systems (WWTSs), and (iii) pay wastewater fees.

There were at least two reasons for selecting these policies. Firstly, policy-makers deemed these three to be among the most effective in controlling pollution from the industry. Secondly, they are practical to implement in the context of Vietnam.

2.0 METHODOLOGY

2.1. Data Collection

The compliance of tanneries with environmental regulations was the core issue in this study. The research team used both secondary and primary data.

The secondary sources of data on the leather and tanning industry in Vietnam included officially and unofficially published information, reports on the studied sector, technical and scientific journals, other domestic and international publications including from branch associations, policy documents, archives/files from relevant management agencies, and scientific data from previous technical and/or monitoring reports by relevant institutions.

The primary data for the research came from two sources: the field survey of tanning firms and face-to-face in-depth interviews with relevant actors and stakeholders.

The survey development process involved both focus group discussions and pre-testing of a draft of the questionnaire. Each is briefly described below along with the key characteristics of the survey template used.

2.1.1 Focus group discussions

Several focus group discussions (FGDs) were conducted with tanning entrepreneurs, workers, service providers, governmental and environmental management officers of different levels, representatives of branch associations, economic agents, and research institutes. These FGDs were held as a platform for participants to discuss (i) their opinions about the development of the tanning industry in Vietnam; (ii) the level of public awareness about environmental issues involving the tanning industry; (iii) the appropriateness of environmental regulations and their effects on the tanning industry; (iv) emerging problems in implementing the regulations; and (v) proposed solutions to improve the compliance of tanneries with the regulations.

2.1.2 Pre-test

Following ‘best practice’, a draft of the survey template was pre-tested with two tanneries in Hanoi to ensure that the questions were understood by the respondents. The issues to be examined in the course of the pre-testing included (i) whether there was any lack of clarity or misunderstanding of the questions presented to the respondents; (ii) whether there were a large number of unanswered questions; and (iii) whether the length and format of the questionnaire were appropriate. In general, the respondents did not find

it difficult to answer the questionnaire. The questionnaire was then revised and finalized to address the concerns raised by the respondents in the pre-test. It was also an opportunity for the research team to gain experience in working with tanning firms and to find the best strategy of approaching the respondents and asking questions.

2.1.3 Key characteristics of the survey template

In keeping with best practice in the conduct of a survey exercise, the questionnaire started with an introduction read out by the enumerator/surveyor which first explained to the potential respondent the overall purpose of the survey and then sought the explicit consent of the potential respondent to participate in the survey. The questionnaire proper comprised four main parts.

The first part of the questionnaire sought information on the tannery's profile, including name, address, location, size, legal status, market share, etc. The second part aimed at collecting information about the environmental performance of the tanneries in terms of waste, waste treatment facilities, etc. The third part of the questionnaire consisted of questions on the perceptions and attitudes of the tanneries and their motivation to bring about environmental improvement. Finally, the last part of the survey questionnaire was on the respondent's suggestions to improve the situation.

2.1.4 Survey implementation

The survey was implemented by means of direct interviews conducted by enumerators. These enumerators were post-graduate students taking their Master's Degree in Environmental Economics from the Hanoi National Economics University and researchers from the Vietnam Development Forum (VDF)². Training was provided to the enumerators on how to approach the respondents and administer the questionnaire to ensure the reliability of the process.

The survey was conducted from July to November 2010 in the northern, central and southern provinces of Vietnam. The survey team received very good support from the local authorities and representatives of LEFASO to facilitate the enumerators' access to the tanneries. Most interviews took 45 to 60 minutes each to complete. A small gift was presented to the participating tanneries as a token of appreciation.

2.2 Data Analysis

To achieve the objectives, the study utilized both quantitative and qualitative analytical tools. Descriptive and comparative analyses were used in interpreting the data collected.

² Vietnam Development Forum (VDF) is a joint research project between the National Economics University and the Graduate Institute for Policy Research. It aims at creating innovative research methodologies.

2.2.1 Descriptive statistics

Descriptive statistics were used to describe the status/characteristics of the tanning firms and their environmental performance. The characteristics of the surveyed tanneries included capacity, firm size, ownership, labor force, location, etc. This method also provided simple summaries about the responses of different groups to the given questions.

2.2.2 Comparative analysis

Comparative analysis was used to show the difference between the tanning groups in terms of productive resources, performance, environmental situation, attitude towards environmental compliance and the regulations, etc. The comparative analyses showed how the different stakeholders perceived their roles/responsibilities in greening the tanning industry and how these perceptions affected or influenced their actions.

3.0 OVERVIEW OF THE TANNERY SECTOR IN VIETNAM

3.1 The Role of the Tanning Industry in the Vietnamese Economy

The leather and footwear sector is a rapidly growing one worldwide. The global production of finished shoes (of all kinds) increased from 12.08 billion pairs in 2000 to 17.9 billion pairs in 2010 (MOIT and LEFASO 2010). The total value of world production in leather also increased continuously from 20.3 billion sq. ft. in 2000 to 25.5 billion sq. ft. in 2010 (MOIT and LEFASO 2010)³. The major sources of supply are the European Union (EU) and developing countries (in Latin America and South Asia in particular).

Like the garment industry, the production of leather goods and footwear in developing countries, including Vietnam, is fast-growing. Vietnam ranks fourth in the world's export of footwear. In the EU market, Vietnam is the second major provider of footwear after China, with 13.7% of the market share in 2005 (MOIT and LEFASO 2010). Vietnam, thanks to its competitive advantage of having a low-cost and hardworking labor force, is expected to become a bigger exporter of footwear and leather goods in the years to come.

As reported in the Master Plan for the Development of the Leather and Footwear Industry (Decision 6209/QD-BCT of 25 November 2010, hereafter called the Master Plan), the footwear sector has steadily increased its production scale as well as turnover achieving an average growth rate of more than 14.5% annually from 2001 to 2008. More than 90% of the produced shoes in the country are exported (MOIT and LEFASO 2010).

The export of leather and footwear products brings in large foreign income to Vietnam. Table 1 shows the figures for the export income from leather goods and footwear in Vietnam in the period 2000-2010. In 2000, the export turnover of footwear

³ Finished leather is measured in square feet (sq.ft.). The conversion rate is 1 square foot = 0.093 m².

was USD 1.7 billion, which accounted for 11.9% of the total national export turnover and ranked third in the country's export list, behind crude oil and garments. This figure reached USD 6.19 billion in 2010.

Table 1. Contribution of the leather and footwear industry to Vietnam's economy

Unit: million USD

	2000	2005	2006	2007	2008	2009	2010
Export industry of leather & footwear	1,721.1	3,511.5	3,591.5	4,622.4	5,601.2	5,303.0	6,190.0
Total export trade of Vietnam	14,448.1	32,442.0	39,605.0	48,100.0	58,600.0	61,400.0	68,000.0
Ratio (%)	11.9	10.8	9.1	9.6	9.6	8.6	9.1

Sources: MOIT and LEFASO (2010)

In order to meet the increasing demand for finished leather to produce leather goods and footwear, the tanning industry in Vietnam also increased its production capacity by about five times, from 15.1 million sq. ft. to 80 million sq. ft. during the period of 2000-2006 (Figure 2).

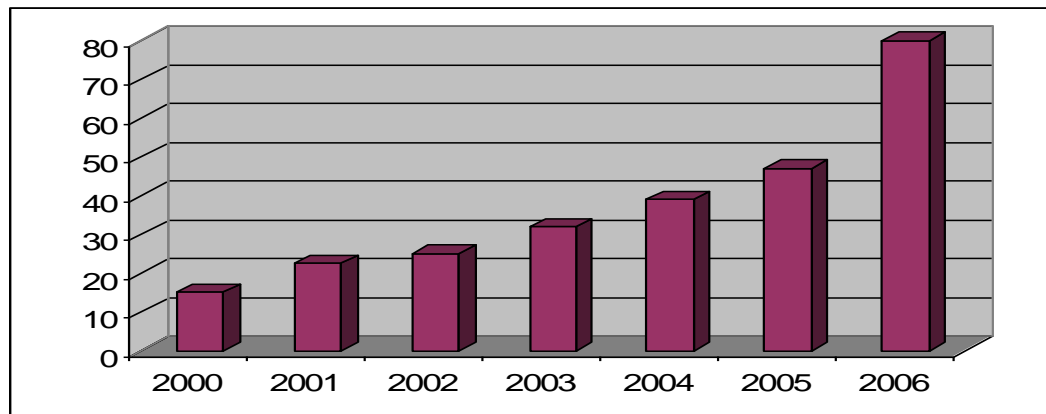


Figure 2. Vietnam's production of finished leather (*Unit: million square feet*)

Source: Adapted from the LEFASO website <http://lefaso.org.vn/>

However, local production of leather far from meets domestic demand. Schmick and Thomas (2001) found that in Vietnam, the production of 230 million pairs of shoes and sandals in 1999 consumed approximately 80 million sq. ft. of leather when the leather production of the whole country then was only 12.6 million sq. ft., accounting for only 15.7% of the total demand. Although in 2004, leather production reached 39 million sq. ft., it still could only meet about 27% of the demand. Despite the fact that the targeted

production of the finished leather for the year 2010 in the Master Plan (80 million sq. ft.) had almost been achieved in 2006, this figure could only meet about 33.7% of the total demand for leather. The production of finished leather is mainly concentrated in tanneries in HCMC where over 70% of the total national leather volume is produced.

In 2008, the leather industry employed 6,030 workers, accounting for about 1% of the total labor force of the leather and footwear industry with an average number of 183 workers per tannery (Table 2). In the leather industry, 5.48% of the workers were university graduates, 25.53% were skilled and experienced technicians, and the rest (68.63%) were unskilled workers. These employees worked in 33 companies, most of which were located in the Hanoi and HCMC regions. Another 200 workers worked in tanning villages spread over Hung Yen and Quangnam provinces (GSO 2010; MOIT and LEFASO 2010).

