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Environmental Sustainability vs. Political Decision: A Review of the Bangladesh Leather Processing Industry Relocation Plan

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Abstract: Over the past four decades, the leather processing activity migrated from developed to developing countries. This led to the uncontrolled and unplanned development of noxious leather processing industries in the environmentally-stressed developing countries, such as Bangladesh. Although these industries are very important for the flourishing export oriented economy of the country, lack of basic environmental protection measures have been entailing serious threats to the environmental sustainability. In response, a relocation project was launched by the Bangladesh government for the industries in Hazaribagh - the principle leather processing zone located in the capital Dhaka. The project planned the relocation of these industries to an upstream and outskirt location – Savar, with the target of mitigating the environmental pollution and ecological hazard. This paper reviewed the relocation project plan from the urban planning and the environmental economics points of views. The concepts and methods, applied for the review, are the 'Social theories of the City', 'Willingness to Pay', 'Pigovian Tax' and the 'Hedonic Pricing Method'. The results prove that the project's target of ensuring environmental sustainability will go in vain because launching and executing this project was merely a political decision, which did not take into account any of those scientific arguments. The upstream location of Savar violates the agricultural land use as a flood flow zone with flood retention facilities proposed in the Dhaka Structure Plan. This also risks the pollution of the entire surface

water sources of Dhaka. The argument of relocating the leather industries to a fringe location proves to be invalid in light of the historic growth trend of Dhaka. 82% of the surveyed leather industry owners is neither willing to move to the proposed location nor willing to pay for the relocation and the effluent treatment sanctioning at the new location. 18% is willing to move under the conditions of expensive subsidies, compensations and government provided effluent treatment facilities. The Bangladesh government has to pay BDT 5.93 billion as compensation and subsidy in addition to the actual project cost of BDT 5.45 billion, whereas the expense is BDT 3.57 billion for redeveloping Hazaribagh as a planned, controlled leather processing zone in the present location with adequate environmental protection measures. The proposed redevelopment plan of Hazaribagh brown field to a mixed use area after industries' relocation poses further threats to the human health and calculate high hedonic price of the houses. Finally, considering the three consecutive failures to meet the relocation deadlines, these results claim that rather the redevelopment of Hazaribagh industries in the present location by providing the environment friendly leather processing equipments will ensure environmental sustainability of the city.

Keywords: environmental sustainability; politics; leather processing; relocation; urban planning; environmental economics; redevelopment.

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1. Introduction

Industries are usually set near the rivers or the railroad lines that paralleled the rivers unless a level terrain invites diffusion. Though exists in principle, no authority so far managed to shift the existing noxious and noisy industries far away from human habitations. Industries are happened to be existed where industrial owners happen to have bought enough land in a 'free competition'. Thus the industries' locations have always been owner determined, winning over the thought of functional planning, and leading to the jumbling of industrial, commercial, and domestic functions in developing countries [1].

Dhaka, the capital of the *development paradox* Bangladesh, emerged and expanded from the river bank of Buriganga and the major industries of this city have also been developed along this river bank following the norm [2]. Among the industries, Leather Processing Industry, which is locally known as *Tannery*, is one of the oldest and has been flourishing in the Hazaribagh area along the bank of the Buriganga since 1965, when the migration process of the leather processing activity from developed to developing countries started [3]. This industrial zone has been gradually expanding since then and the location of the 95% of the tanneries of Bangladesh establishes Hazaribagh as the principle leather processing zone [4] of the country. It is a rich manufacturing sector in terms of both financial return and social benefits [5]. The total export from the leather sector in 1993-94 was $168 million, which was increased by $212 million in 1995-96. The total income from this sector for the footwear and manufactured leather goods in the year 2008-2009 is $250 million and it shares 1.83% of the national GDP [6].