Table 2. Employment statistics of the leather industry in Vietnam

	Number of firms		Number of employees			Total output (in VND billion)		
	Total	%	Total	On average	% of total	Total	On average	% of total
Leather industry	33*	4.06	6,030	182.7	0.97	1,244	37.7	4.74
Leather and footwear industry	812	100	623,905	768.3	100	26,190.5	32.3	100

Sources: MOIT (2010) and GSO (2010)

Note: * Household enterprises in tanning villages not included

In terms of ownership, the industry features both non-state and foreign-owned enterprises. The private sector accounts for almost 82% of all the firms in the tanning industry which produces more than 95% of the total output.

The tanning industry was introduced in Vietnam in the footsteps of China hundreds of years ago. Leather tanning was traditionally regarded in Vietnam as a low-tech industry as it was one of the earliest traditional manufacturing industries in Vietnam, characterized by small tanning craft villages scattered around the country. From the beginning, the operational scale of the village tanneries has been small and mainly family-based. By the late 20th century, however, some large tanneries had been set up, driven by the dramatic increase in the demand for tanned leather. However, the technology is still lagging behind. According to a study by the Leather and Shoe Research Institute reported by Tran in 2008, the percentage of modern machines was 30% while 40% were normal machines and 30% were old obsolete machines.

3.2 Environmental Problems Caused by the Tanning Industry

Leather tanning is a multi-step process in which raw hides or skins are converted into leather. Tanning involves treating raw hide material (animal hides and skins) with

many different chemicals (including toxic chemicals) and a lot of water (about 50 m³/per ton of raw hide). The process emits much solid and liquid waste, namely, chromium salts and organic matter such as Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), and chlorides⁴; which pollute rivers, soil and air. Most tanning factories, however, cannot afford to invest in waste treatment facilities.

3.2.1 Leather tanning processes

Tanning essentially involves the reaction of collagen fibers in hides with tanning agents. A wide variety of methods is used. In Vietnam, there are two main groups of tanning methods used in practice, i.e. vegetable tanning and mineral tanning.

Vegetable tanning: Extracts from a number of plant species were first discovered early in human history as having tanning properties and became used as agents in tanning hides. In the extracts, there can also be non-tanning components which although easily washed out, have an important influence on the specific properties of the final leather product.

Mineral tanning: Compounds of chromium, zirconium, aluminum and iron belong to this group. Due to their much smaller molecular size, mineral tans give rise to significantly less filling of the leather. Their major advantage is that they are able to link together into much larger complexes, which can grow sufficiently to bridge adjacent protein molecules giving a high degree of stability to the structure. Chromium is predominantly used as a tanning agent because it is cheap despite growing pressure to replace it with less hazardous agents such as aluminum.

According to the European Commission (2003), the whole tanning process can typically be divided into four main groups of operations: (i) beam house operations, (ii) tan yard operations, (iii) post-tanning operations, and (iv) finishing operations. Tanning processes vary according to the type of leather produced: (i) wet-blue leather from hides, wool skins, or dewooled or fell mongered pickled-pelts from sheepskins; (ii) finished leather or (iii) sole leather. The chemicals used and the pollutants generated vary widely, although there are some similarities in the processes.

⁴ Biochemical oxygen demand (BOD) is the amount of oxygen required by aerobic micro-organisms to decompose organic matter in a sample of water, such as that polluted by sewage. It is used as a measure of the degree of water pollution.

In environmental chemistry, the chemical oxygen demand (COD) test is commonly used to indirectly measure the amount of organic compounds in water. Most applications of COD determine the amount of organic pollutants found in surface water (e.g. lakes and rivers), making COD a useful measure of water quality.

Total Suspended Solids (TSS) are solid materials, organic and inorganic, that are suspended in water. These would include silt, plankton and industrial waste.

3.2.1.1 Beam House Operations

Raw or cured hides, upon arrival at a tannery, have to be washed to remove sand, dust and salt from the surface and trimmed in some parts, for example, the tail and leg areas. The hides are then fleshed to remove any excess tissue, muscles or fat adhering to the hide and to ensure uniform thickness. Soaking then takes place to make the hides reabsorb the water content that may have been lost after being flayed and to remove any remaining dirt, dung, blood, etc. The next step is called ‘unhairing’ and involves removing the hair and epidermis from the hides. This helps open up the fiber structure and ensures that the grain is clean and that hair follicles are free of hair roots. Liming is the most common method of hair removal. The step of unhairing normally takes 12 hours.

3.2.1.2 Tan Yard Operations

Deliming is the first step in tan yard operations. The purpose of this step is to remove residual lime from the pelts to put the raw hide in optimal condition for steps to come. Next, bating⁵ is done by adding some chemicals to lower the pH. An enzyme is also added to further remove unwanted hide components. Pickling⁶ then takes place to further decrease the pH. Next, tanning, the most important part of the whole process, is carried out. The collagen fibers are stabilized by the cross-linking action with the tanning agent, making the hide no longer susceptible to putrefaction or rotting. After tanning, the leather pieces are wrung to reduce the moisture content, and then they are split to the desired thickness, and finally shaved to obtain an even thickness.

Most of the small tanneries limit their production to this stage due to lack of capacity for further processing. The intermediate products are tradable and are usually sold to larger tanneries where post-tanning and finishing operations are carried out.

3.2.1.3 Post-Tanning Operations

Post-tanning operations start with the neutralizing step. Neutralization ensures that the tanned hides have a pH suitable for the subsequent steps of retanning, dyeing and fat liquoring. Retanning is optional and is commonly applied for chrome tanning only. This step is carried out to improve the feel of the leather and its resistance to alkali and perspiration. Dyeing is then carried out to produce a uniform color over the whole surface of each leather sheet. Then, by fat liquoring, the leather is lubricated according to specific desired characteristics and to re-establish the fat content that had been lost in the processing. The desired leather properties differ depending on the purpose of use. After this, the leather sheets are washed to remove residual chemicals from the surface. Next, the leathers are wrung, set out, and dried to reduce the moisture content and to optimize the quality and shape.

⁵ Bating is a generic term for the use of proteolytic enzymes to degrade non-structural protein in hides.

⁶ Pickling is the acidification of pelt in brine for preservation or preparation prior to tanning.

3.2.1.4 Finishing Operations

Finishing operations refer to all the steps that are carried out after drying and are mostly employed in chrome tanning. Buffing is the first step in these operations. In this step, sand paper or glass paper is applied to the leather surface to remove material and flatten tanned leather in preparation for the next step which is surface coating. A thin layer of oil paint is placed on the leather surface. The leathers are then dried before being coated. Finally, plating/embossing takes place to print a pattern into the leather.

3.2.2 Pollution from the tanning industry

The rapid development of Vietnam's tanning industry has caused three main environmental problems: (i) discharge of untreated wastewater into rivers and other water sources, (ii) air pollution and odor, and (iii) discharge of solid waste into the environment. Besides these, minor problems such as noise are also associated with tanning activities. Figure 3 shows the pollutants generated at each step of the tanning process.

3.2.2.1 Water Pollution

Since most of the tanning processes are performed using water, generating wastewater is one of the main concerns. By consuming a large amount of groundwater for processing, the chrome tanning industry generates a huge amount of wastewater, which has a high pH value and contains high concentrations of hazardous chemicals including chromium salts and very high levels of BOD, COD, TSS and chlorides (Table 3).

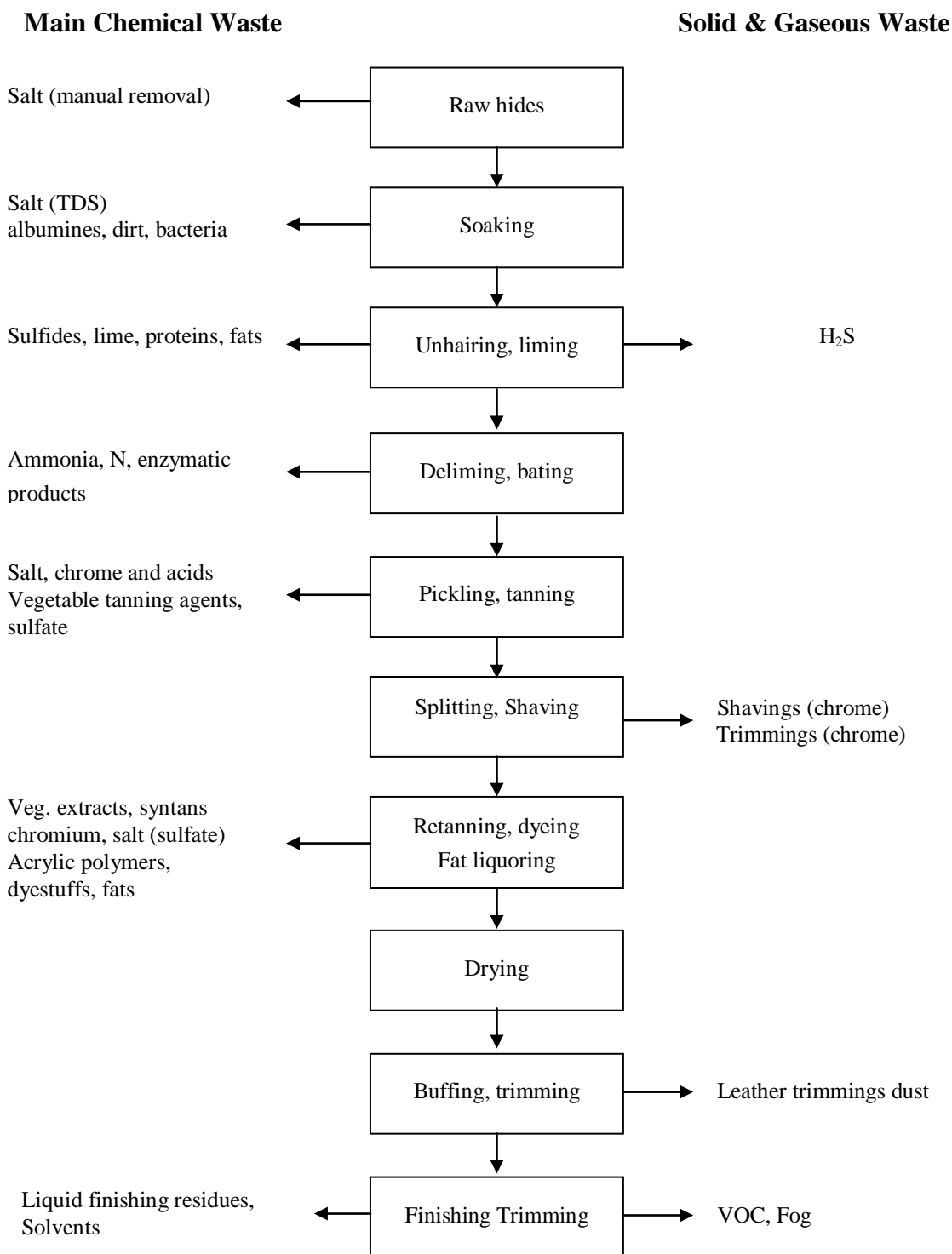


Figure 3. Leather tanning processes and pollutants

Source: PISIE (2004)