Though this sector has been contributing significantly to the Bangladesh's economy, the uncontrolled and unplanned expansion of this industrial zone has been extending its pressure on its physical environment. The noxious leather processing activity finally turned the zone into a brown field [7]. There has neither been any central or individual Effluent Treatment Plant (CETP/ETP) established for treating the liquid and solid wastes produced from leather processing, nor been any control on the use of noxious chemicals [8]. Till 21st century, no attempt has been made by the government or non-government authorities to introduce an environment friendly tanning process in the Hazaribagh area [9]. As a consequence, nearly 22,000 cubic meters of untreated effluent that are released by the leather tanning process daily, have been dumped into the surrounding environment [10]. All the liquid wastes carried by the city corporations' drains are deposited to the low-lying lands of Hazaribagh. The solid wastes (tiny pieces of leather, excess fat, flesh and hair) are piled up at roadsides in front of the tanneries. Ultimately, these liquid and solid wastes make their way into the lifeline of the Dhaka city - Buriganga River. Before 1988, the low lands of Hazaribagh used to be regularly flooded by the Buriganga River and the tannery wastes would go directly into the river. After the severe flood of 1988 the government raised Dhaka Protection Embankment. Thus the wastes did not go directly to the river but got blocked by the embankment, which in monsoon were mixed with rainwater and spread to the surrounding residential area. In 1996 four pumps were installed at the part of the embankment, which is situated at the low lands of Hazaribagh to pump out the water into Buriganga and eventually the tannery wastes are also pumped into the river [11]. Thus, the noxious leather tanning industries along the river bank of Buriganga at Hazaribagh has been turned out to be the principle threat to the environmental sustainability of the capital city of 16 million people. The living environment of the Hazaribagh leather industrial zone has been deteriorating radically by the tannery effluents over decades. The aquatic life of Buriganga has been diminished and around two million people living in the surroundings of Hazaribagh and Buriganga are now vulnerable due to this degraded living environment [12].

The government of Bangladesh has been continuously insisted by the local community, civil society and international leather market to ensure environment friendly leather processing in Hazaribagh and to revive Buriganga considering these life threatening circumstances. But in response, Bangladesh Small and Cottage Industries Corporation (BSCIC) under the Ministry of Industries signed a trilateral agreement with Bangladesh Finished Leather, Leather Goods and Footwear Exporters Association (BFLLFEA) and Bangladesh Tanneries Association (BTA) on 23rd October 2003 [13]. According to the agreement, the Hazaribagh tanneries need be relocated to a planned and central effluent treatment plant based leather estate. Savar, an area on the north-west of Dhaka city, situated at the fringe of the Dhaka Metropolitan Area, was selected as the new location for this planned estate. It is apparent that having failed with the stick, the Bangladesh government was using the carrot to deal with serious environmental and public health problems of the Dhaka city (BSCIC). The risk of losing the international market of leather due to the increasing pressure from the international buyers to promote environment friendly tanning, drove the government to take this decision by neglecting the proposal of the United Nations Industrial Development Organization (UNIDO) for installing central effluent treatment plant and environment friendly tanning process in Hazaribagh [14]. Controversies have been raised since then that to what extent this relocation project would contribute to the environmental sustainability of the city [15].

Promoting environmental sustainability in the project concerning city development is a major challenge of the 21st century [1] and so it is in case of the Dhaka city [13]. There have been several studies conducted on the disastrous impacts of the leather processing activities in Hazaribagh on the Dhaka city's environment and environmental sustainability [16-18]. It is evidenced in the literature that in similar contexts, attempts have been made by governments to implement *top-bottom* leather processing industry relocation projects, like in Tamil Nadu, India [19]; Cairo, Egypt [20] and in Mexico [21], but all of them have failed. The reasoning of this failure goes back to the classical concept of environmental sustainability proposed by Goodland [22]. Goodland [22] claims that the environmental sustainability of a project concerning city development should include the decision made by the social community involved as major stake holders, economic sustainability of such project and finally the *assimilative capacity* of the local environment. The involvement of the stakeholders especially the social community, which in case of the leather processing industries is the tannery owners community, therefore can be analyzed by the famous urban planning theory - *Social theories of the City* introduced by Bowley et al. [23]. The theory also includes Goodland [22] proposed assimilative capacity of the city environment. To analyze the economic sustainability, three primary concepts of environmental economics are applicable - *Willingness to Pay*, *Pigovian Tax* and *Hedonic Pricing Method* as proposed by Kolstad and Turner et al. [24-25] and Goodland [22] conformably .