Notes: VOC = Volatile Organic Compound; TDS = Total Dissolved Solids

Fog = a collection of water droplets or ice crystals suspended in the air at or near the surface

Syntans = A synthetic tanning agent of polymerised aromatic hydroxyl compounds, designed to perform various functions, depending on the structure, including assisting chemical processes

Table 3. Wastewater parameters at the different stages of tanning

Unit: m³/t (cubic meter of water per ton of raw hide material)

Processes	Water (m ³ /t)	pH	TSS (mg/l)	COD (mg/l)	BOD ₅ (mg/l)	S ²⁻ (mg/l)	Cr ³⁺ (mg/l)
Soaking	2- 4	7,5 - 8	400 - 800	600 - 1200	400 -700		
Liming	2-3	11- 13	600 - 800	1200 - 1800	500 - 700	250 - 300	
Washing 1	2	10- 12	200 - 300	800 - 1000	100 - 150	50 - 100	
Washing 2	2	9- 10	100 - 200	300 - 500	100 - 150	20 - 50	
Deliming Bating	2- 4	8- 9	250 - 300	400 - 900	80 - 150		
Washing	2- 4	8- 9	80 - 170	100 - 200	40 - 80		
Acidifying	1- 2	3- 4	50 - 100	100 - 200	70 - 130		300 - 400
Washing	2	4- 5	100 -150	200 - 300	60 - 100		50 -100
Neutralising	2- 4	4,5- 6	400 - 500	400 - 600	200 - 300		
Retanning	1- 2	4- 6	500 - 800	900 - 1300	350 - 700		
Dying and fat liquoring	1- 2	5- 6	500 - 700	500 - 1000	200 - 400		
Washing	7- 9	7- 9	70 - 150	180 - 350	80-150	2 - 6	8 - 15

Source: Tran (2008)

Notes: TSS = Total suspended solids; S²⁻ = Sulfite; Cr³⁺ = Chromium III

3.2.2.2 Air Pollution

Although gaseous emissions from the tanneries are often of less concern compared with wastewater discharge, the odor and release of Volatile Organic Compounds (VOC), organic solvents and other toxic substances such as sulfides and ammonia are nevertheless a problem. At high enough concentrations in the air, some of these gases can be toxic to humans. In addition, particulates are generated during the drying processes such as milling, buffing and spray finishing, and contain some amounts of chromium and a number of other chemicals, which can be dangerous to human health.

3.2.2.3 Solid Waste

Solid waste and by-products such as hair, trimmings, fleshings (bits of flesh scraped from the hides or skins of animals), shavings, fats, grease, etc. are also generated from the tanning process. A number of authors report on the large amounts of tanning solid waste. Alexander et al. (1991), for instance, estimates that the tanning of one metric ton of wet salted hides produces about 700 kg of waste and by-products, including about 250 kg of tanned solid waste, 350 kg of non-tanned waste, and 100 kg of wastewater. The European Commission (2003) reports that only 20-25% of the weight of the raw hide is processed into leather while the rest plus the chemical inputs end up as either waste or by-products in both liquid and solid forms. Poor management of the solid waste can create not only unhygienic conditions at the workplace and neighborhood, but can also contaminate the soil.

3.3 Environmental Regulations & Institutions Affecting the Tanning Industry

3.3.1 Public and private institutional frameworks

Institutional regulatory frameworks for environmental protection have in general been well established in Vietnam, but not in the case of the tanning industry specifically. The environmental regulations that do affect the tanning industry are governed by the Ministry of Natural Resources and Environment (MONRE) and the Vietnam Environment Administration (VEA) under MONRE at the central level, and the Department(s) of Natural Resources and Environment (DONRE) at the city and provincial levels.

There are also other public and private sector agencies that influence the tanning industry. The Ministry of Planning and Investment (MPI) is the lead agency in charge of developing economic plans, preparing national investment plans, and determining external assistance requirements. The MPI is also the agency in charge of approving foreign investment projects through a formal review process including an environmental review. The Ministry of Industry and Trade (MOIT), on the other hand, is responsible for performing state management functions related to industrial and trade development, including environmental aspects. The Industrial Estate Management Boards under the Provincial and City People's Committees attract investors and provide support to firms inside industrial parks/zones (IPs/IZs) on matters pertaining to project development, administrative and regulatory compliance, and environmental management.

As a business association, LEFASO was established in June 1990. LEFASO is a socio-economic, voluntary organization representing manufacturers, traders, technical and scientific researchers, and service suppliers engaged in the leather and footwear industry in Vietnam. According to the information provided on the LEFASO website⁷, the association has 169 member companies consisting of shoe-makers, tanneries, material providers, leather bag makers, and machinery and equipment producers. The association's goals are to conduct economic activities and coordinate actions related to

⁷ <http://lefaso.org.vn/>

manufacture, export, import, material supply, and product consumption in the leather and footwear sector. It also aims at improving product quality and the socio-economic conditions of its member enterprises, increasing the competitiveness of the sector in export markets, and promoting its members' interests.

In the south, where most of Vietnam's tanneries are concentrated, there is the Shoes and Leather Association HCMC (SLA), which was established in 1996. It represents and protects the rights of enterprises and business establishments in the sector. The SLA, also a member organization of LEFASO, has 88 member companies in HCMC, Can Tho Province, Dong Nai Province, and Ba Ria Vung Tau Province. It provides services to its member enterprises such as the provision of relevant information, training, the organization of exhibitions to introduce products, and business consultation.

LEFASO and its branch offices have initiated only a few environmental-focused activities so far like organizing specialized seminars and training on cleaner production and sustainable development, and introducing the concept of corporate social responsibility (CSR) to the tanneries.

3.3.2 Environmental laws and regulations

In Vietnam, there are three main levels of environmental legislation: (i) the National Law on Environmental Protection (LEP) 1993, amended in 2005, (ii) regulatory instruments issued by the government, and (iii) regulatory instruments issued by ministries and provincial governments.

The basic legal framework for environmental protection in Vietnam is the LEP, which was adopted by the National Assembly in late 1993 and which took effect in January 1994. The LEP was enacted to serve the long-term and sustainable development of the nation. It has articles on waste management including encouraged activities; forbidden activities; and civil and organizational responsibilities relating to the use of technical equipment and treating, transporting, burying and discharging waste, hazardous waste, and radioactive materials. The LEP encourages cleaner production and the application of progressive technologies. It applies to all kind of economic facilities in Vietnam; both large and small, national and foreign. However, the particular modes of action are not indicated in detail in the law itself.

The second group of legislation consists of regulatory instruments issued by the government, such as decrees, decisions and regulations. They provide instructions on how to implement as well as operationalize the LEP. In November 1994, the Government issued Decree 175/CP on 'Guidance for the Implementation of the Law on Environmental Protection'. This is an important decree as it has detailed stipulations on the implementation of the LEP. Meanwhile, Decree 26-CP of 26 April 1996 provides reward and punishment regulations relating to administrative violations of the LEP. After the new Environmental Protection Law was declared in 2005, Decree 175 of 1994 and the Decree 26 of 1996 were replaced by Decree 80/ND-CP and Decree 117/2009/ND-CP, respectively. The key features of the newly approved decrees are stronger obligations on the part of different stakeholders in environmental protection and heavier punishments for environmental violations in an effort to raise public and corporate awareness of

environment protection. Under the new decrees, individuals and organizations violating environmental regulations will face two major forms of punishment: warnings and pecuniary penalties (from VND 100,000 to VND 500 million). The top penalty is seven times higher than the previous rate. Violators will also have to bear additional punishment including the revocation of business licenses and the confiscation of exhibits.

Furthermore, there are some other subsidiary guidelines on waste management. They include Directive No. 29/1998/CT-TTg dated August 25, 1998, on strengthening the management of the use of plant protection chemicals and persistent organic pollutants; Decision 155/1999/QD-TTg of 16 July 1999 on hazardous waste substance management; Decision 82/2002/QD-TTg of 26 June 2002 on the establishment of Environmental Protection Funds of Vietnam; and Decree 67/2003/ND-CP of 13 June 2003 on collecting wastewater fees.

On 22 April 2003, the Prime Minister approved the ‘Plan for the Complete Treatment of Units Causing Serious Environment Pollution’ (Decision 64/2003/QD-TTg). Phase I (2003-2007) of this plan focused on the complete treatment of 439 enterprises causing serious environmental pollution. Phase II (2008-2012), based on the experiences of Phase I, involves measures to continue treating a further 3,856 units creating serious pollution. Seriously polluting units which improve their pollution control according to the Plan will enjoy favorable treatment under corporate tax, import tax for machinery and equipment, and land use tax.

The above-mentioned ordinances regulate activities in all aspects of industry in Vietnam, including tanneries. However, it should be noted that there is no regulation in the LEP that mentions the tanning industry specifically.

The third group of legislation comprises regulatory instruments issued by ministries and provincial governments, such as standards, regulations, rules, directives and circulars. For instance, the Ministry of Science and Technology (MOST) issued the Vietnam Standard on Industrial Wastewater (TCVN 5945-1995). This standard limits concentrations of substances causing pollution in wastewater and was revised in 2005 (to become TCVN 5945-2005) to be stricter on the levels of contamination. Along with this standard, other environmental standards on air quality, noise, and other indicators were also issued. These standards apply to all industrial facilities, including those of the tanning industry (Appendix 1).

In 2006, the Government issued the Law on Standards and Technical Regulations. Based on this, MOST issued Circular 21/2007/TT-BKHHCN dated 28 September 2007, providing guidelines on how to develop and apply standards including the national standard system and basic standards; and on regional standards and international standards. These include technical standards and standards on hygiene and safety in the tanning industry. The bodies responsible for enacting legislation in Vietnam are summarized in Table 4.

Table 4. Legislative bodies at various levels of government in Vietnam

Legislative body	Legislative instruments	Comments
National Assembly	1. Law 2. Resolutions	Highest form of legislation in Vietnam
Standing Committee of the National Assembly	1. Ordinances	Passed when National Assembly is not in session
Government	1. Decrees 2. Decisions 3. Regulations	Generally used to implement laws and ordinances, and provide additional details
Ministries, Offices equivalent to ministries, Governmental Offices	1. Decisions 2. Instructions 3. Circulars	Provide guidance on how a particular ministry will administer laws, ordinances, decrees and regulations
People's Committees at (a) provincial level (b) district level (c) commune level	1. Decisions 2. Instructions at: (a) provincial level (b) district level (c) commune level	

Source: UNDP (1995)

4.0 RESULTS AND DISCUSSION

4.1 Profile of Surveyed Firms

This study involved a field survey on tanning firms in Hanoi, HCMC and Quangnam regions in 2010. The main objective of the survey was to assess their motivations and practices and find opportunities and ways to improve their environmental performance. Interviews were conducted to investigate how the tanneries really perceived the impact of environmental regulations and other factors on their environmental performance. The evaluation was more qualitative in nature as it was difficult to conduct technical environmental assessments at the visited tanneries. However, valuable insights were obtained from which important policy implications have been drawn.

The survey involved firm managers, supervisors, and environmental officers as they were deemed to be in the best position to talk about their firms' perceptions of the environmental situation and factors affecting their environmental performance.

The survey targeted all the tanneries in Vietnam. As of November 2010, however, only 54 tanneries, which represented almost 90% of the total number of tanneries in Vietnam, had responded to the survey. The respondents varied in terms of region and ownership. The summary of respondents by location in Table 5 shows that 38.8% came from the north of Vietnam; 5.6% came from the central provinces; and 55.6% were from

HCMC and surrounding areas in the south. As for the breakdown by ownership, 88.9% were Vietnamese private enterprises while 11.1% were foreign-invested enterprises (Italy, Taiwan, France and Korea). There are no state-owned enterprises in this sector.

Table 5. Summary of respondent firms by region, ownership and type

	No. of firms	%
Region		
Northern region	21	38.8
Central region	3	5.6
Southern region	30	55.6
Total	54	100
Ownership		
Vietnamese (private)	48	88.9
Foreign (private)	6	11.1
Total	54	100
Type of enterprise		
Household enterprise	21	38.9
Company	33	61.1
Total	54	100

The location and working conditions of the visited tanneries were diversified: 46.3% were located inside industrial parks/zones while 53.7% were located within densely populated residential areas in HCMC, Hanoi and Quangnam provinces (Table 6). The latter tanneries formed ‘tanning villages’ in Phu Tho Hoa in the south (HCMC) and Pho Noi in the north (Hanoi region) and Tam Ky in the central region (Quangnam Province).

Table 6. Distribution of respondent firms inside and outside industrial zones

Location	No. of firms	%
Inside industrial zones	25	46.3
Outside industrial zones	29	53.7
Total	54	100

Located on a small piece of land, ranging from 300 to 2,200 m² (typically about 500 m²), the production activities of household enterprises in tanning villages are confined by fences and most of them have had to construct a (temporary) second floor for their production, mainly made of wood with corrugated steel sheet roofing. In all cases,

the owner-families lived within the premises. Most of their available land was utilized for production. The working environment was very poor; the smell of chemicals and raw materials was pervasive. Some workers protected themselves with soft mufflers and rubber gloves.

About 96% of the interviewed firms could be classified as small and medium-sized tanneries in terms of production scale and labor (Table 7). The production scale of the surveyed tanneries differed from one to the other. This study classified them into three categories. There were 30 small enterprises (with a production capacity of less than 4,000 kg/day), 22 medium-sized enterprises (4,000–10,000kg/day) and two large enterprises (above 10,000 kg/day).

The number of workers per firm varied from 10-200 persons. The tanning villages operated mainly on a family basis and labor comprised family members and relatives. In most cases, family workers played lead roles in the management and running of the enterprises. Most of the workers, including the majority of household tannery entrepreneurs, had a very low level of education. Some larger tanneries, however, employed highly qualified staff to see to the technical aspects of the business.

Table 7. Firm classification by production capacity

Production capacity (kg/day)	No. of firms	%
Less than 4,000 (small)	30	55.6
4,000-10,000 (medium)	22	40.7
More than 10,000 (large)	2	3.7
Total	54	100

With regard to raw material, the input hides/skins were classified into three main types according to animal: cattle, water-buffalo and crocodile. The majority of the tanneries processed cattle and water-buffalo hides/skins while only two worked with crocodile skins.

A cross-tabulation analysis of the characteristics of the surveyed firms showed a number of interesting trends (Table 8). It appeared that the large and medium facilities were located mostly in the south within industrial estates. All southern tanneries were officially registered. In contrast, the tanneries of the northern and central regions were mainly small and household enterprises. About 92% of them were located outside industrial estates. There were also no foreign-owned companies in the northern and central regions.

Table 8. Summary of respondent firm characteristics

	Northern Region	Central Region	Southern Region	Total
Location				
Inside industrial zones	2	0	23	25
Outside Industrial zones	19	3	7	29
Total	21	3	30	54
Production capacity				
Less than 4,000 (small)	19	2	9	30
4,000-10,000 (medium)	2	1	19	22
More than 10,000 (large)	0	0	2	2
Total	21	3	30	54
Ownership				
Vietnamese (private)	21	3	24	48
Foreign (private)	0	0	6	6
Total	21	3	30	54
Type of enterprise				
Household enterprise	19	2	0	21
Company	2	1	30	33
Total	21	3	30	54

4.2 Environmental Awareness of Tanneries

In order to assess the attitudes and perceptions of the tanneries towards environmental issues, a series of questions was put forward to the respondents. These included questions on the current environmental quality of surrounding areas and the sources of pollution as well as specific questions on environmental issues related to tanneries.

Environmental quality of surrounding areas and sources of pollution

About 32% of the respondents said that the areas surrounding their tanneries were polluted while 68% stated that the environment was slightly polluted. None of the respondents believed that the surrounding environment was either very clean or seriously polluted.

Regarding the sources of pollution, 75% acknowledged that their production processes created environmental pollution. One fourth of the respondents did not think that the tanning industry was a source of pollution.

Environmental problems of the tanning industry

About 68% of the respondents were concerned about the wastewater discharged by the tanneries while 23% thought that the odor produced in the tanning process was the

most important issue. On the other hand, solid waste was the issue of concern for 9% of the respondents (Figure 4).

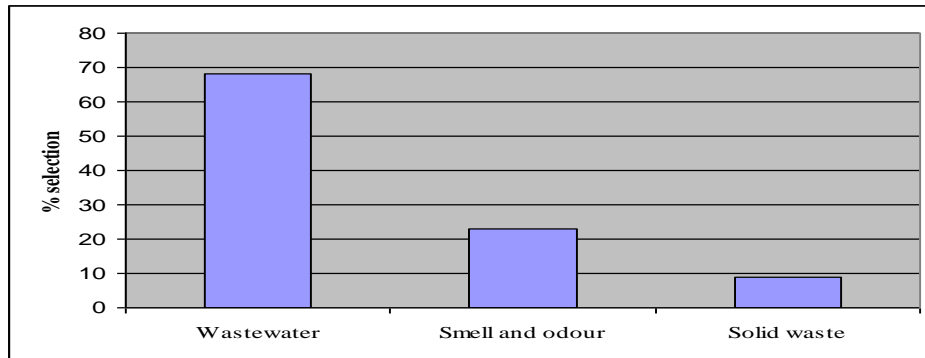


Figure 4. Respondents' perception of the most important environmental problems caused by tanneries

Environmental performance of tanneries

Regarding the current environmental situation of tanneries, 15% of the interviewed firms believed they had outstanding environmental performance while one fourth of the respondents thought just the opposite, and 60% believed that their environmental status was either good or very good (Table 9).

Table 9. Respondents' perception of their environmental performance

	Responses (%)			
	Much better	Better	Same	Worse
How do you rate your present environmental performance compared with 2005?	23	47	30	0
	Outstanding	Very good	Good	Bad
What do you believe to be your current level of environmental performance?	15	25	35	25
	Strongly Agree	Agree	Fair	Disagree
The CEO of your company is committed to environmental improvement.	12	53	35	0

Regarding the trend of environmental performance of tanneries in the last five years, 23% of the respondents said that their environmental performance had significantly improved while 47% indicated that their environmental performance had become better

compared to 2005. About 30% felt that their environmental performance had stayed at the same level while none believed that they had done worse.

Interest in environmental issues

The survey also identified two distinct groups of tanneries: those with interest and those with little/no interest in environmental issues. Those interested in environmental quality expressed their willingness to participate in environmental activities. If people are really interested, they can be mobilized to actively solve environmental problems. Twelve per cent of the respondents said that improving environmental quality was a top priority in their business. They regarded environmental management as a strategic tool in enhancing their competitive advantage. About 53% said that they should comply with environmental regulations. Meanwhile, 35% of the respondents felt that although the environment was important, their first priority was making a profit; in fact, about 90% of the individual household tanneries agreed with this statement.