So far no study has been conducted by the scientific community to review the proposed relocation plan for the Hazaribagh tanneries. In light of the discussed scenario, such study is very important to avoid another eventual failure of tannery relocation project in Bangladesh and further disruption of the environmental sustainability of the city. This paper reviews the Hazaribagh tannery relocation project plan proposed by the government of Bangladesh from the urban planning and environmental economics points of views. From the urban planning point of view it applies the social theories if the city and from the environmental economics point of view it applies the three economic concepts willingness to pay, Pigovian tax and hedonic pricing method to evaluate the justification of the project from social, economic and environmental aspects. The required information and data to conduct the study are collected through an extensive questionnaire survey among the tannery owners and studying the original project documents. The research goal of the study is set to analyze whether the successful accomplishment of the relocation project would ensure the environmental sustainability of the Dhaka city or not. This study, based on scientific analysis, is objected to provide a viable recommendation for the location of the leather processing activity in Dhaka so that sustainability can be attained from social, economic and environmental perspectives.

2. Context and Methodological Framework

2.1. Context: A Brief Description of the Relocation Plan

As documented in the memorandum of understanding of the trilateral treaty signed by the BSCIC, BFLLFEA and BTA [26], the project objectives of relocating the leather processing industries of Hazaribagh to Savar are – (a) to provide collective effort of space, electricity, water, gas, drainage, internal roads etc. and the possible local and foreign investments for leather processing activity; (b) to incorporate the most modern leather processing technology and initiate export oriented leather industry by attracting foreign patrons; (c) to establish sales centers and showrooms at different suitable sites in

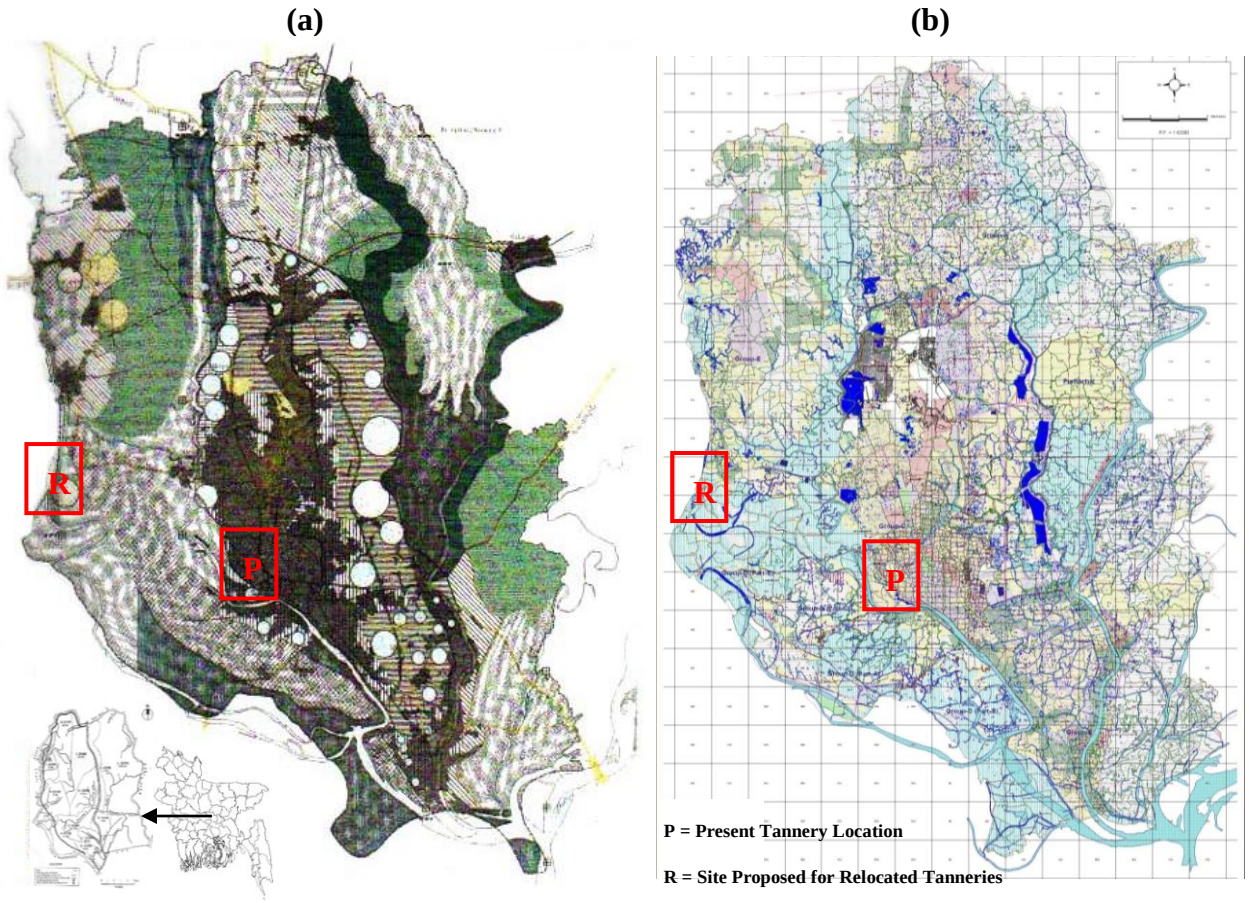
Dhaka to facilitate the leather goods export; (d) to increase the production of the leather industry by government intervention in leather processing; (e) to foster the foreign currency earning and thereby ensure adequate employment opportunities in the leather sector; (f) to ensure the improved health condition as well as hygiene for the investor, leather technologists and most importantly for the labors; and (g) to save the environment by establishing proper effluent treatment plant for the treatment of solid and liquid wastes. The primary analysis of the objectives depicts that the issues of environmental sustainability of the Dhaka city got the least priority in ranking whereas attracting the foreign buyers from the international labor market by displaying a temporarily clean leather tanning-process got the highest priority.