4.3 The Impact of Environmental Regulations on Tanning Firms

The discussions that follow are on the quantitative impacts of the regulations on tanneries since time series data on changes in the environmental performance of the tanneries was not available. These quantitative impacts include the degree of compliance of tanneries with three chosen environmental regulations, namely, those requiring tanneries to (i) submit their environment impact assessment (EIA) reports, (ii) install wastewater treatment systems (WWTSs), and (3) pay wastewater fees.

The study used compliance as the indicator of positive impact of the regulations on environmental performance. According to a study on the compliance of Vietnamese paper-making plants with environmental regulations, compliance is a behavioral response to regulatory requirements (Dung 2009). Similarly, Environment Canada (2003) defines compliance as a state of conformity with the law. The United States Environmental Protection Agency (USEPA 1992) defines environmental compliance as the full implementation of environmental requirements. Hence, compliance indicators should be measurable pieces of information about the behavioral response of those regulated to the regulation/s in question.

It was hypothesized that those tanneries which had submitted their EIA reports were expected to be less pollution intensive in comparison with those which had not. The tanneries which had installed wastewater treatment facilities and those which paid water pollution charges were also hypothesized to be more motivated to reduce pollution.

4.3.1 Compliance with requirement to submit EIA report

According to the LEP of 2005 and Decree 80/ND-CP guiding its implementation, companies, depending on their location, sector and capacity, are required to submit their EIA reports to the authorities for evaluation and approval prior to commencing operations. Thereafter, the companies should submit an environmental monitoring (EM) report twice a year. The EIA and EM reports should be prepared by certified

environmental consulting firms from the Environmental Monitoring and Analytical Center under the provincial DONRE.

Since the leather tanning industry has been categorized as one of the most polluting industries in Vietnam, all tanning companies are required to comply with the above requirements. The survey results showed that 33 (61.1%) of the 54 respondent tanneries had submitted EIA and EM reports while 21 (38.1%) had not. All of the firms which had not submitted their environmental reports were household enterprises located in tanning villages.

4.3.2 Compliance with requirement to install wastewater treatment systems

According to Article 37(a) of the 2005 LEP, manufacturing, business and service establishments must have a system, which satisfies environmental standards, installed for the collection and treatment of wastewater. If wastewater is transferred to a common/shared WWTS, then the firms must comply with the regulations issued by the organization responsible for the management of such common system.

In accordance with TCVN 5945-2005 on industrial wastewater, wastewater discharge standards are divided into three levels; A, B, and C⁸. For example, the permitted standard for BOD is less than 30 mg/l for Level A, less than 50mg/l for Level B, and less than 100mg/l for Level C. For COD, the standard is less than 50 mg/l, less than 80mg/l, and less than 400 mg/l while for TSS, it is less than 50 mg/, less than 100 mg/l, and less than 200 mg/l, all for levels A, B and C, respectively. Level A standards require the most extensive and sophisticated wastewater treatment whereas Level C standards require minimal treatment. According to TCVN 5945-2005, industrial waste treatment facilities are expected to treat wastewater to at least Level B standards. Wastewater with pollutant levels higher than Level C cannot be discharged.

All tanneries are required to establish WWTSs to treat their wastewater up to Level B. For those located inside IPs/IZs with common WWTSs, they must comply with the regulations issued by the IP/IZ infrastructure company. Their wastewater must be treated up to Level B before being discharged into the common treatment system, which will further treat the water up to Level A.

Among the 54 visited tanneries, 35 of them had installed WWTSs while the rest had not. Twenty-five (25) of these 35 tanneries were located in IPs/IZs while the remaining 10 were located in cities. Two of the 35 firms had installed simple sediment tanks for wastewater treatment while the other 33 had installed modern WWTSs. Figure 5 refers.

⁸ These levels are aimed at controlling the quality of industrial wastewater discharged into water bodies that are intended to be sources of domestic water (Level A) or sources of water with lower quality like lakes or rivers (Level B). The Level C standard is for wastewater discharged into specific water bodies permitted by authority agencies such as wastewater ponds.

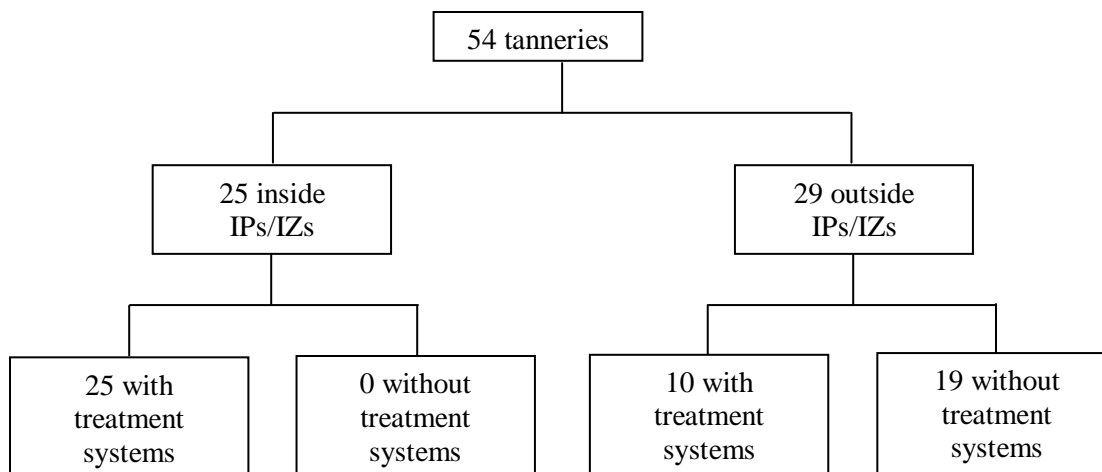


Figure 5. Compliance of tanneries with WWTS installation regulations

4.3.3 Compliance with requirement to pay wastewater charges

According to Decree No. 67/2003/ND-CP⁹ signed by the Prime Minister of Vietnam on 13 June 2003, all production and business units, including tanneries, should bear the cost of polluting the environment by paying wastewater charges. Wastewater charges are calculated based on the pollution loads that an enterprise imposes on the environment. The pollution level is calculated based on the quantity and toxicity of the pollutants contained in the wastewater. The quantity of pollutants is identified based on mass (m³) and concentration (mg/l). For industrial wastewater, enterprises do a self-declaration to DONRE quarterly. DONRE, in turn, appraises the data and indicates the fees to be paid. The enterprises then pay the fees to the provincial office of the State Treasury.

This study discovered three groups of tanneries related to compliance with the wastewater charges regulation (Figure 6). Twenty-five (46.3% of the total) tanneries which were located in IPs/IZs and connected to common wastewater treatment plants (WWTPs) of the IPs/IZs did not pay wastewater charges according to Decree No. 67/2003/ND-CP. Instead, they paid wastewater treatment (WWT) fees to the industrial infrastructure companies for wastewater discharged into the common WWTPs. The WWT fees applied in industrial estates are not uniform. They range from VND 3,900 per m³ (Vinh Loc IP) to VND 6,240 per m³ (Hiep Phuoc IP)¹⁰. The fee is set according to Decree 88 CP dated 28 May 2007 on sewerage connection fees. The average monthly payment was found to be VND 26.4 mil. In the case of tanneries located in IPs/IZs, the payment of sewerage connection fees is understood as compliance with the wastewater charges requirement.

⁹ Decree 67 covers both household (or domestic) wastewater and industrial wastewater. However, this study focused only on industrial wastewater.

¹⁰ USD 1= VND 19,500 in this study.

Of the 29 tanneries located outside IPs/IZs, eight (14.8% of the 54) paid their wastewater charges according to Decree No. 67/2003/ND-CP with average monthly payments of VND 0.3 mil) while the remaining 21 tanneries (38.9%) did not pay anything.

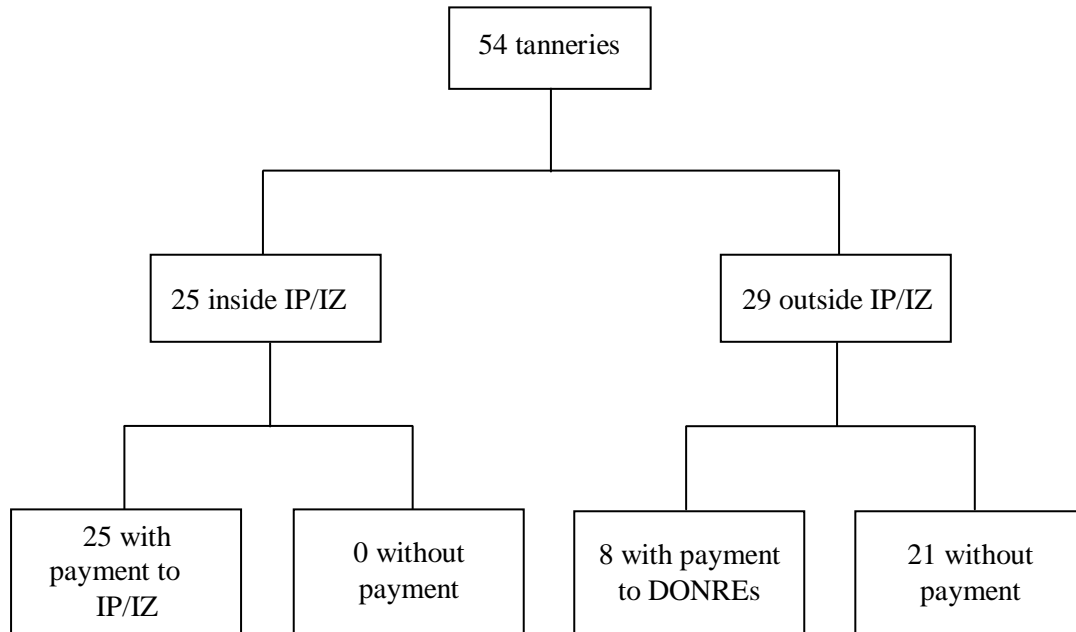


Figure 6. Compliance of tanneries with wastewater charge regulations

In general, the three mentioned regulations have been successful in inducing compliance by the tanning facilities judging by the relatively high percentages of such found through the survey. More than 61% of the surveyed firms had submitted their EIA and EM reports and paid their wastewater fees while around 65% had installed WWTSs or were linked to a common sewerage system in their respective IPs/IZs.