A site at Chandranarayanpur of Savar thana, situated at the bank of Dhaleswari River; was selected for the development of the relocated tanneries. Figure 1 represents both the present location of Hazaribagh tanneries and the location of the site proposed for the relocated tanneries. The locations are shown on the Dhaka Structure Plan Map [27] (Figure 1(a)) and the Dhaka Detail Area Plan Map [28] (Figure 1(b)) respectively. The original legends of the maps of Figure 1 cannot be represented within the scope for visualization, but the interested readers are referred to the original website of the both plans hosted by the Capital Planning Authority of Dhaka (RAJUK) [27-28]. In both the structure plan and the detailed area plan of the Dhaka city, the present Hazaribagh tannery location is demonstrated as industrial belt whereas the proposed site for new tannery estate is identified as a Flood Flow Zone (Figure 1(a)) with demonstrated agricultural land use providing flood retention facilities in the Dhaka structure plan and as an industrial zone (Figure 1(b)) in the detailed area plan surrounded by the agricultural land for a long extent. There is an apparent dispute between the proposed relocation project and the Dhaka structure plan, which will be further discussed in the results section.

The layout design and plot allotment in the proposed site for relocated tanneries was performed by the Sheltech Consultants Pvt. Ltd. (http://www.sheltech-bd.com/#home). According to their project report [29], the planned area of this site is 187.90 acre with another 200 acre for future expansion. The total plot area is 134.46 acre, road area is 38.31 acre, area for CETP is 7.91 acre and area for safe landfill site is 7.22 acre. A total of 195 plots were allocated in the leather estate categorized as A, B, C and D according to their area and have been distributed among the tannery owners proportionally to their existing plots sizes in Hazaribagh. There are total 249 small and big tanneries in the Hazaribagh area [26], therefore all the tanneries were not included in the project layout plan and no provision has yet been made for the remaining 54 tanneries.

The original time period of the project was January 2003 - December 2005, but later it was revised to January 2003 - May 2009. Thus, the tanneries were supposed to be relocated by December 2005, but the failure of the deadline due to the unwillingness of the tannery owners leaded to an extended deadline until May 2009 [26]. The target was essentially failed again due to the disputes of the tannery owners with the project executers regarding different socio-political issues. On 13th May 2009, the Supreme Court of the People's Republic of Bangladesh gave a jurisdictional order to complete the relocation of the tanneries by February 28, 2010. The target failed again for the third time and finally the Minister for Natural Environment and Forests has recently assured the country's Parliament that the relocation can be finished by December 2012, which is still under dilemma [30].

Figure 1. The present location of the Hazaribagh Tannery –P and the proposed site for the relocated tanneries of Hazaribagh –R identified on the **(a)** Dhaka Structure Plan Map [27] and **(b)** Dhaka Detailed Area Plan Map [28]. The original maps legends are available in the original project plans [27-28]. The base map of the Dhaka city with its location on the map of Bangladesh is shown at the inset of (a).



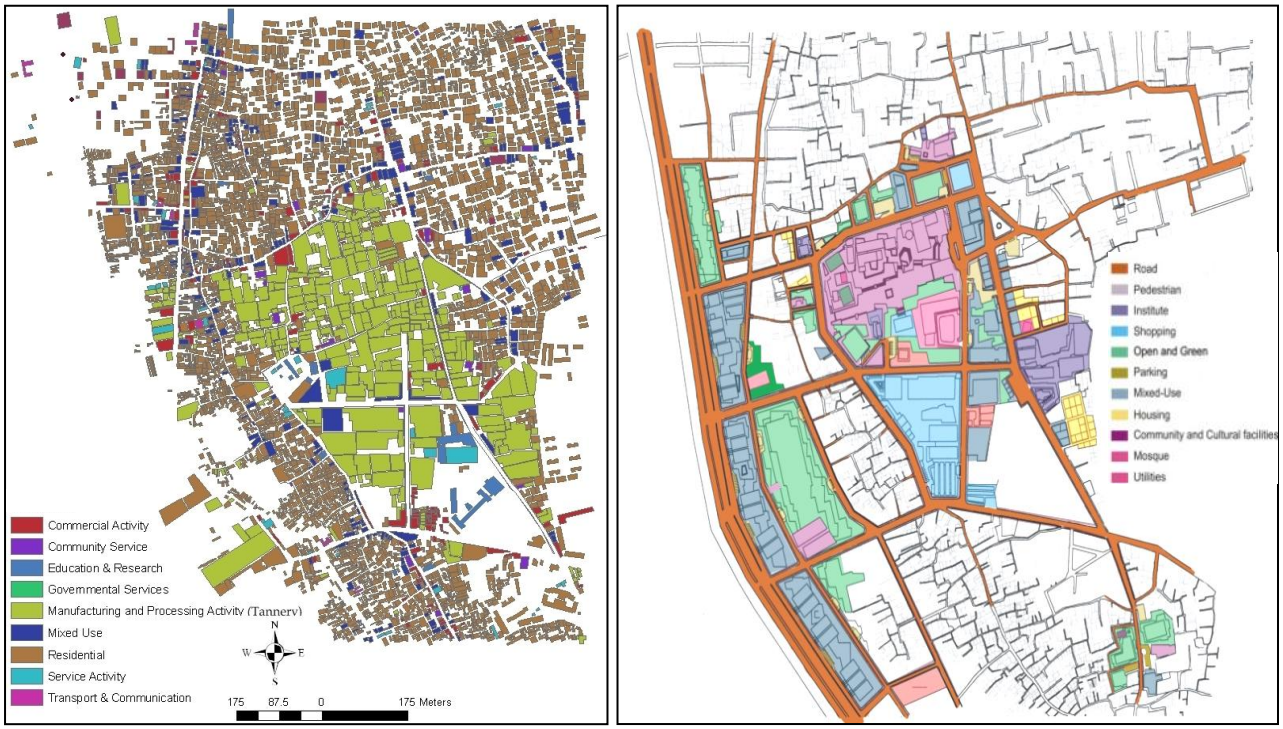
The revised cost of the relocation project is BDT 5.45 billion; the entire project is financed by the government of Bangladesh and the tannery owners have been clearly denying their cooperation to the project finance holistically and partly from the very beginning. According to the calculation, BDT 3.0 billion was allocated for development of land and infrastructure and other facilities for the tannery industries, while BDT 2.45 billion for setting up the CETP. The unit cost of plot type A is BDT 0.02 billion, type B is BDT 0.006 billion and type C is BDT 0.002 billion [26].