This compliance rate appears to be much higher compared with paper-making plants and companies in the food processing industry (Table 10). Recent EEPSEA studies on compliance with environmental regulations in Vietnam documented evidence of fairly low compliance (Dung 2009; Thanh 2009). The percentage of paper-making plants complying with the EIA submission, WWTS and wastewater fees regulations was 10.9%, 5.1% and 49.1%, respectively (Dung 2009). For food processors, it was 49.6%, 20.1% and 27.7%, respectively (Thanh 2009).

Given this, the encouraging conclusion is that tanning firms have generally responded positively to environmental regulations. However, attention should be paid to the cost of compliance that could make the regulated firms less competitive, among other things.

Table 10. Compliance with environmental regulations across industrial sectors in Vietnam

Unit: %

Sector	Environmental regulations			Source
	EIA submission	Installation of WWTS	Payment of wastewater fees	
Paper-making	10.9	5.1	49.1	Dung (2009)
Food processing	49.6	20.1	27.7	Thanh (2009)
Leather tanning	61.1	64.8	61.1	Current study

4.4 The Costs of Compliance vs. the Costs of Non-Compliance

Compliance induces costs. From the theoretical point of view, there is no single definition about the cost of compliance. The US Environmental Protection Agency's report on environmental investments (USEPA 1990) set the stage for a national debate about environmental costs with an estimate that the US spent approximately 2.1% of its Gross National Product in 1990 to comply with environmental regulations. Beyond these direct costs, there has been concern that environmental regulation may lead to job loss, reductions in international competitiveness, and declines in economic growth. At the same time, claims are made that environmental regulations generate positive externalities and result in a net benefits to society. Porter and van der Linde (1995), Romm (1994) and others suggest that investments in new processes and technologies to comply with environmental regulations often result in increased productivity, higher-quality output, greater employment, and increased competitiveness. Romm (1994) cites export opportunities in the growing international market for green technologies as a benefit of environmental regulations.

In this study, compliance costs are understood as the costs that occur when tanning companies comply with the environmental regulations on the submission of EIA reports, installation and running of WWTSs, and payment of wastewater fees. Compliance with environmental regulations can be expensive and non-compliance with these regulations may result in adverse publicity, potentially significant monetary damages and fines, and suspension of business operations.

Discussed below are comparisons between the costs of compliance and the expected costs of non-compliance of tanneries showing the trade-offs involved. The expected cost of non-compliance can be calculated based on Decree 117/2009/ND-CP dated 31 December 2009 on administrative violations of the LEP. Under this decree, individuals and organizations violating environmental regulations will face two major forms of punishment: warnings and pecuniary penalties. Violators will also have to face the possible revocation of business licenses and confiscation of exhibits as well as an order for the complete removal of the generated pollution.

4.4.1 Submission of EIA report

The study discovered that the cost of preparing the EIA reports varied from VND 150 mil to VND 250 mil. The cost of preparing an environmental monitoring report was on average, VND 200 mil, depending on the company's production scale and negotiation with the consulting firm. Collectively, these add up to the full cost of compliance.

Article 8 (point 6) of Decree 117/2009/ND-CP states that a fine of between VND 200 mil and 300 mil will be imposed for failing to have the EIA approved by competent state agencies. Meanwhile, the expected cost of non-compliance with EM report submission varies from VND 10 mil to VND 15 mil.

Table 11. Costs of compliance and non-compliance with EIA and EM report submission regulations

Type of requirement	Full cost of compliance	Expected cost of non-compliance	Remarks
EIA report	VND 150-250 mil	VND 200-300 mil	One time prior to operation
EM report	VND 20 mil	VND 10-15 mil	Twice a year

The expected cost of non-compliance with the EIA submission regulation appears to be higher than the cost of compliance. This could act as an incentive for tanneries to improve their compliance. Fines are treated as the costs of doing business and it is assumed that polluters will want to minimize the amount of expected compliance costs and penalties.

4.4.2 Installation of a WWTS

The investment cost of a WWTS depends on the treatment capacity and technology involved. It was found in the study that a simple sediment tank cost only VND 20–30 mil while a modern wastewater treatment system cost from VND 1,500–5,000 mil. The operational costs for electricity, chemicals, labor and other induced costs per month were about VND 2 mil for sediment tanks and VND 25 mil for modern WWTSs.

The fine imposed on tanneries for failing to build or install; improperly building or installing; and failing to operate or regularly operate or improperly operating environmental treatment facilities is between VND 130 mil and VND 170 mil. Table 12 shows the costs of compliance and on-compliance with WWTS regulations.

Table 12. Costs of compliance and non-compliance with WWTS regulations

	Type of WWTS	Full cost of compliance	Expected cost of non-compliance
1	Modern WWTS		
	Investment cost	VND 1,500-5,000 mil	
	Operational cost	VND 25 mil	VND 130-170 mil
2	Simple sediment tank		
	Investment cost	VND 20-30 mil	
	Operational cost	VND 2 mil	

The expected cost of non-compliance with the requirement to install a WWTS is relatively low compared to the cost of having a modern WWTS but as much as six times higher than having a low-tech WWTS. In the case of a modern WWTS, this would encourage a high level of non-compliance.

4.4.3 Payment of wastewater charges

There are two types of tanneries which pay wastewater charges. The tanneries located in IPs/IZs which are connected to common WWTPs of the respective IP/IZ pay on average VND 26.4 mil per month in wastewater fees. The fee is set by the industrial infrastructure companies. The fine or penalty for non-payment is regulated under the contract signed between both parties for wastewater treatment services.

The second group of tanneries pays its wastewater charges according to Decree No. 67/2003/ND-CP. The average monthly payment is VND 0.3 mil. There are no fines or penalties imposed on firms that fail to pay their wastewater charges. Decree 117/2009/ND-CP does not cover non-compliance by firms subject to wastewater charges. Thus the expected cost of non-compliance is zero.

Table 13. Costs of compliance with wastewater charge regulations

	Type of tannery	Cost of compliance	Expected cost of non-compliance
1	Tanneries with connection to common WWTS of IPs/IZs	VND 26.4 mil	According to the contract
2	Tanneries outside IPs/IZs	VND 0.3 mil	0

4.5 Understanding the Behavior of Polluters

4.5.1 Factors affecting the behavior of tanneries

One of the objectives of this study was to examine the determinant-related behavior of the tanning firms i.e., to identify their sources of pressure. The environmental behavior of an enterprise is affected by many factors including location, type of enterprise, production capacity, policy regulations, monitoring and enforcement actions, and public pressure.

4.5.1.1 Production capacity

The production capacity of interviewed tanneries can be divided into three groups namely, small enterprises, medium-sized enterprises and large enterprises (Table 14). In general, production capacity appears to be an important determinant of the environmental behavior of tanneries. The tanneries that had a higher production capacity demonstrated better environmental performance than those with smaller capacities. No small-scale tanneries were found to have complied with environmental regulations in terms of submission of their EIA reports, payment of wastewater fees or the installation of WWTSs. On the other hand, all except one of the 22 medium-sized enterprises and both the large tanneries had complied with the regulations.

Table 14. Compliance of tanneries with environmental regulations by production capacity

Regulation	Small	Medium	Large
EIA submission	0/30	21/22	2/2
Payment of wastewater fee	0/30	21/22	2/2
Installation of WWTS	0/30	21/22	2/2

4.5.1.2 Location

In this study, location was considered in two ways i.e., by (i) geographical region and (ii) whether the tannery was located inside or outside an industrial park/zone. The data in Table 15 shows that the tanneries in the south seemed to comply better with environmental regulations than those in the central and northern regions while the tanneries located inside IPs/IZs had better environmental performance compared to the ones located outside the zones.

Table 15. Compliance of tanneries with environmental regulations by location

Regulation	Northern Region	Central Region	Southern Region	Inside IPs/IZs	Outside IPs/IZs
EIA submission	2	1	30	25	8
Payment of wastewater fees	2	1	30	25	8
Installation of WWTS	4	1	30	25	10

These findings reflect the prominent role that the local governments and local stakeholders play in the enforcement process. Some IPs/IZs in the south tended to impose stricter environment standards, for example, by setting up their own standards for wastewater effluents. Such self-imposed higher standards apparently served to improve environmental performance of the firms.

4.5.1.3 Type of tannery

As discussed earlier, the surveyed tanneries could be divided into companies and individual household enterprises. The distinction between the two types is that companies are officially registered and run their business in accordance with the corporate laws of Vietnam while household enterprises are not registered and have a quite free hand in running their business. It was found that companies complied better with environmental regulations than household tanneries. None of the individual household enterprises had submitted EIA reports, paid wastewater fees or installed WWTSs. They usually released untreated wastewater directly into water bodies, which significantly damaged the environment.

However, as shown in a numbers of studies such as Magat and Viscusi (1990), Wang (2000), and Dung (2009), the differences in production capacity, locality and type of firms are not the only reasons for the variances in environmental behavior. Other factors such as regulations and inspections, also affect environmental behavior.

4.5.1.4 Inspections

The expectation was that regulations would act to prevent tanning firms from having a poor attitude towards environmental protection. Regulation enforcement serves to ensure that firms comply with regulations. At the national level, regulations are enforced mainly through inspections by MONRE and related ministries like the Ministry of Health and Ministry of Construction. At the city and provincial levels, this duty is carried out by the provincial DONRE, Department of Health, Department of Construction, and IP/IZ Management Boards. Inspections can be classified into regular/annual and irregular/random ones. Among this, the annual inspections by DONRE are the most important. Regular inspections must be announced in advance with details about the content and time of the inspections. It was found that southern tanneries located inside IPs/IZs had been inspected more frequently compared to the ones located in the central and northern regions.

Table 16. Inspection of tanneries

	Northern Region	Central Region	Southern Region	Inside IPs/IZs	Outside IPs/IZs
% of tanneries inspected	0.09	0.33	100	100	100
Average number of inspections per tannery per year	0.31	1	3.86	4.08	2.8

4.5.1.5 Public pressure

Environmental performance is expected to be closely related to public pressure. Many studies have used the number of citizens' complaints as a parameter to reflect the level of public pressure on industrial polluters' behavior. Similarly, in this study, the respondents which were under much public pressure were found to exhibit better environmental compliance.

The study found that tanneries in the north and central regions were not under as much public pressure as those in the south. In the north and central regions, complaints from neighboring communities existed, but these were few because the majority of the tanneries were located within tanning clusters where most people had been running this business for a long time. These tanneries operated mainly on a family basis and used labor only from their own families or relatives. In some cases, in addition to family labor, they employed workers from the surrounding neighborhood. In all the cases, the owners' families lived within the business premises. In contrast, 100% of the tanneries in the south received complaints from local inhabitants. This led to a number of inspections of the tanneries.

4.5.1.6 Social factor

During the interviews, some questions had been asked about the role of corporate social responsibility (CSR) and the codes of conduct which had started being practiced in garment and footwear industries¹¹. CSR is based on the notion that businesses should voluntarily adopt social, environmental and ethical practices which are both profitable and good for economic development. However, one thing repeatedly mentioned by interviewed firms was that they had no idea about such concepts or programs. CSR-related practices had been adopted by some large export shoe-makers, but not small and medium-sized enterprises targeting the domestic market. Moreover, the incentive to introduce CSR was stronger among multinational companies which had valuable brands to promote and their sub-contractors. Many of these companies were developing CSR practices on their own in the hope of increasing their market share. Vietnamese suppliers that try to enter the global market are usually asked about their CSR standards and codes of conduct. The codes of conduct are generally decided by the buyer, not the supplier. In most cases, Vietnamese enterprises have adapted their CSR standards because their buyers requested them to do so.

4.5.2 Reasons for not complying with environmental regulations

According to LEP (2005), Decree 80/ND-CP guiding its implementation, and Decree No. 67/2003/ND-CP on industrial wastewater charges, all tanneries are required to submit their EIA and EM reports to the authorities for evaluation, pay wastewater charges, and establish a WWTS to treat their wastewater before discharging it into the

¹¹ In Vietnam, the adoption of CSR principles has emerged strongly in the garments and footwear industries where enterprises are required or encouraged to adopt one or more codes of conduct. Basic information on CSR is provided by business associations, such as the Vietnam Textiles Association (VITAS) in the case of textile companies and the Vietnam Leather and Footwear Association (LEFASO) in the case of footwear companies.

environment. The results of the survey conducted showed that 100% of the tanneries in the south did comply with these environmental regulations. The percentage of tanneries in the northern and central provinces which complied was relative small, accounting for only 12.5% of the total surveyed firms. The main reasons for non-compliance with regulations are discussed below.

4.5.2.1 Lack of technical and financial capacity

The non-compliant tanneries were mainly individual household enterprises in tanning villages located outside IPs/IZs. Their working environment was very poor. The average monthly income of the workers varied from VND 1.5–2 mil, which was just enough to cover basic living expenses. Discussions with local authorities revealed that they perceived the high cost of compliance as the main underlying reason for non-compliance by household tanneries. As these tanneries could not prepare the EIA and EM reports by themselves, they would have to hire environmental consulting firms at the average cost of VND 200 mil for the EIA report and VND 20 mil for the EM report. The costs of installation of a modern WWTS and running the system would be even higher as shown in Table 12. Thus compliance with environmental requirements would place a heavy burden on small and medium-sized enterprises, and also reduce the competitiveness of their products.

4.5.2.2 Weak enforcement

The second underlying reason for non-compliance was weak enforcement. The Vietnamese institutional framework for the environment appears to be well structured, but its actual functioning is far from effective. The household tanneries in Hanoi and Quangnam regions are good cases in point. They have survived so far without complying with any environmental regulations with no action being taken against them for such omissions. Although in principle, the expected costs of non-compliance were quite high (see Tables 11 and 12), the local DONREs were unable to enforce any fines.

From the survey and FGDs, it was found that there were at least two reasons for weak enforcement. The first reason was the heavy workload of the environmental agencies. The number of environmental staff in Hanoi and Quangnam provinces in particular and in Vietnam in general is very small in comparison with other countries. Vietnam has only two to four environmental officials for every one million persons. In comparison, China has 20 environmental officials; Thailand has 30, and Cambodia has about 100 per one million persons (Thanh 2009). The second reason pertained to the inadequate awareness of the local authorities. Although located amidst highly populated urban areas, the tanneries in the north and central provinces did not attract more attention from the authorities than any other industry. Most of the local government officers consider environmental protection as a responsibility of MONRE and DONRE. It is understandable that limitations in knowledge and heavy administrative workloads have prevented local government officers from bringing about any real improvement to the environmental performance of the tanneries. To them, the only way to get rid of environmental pollution is not to have the polluting firms in their jurisdictions and the

easiest way to reach this goal is to relocate the polluting tanneries out of their territories. As compensation for relocation, the tanneries received very little or even no inspections, fines or penalties.

4.5.2.3 Relocation program

In the year 2002, the HCMC People’s Committee issued Decision 80/2002/QD-UB on the relocation of polluting industries to IPs/IZs and Decision 78/2002/QD-UB announcing the list of industrial sectors not to be issued new investment licenses (see Box 1 below). Categorized as one of the most polluting industries in the country, the leather tanning industry was put on this list for relocation out of a number of urban places in the country. Nineteen of the surveyed household tanneries stated that they were to move to other places in the near future and that investment in environmental protection was, in their opinion, a waste of money. This is why they did not bother to comply with the regulations in their current locations.

Box 1. Fourteen restricted categories of production in the inner city of HCMC

1.	<i>Chemical industry</i>
2.	<i>Waste recycling</i>
3.	<i>Fabric bleaching and dyeing</i>
4.	<i>Rubber vulcanization</i>
5.	<i>Leather tanning</i>
6.	<i>Electroplating and metal forgery</i>
7.	<i>Pulp production</i>
8.	<i>Production of building materials</i>
9.	<i>Wood processing</i>
10.	<i>Producing and processing food-product and beverages</i>
11.	<i>Tobacco processing</i>
12.	<i>Industrial breeding of livestock</i>
13.	<i>Animal slaughtering</i>
14.	<i>Coal processing</i>

Source: Decision 78/2002/QB-UB

4.5.3 Reasons for violating environmental standards

Even though showing very good compliance with environmental regulations, all of the tanneries in the south had been fined for various environmental violations from between VND 20 mil and 170 mil (Table 17). Among the tanneries located inside IPs/IZs, the research results showed that 100% of the tanneries which complied with environmental regulations had also been found to have violated environmental standards on wastewater and air quality. Some of tanneries had been subjected to warnings, fines and even threat of shutdown.

Table 17. Environmental fines

	Northern Region	Central Region	Southern Region	Inside IPs/IZs	Outside IPs/IZs
% of tanneries fined for environmental violations	0.09	0.33	100	100	100

The question to ask here is: why did the tanneries which complied with environmental regulations still violate environmental standards? The survey revealed three possible reasons. First, from a technical point of view, it is impossible to eliminate all the pollution emanating from the tanning process, especially wastewater and odor.

Second, the capacities of the WWTSs of individual tanneries were less than what was required given their production capacity. For example, the daily discharge of the Hao Duong Leather Company was 3,500 m³ while the capacity of its WWTS was only 2,500 m³ per day. Similarly, the capacity of common WWTPs in IPs/IZs appeared to be lower than the actual discharge volume. One company had even set up a hidden sewage system to discharge untreated wastewater at night.

Third, many tanneries argue that compliance with environmental regulations produces a negative impact such as a decrease in competitiveness due to the high cost of production. Tanneries in the HCMC region had been relocated to IPs/IZs under Decision No.64/2003/QD-TTg. Starting a new business in a new place with a huge investment, they were now facing financial constraints, lacking the capital to modernize their operations to cope with increasing competition. This study found that for the biggest tannery in the south with a production capacity more than 10,000 kg per day, the cost of relocation was VND 450 bil (USD 23 mil). However, compliance with environmental regulations on the submission of EIA reports, installation of WWTS and payment for wastewater discharge are preconditions to be accepted for relocation. However, it was found that firms which had already installed WWTSs did not operate them fully or at all due to the high cost of running and maintaining them.

Box 2. Case study of government action against a tannery for environmental violation

Municipal authorities act to revoke the license of a tannery in Nha Be District in HCMC for continuing to pollute a nearby river with untreated wastewater

In October 2008, Ho Chi Minh City's Department of Natural Resources and Environment asked the People's Committee to revoke the license of Hao Duong, a joint-stock tanning company in Long Thoi Commune, which has continued to pump its untreated wastewater into the Dong Dien River in spite of warnings from the local authorities to stop.

Officers from the city's environmental police department said that they had caught the company's workers pumping untreated wastewater into the river through a hidden sewage system at night red-handed. The sewage pipes were then sealed by the police officers. However, the officers and representatives of the city's Authority for Industrial Parks and Export Processing Zones found that the sealed sewage pipes had been removed when they came back to the company's premises the next day.

The Chairman of the Management Board of Hao Duong Company admitted the company's wrongdoing. He said the company would try to properly discharge the hundreds of tons of solid waste stored on company grounds. The firm has flouted environment codes at least 20 times since 2005 and 10 times in 2008 alone.

Since Hao Duong, which began operating in 2003, upgraded its capacity in mid-September 2007, the firm has discharged large amounts of untreated wastewater, estimated at around 3,500 cubic meters every day, through a floating pipe system leading down to the Dong Dien River. The toxic effluents were found to contain a cancer-causing substance, chromium VI, at levels dozens of times higher than permissible.

The company had also released around 48 tons of waste mud and other leather waste into the vicinity in the course of the year 2008, leaving nearby companies and locals bearing the brunt of the stinky odor and other unpleasant and unhealthy environmental impacts.

Source: Adapted from MONRE website

<http://www.monre.gov.vn/v35/default.aspx?tabid=675&CatelID=58&ID=52640&Code=YMTZR52640>

(downloaded June 2010)

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

Vietnam's rapidly increasing leather and footwear export industry has made a significant contribution to the country's economic development over recent years. Currently, leather and footwear products are among Vietnam's four major export items in terms of monetary value and amounted to USD 6.19 billion in 2010. Vietnam, thanks to her low-cost and hardworking labor force, is regarded as one of the most promising countries to become a leading exporter of leather and footwear goods. Leather is the most important material for the production of footwear, but leather production in Vietnam is still small. It can meet only about 30% of the local demand. This means that there is a great potential for this industry to grow significantly in the coming years. A major concern, however, is that the production of finished leather causes considerable pollution.

Experts note that in recent years, pollution from the tanning industry has become a prominent issue. The leather tanning industry has been categorized as one of the most polluting industries in the country and was put on the list for relocation away from a number of urban sites in the country.

Another serious concern is the poor working conditions of the industry. Workers in tanneries work longer hours in polluted conditions. This situation may lead to a shortage of labor in future if wages in other 'cleaner' industries are raised.

Through a survey of 54 tanneries throughout the country, which represented about 90% of the tanning establishments in Vietnam, it can be concluded that improving environmental quality is crucial for Vietnamese tanneries.

5.1.1 The impact of environmental regulations

In general, the three regulations studied in this research can be said to have been quite successful in influencing the environmental behavior of large and medium tanning facilities. This is reflected in the relatively high percentage of medium-sized and large tanneries which complied with these requirements. The compliance rate of tanneries in general was found to be much higher than that of other industrial sectors in Vietnam like the paper-making and food processing industries. This shows that firms in the tanning industry have generally responded positively to environmental regulations, except for the small household tanneries none of which were found to have complied with environmental regulations. The main reasons found for non-compliance were the lack of technical and financial capacity and the low level of awareness among the small tanneries and governing environmental authorities. Compliance with environmental requirements has also placed a heavy burden on tanneries. Small tanneries generally cannot afford the costs of compliance. This results in negative impacts on the surrounding environment and human health.

5.1.2 The costs of compliance vs. the costs of non-compliance

Compliance costs in this study are defined as the costs that are incurred when tanning companies comply with the environmental regulations on submission of EIA reports, installation of WWTSs, and payment of wastewater fees. The study discovered that the cost of preparing an EIA report was about VND 150–250 mil and the cost of preparing an EM report was about VND 20 mil. A simple sediment tank cost only VND 20–30 mil while the cost of a modern wastewater treatment system varied from VND 1,500–5,000 mil. The average monthly payment for wastewater fees was VND 26.4 mil for tanneries located in IPs/IZs and VND 0.3 mil for those outside such zones.

Non-compliance with environmental regulations can result in adverse publicity, potentially significant monetary damages and fines, and suspension of business operations. The expected cost of non-compliance with the requirement on EIA report submission was from VND 200–300 mil, higher than the cost of submission. This may serve as an incentive for tanneries to comply. The expected cost for not having a WWTS varied from VND 130–170 mil, and the cost for not paying wastewater fees was zero. The costs of compliance with the regulations on WWTS installation and wastewater charges proved to be higher than the costs of non-compliance. This could encourage non-compliance over compliance.

5.1.3 Factors affecting environmental performance

The environmental performance of tanneries depends on many factors. It was found that national regulations represented one of the most influential factors affecting the environmental attitude of firms in the tanning industry. However, the effects of governmental regulations were seen to depend largely on the enforcement and inspection capacity of the relevant authorities. Factors affecting the compliance of tanneries such as production capacity, location of firms, and type of tannery were considered. The results indicated that tanneries with a higher production capacity were more likely to display better environmental performance than those with smaller capacities. Southern tanneries seemed to comply better with environmental regulations than those in the central and northern regions. The tanneries located inside IPs/IZs had better environmental performance compared to the ones located outside the zones.

However, environmental regulations proved to be inadequate protection by themselves. The study found that 100% of the tanneries which had complied with environmental regulations had violated wastewater and air quality standards. Some of the tanneries had been given warnings, fined, or threatened with shutdown. This means that compliance with regulations does not necessarily ensure an improvement in environmental quality. The study found that low awareness of environmental issues, lack of technical and financial capacity, weak enforcement, inadequate wastewater treatment systems, and the high costs of compliance and relocation were the main reasons for non-compliance.

5.2 Policy Recommendations

Environmental economists have suggested that the effectiveness of environmental regulations can be enhanced by raising penalties for non-compliance, increasing monitoring activities to detect offenders, or by changing legal rules to increase the probability of conviction. If the probability of detecting polluting firms is low and penalties are perceived to be insignificant, the level of non-compliance is likely to be very high. Thus, to make tanneries comply with environmental regulations and develop in an environmentally sound manner, a number of actions should be taken.

(i) Increasing monitoring activities and improving the capacity of environmental authorities

Inspections, monitoring activities and enforcement are strong determinants of environmental performance. Magat and Viscusi (1990) showed that inspections permanently reduced the level of emissions of plants by approximately 20%. Laplante and Rilstone (1996) later found that not only inspections but also the threat of inspections could reduce emissions by approximately 28%.

One obstacle in the monitoring and enforcement process in Vietnam is that the organizational capacity to manage the system is not sufficiently strong. While the responsibility for environmental management is huge, the capacity in terms of staff and resources is limited. It is understandable that limitation in knowledge and heavy workloads have so far prevented the relevant authorities from bringing about significant improvement in the environmental performance of the tanneries. Enforcement activities need personnel with relevant experience and knowledge who can manage and conduct effective monitoring and inspection measures. Environmental departments at all levels should therefore formulate plans to improve their human resources starting with introducing a staff development program.

(ii) Making the costs of non-compliance higher

Becker (1968) in his study of crime found that firms greatly responded to the probability of detection and the severity of punishment if detected and convicted. Fines are treated as the costs of doing business and it is assumed that polluters will want to minimize the sum of expected compliance costs and penalties. This study found that the costs of compliance with WWTS installation and wastewater fee regulations proved to be higher compared to the costs of non-compliance for tanneries in Vietnam. This would encourage a high level of non-compliance with the regulations in question.

In order to increase the compliance of tanneries with environmental regulations, it is recommended that the fines or penalties for non-compliance be 5-10 times the total cost of compliance. However, imposing high penalties could result in additional enforcement costs for the managing authorities. It has been estimated that in the US, 50 cents out of every dollar collected from polluting firms is spent on enforcement costs (Priyadarshini and Gupta 2003). Incorporating the cost of enforcement into fines/penalties would be one way to transfer this cost to the violators.

(iii) Raising public awareness on environmental issues

Dasgupta and Wheeler (1997) documented the positive impact of public pressure on industrial polluters' behavior. Firms are more likely to cooperate with regulatory

authorities when they are in a group of firms that receive more stringent regulatory inspection because of the nature of the surrounding community which exerts direct and indirect pressure on them. This makes the expected costs of non-compliance higher than it appears on the surface.

The tanneries in the south of Vietnam were found to be under much public pressure to be green. To improve the environmental performance of tanneries, it is recommended that public awareness be raised to increase informal community pressure on polluting tanneries. This may yield significant levels of compliance in a cost-effective manner.

(iv) Relocation with support for waste treatment measures

A number of studies like Helland's (1997) and Cohen's (1999) have documented evidence of high compliance despite very low penalties. One reason given for this was the existence of economic incentives like cost subsidies in the form of tax breaks and special financing given to firms. Under the coercive relocation program, tanneries have to move their factories without any financial help. Thus waste treatment facilities might be the last thing they choose to invest in, especially for the small tanneries, after they have spent billions of Vietnam dong to obtain the land and set up operations. The relocation of factories without any support may only result in the relocation of polluters to suburban areas. One possible way to tackle this problem is to have a low interest rate lending scheme with consulting services to help tanneries install and manage waste treatment systems. The Environmental Protection Fund and Recycle Fund could be tapped in establishing such a scheme.

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APPENDIX 1. List of environmental standards related to the tanning industry

Name	Year	Description
Water quality-related standards		
TCVN 5944:1995	1995	Underground water quality standard
TCVN 5942:1995	1995	Surface water quality standard
TCVN 5943:1995	1995	Coastal Water Quality Standard
TCVN 5945: 2005	2005	Industrial discharged wastewater standards
TCVN 6980: 2001	2001	Standards for industrial effluents discharged into rivers used for domestic water supply
TCVN 6981: 2001	2001	Standards for industrial effluents discharged into lakes used for domestic water supply
TCVN 6982: 2001	2001	Standards for industrial effluents discharged into rivers used for water sports and recreation
TCVN 6983: 2001	2001	Standards for industrial effluents discharged into lakes used for water sports and recreation
TCVN 6987: 2001	2001	Water Quality Standards for industrial effluents discharged into coastal waters used for water sports and recreation
TCVN 6984: 2001	2001	Standards for industrial effluents discharged into rivers used for protection of aquatic life
TCVN 6985: 2001	2001	Standards for industrial effluents discharged into lakes used for protection of aquatic life
TCVN 6986: 2001	2001	Standards for industrial effluents discharged into coastal waters used for protection of aquatic life
Air quality-related standards		
TCVN 5937 – 2005	2005	Ambient air quality standards
TCVN 5938 – 2005	2005	The maximum permitted level of toxic substances in ambient air environment
TCVN 5939 – 2005	2005	Standards for industrial air emission of particulate matter and organic substances
TCVN 6991: 2001	2001	Standards for non-organic substances in ambient air environment of industrial zones
TCVN 6992: 2001	2001	Standards for non-organic substances in ambient air environment of urban areas
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