After the completion of the relocation of the tannery industries to the Savar Tannery complex; government of Bangladesh has a plan to redevelop the Hazaribagh area which is undertaken within the framework of the Dhaka detailed area plan. The future land uses have already been established as residential - houses, parks, etc., which should be built on those initially high polluted areas (lagoons and isolated pollution sources areas) where extensive remediation will be executed. The urban planning will be designed carefully to assure that the works associated to the construction of the houses (sewer system, buried electrical wiring, etc) do not affect to the remediated areas. Also in order to build a sustainable residential area, public infrastructures such as sewage plants, potable water supply, electricity supply, etc. will be available. Offices, industrial and commercial uses will be

developed to support residential land use [28]. Figure 2 represents the existing land use in the Hazaribagh area and the proposed land use plan after the relocation of the tanneries.

Figure 2. (a) Existing land uses in the Hazaribagh area (author produced from the land use data provided by Sheltech [29]) and **(b)** the proposed land uses for the Hazaribagh area after the relocation of the tanneries according to the Dhaka Detailed Area Plan Map [28].

(a) **(b)**



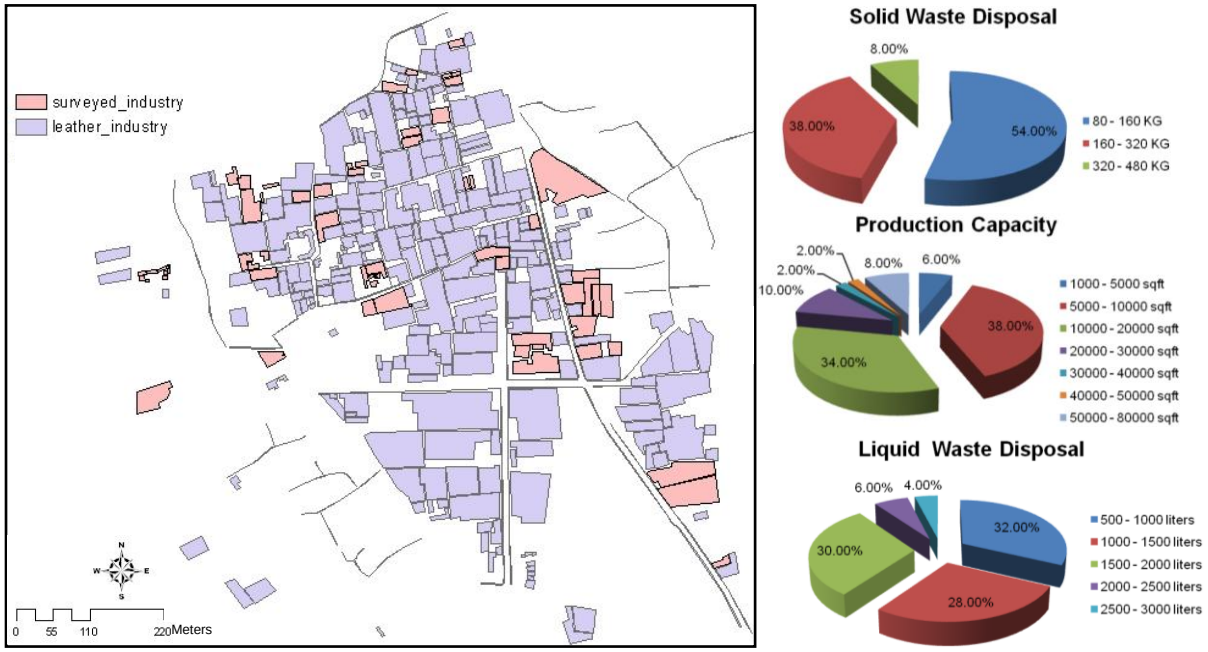
An extensive remediation of soil, surface and ground water in Hazaribagh is required before implementing this redevelopment plan, which is currently being evaluated by the Asociación Cluster de Industrias de Medio Ambiente de Euskadi (ACLIMA) (http://www.aclima.net) with collaboration of the Khulna University, Bangladesh (http://www.kuet.ac.bd/). The project report [31] outlined a very complicated, time consuming and expensive procedure to get rid of the environmentally threatening elements in Hazaribagh. It recommends and prefers the natural recovery of the brown field over the proposed complicated and unaffordable technical recovery for a developing country like Bangladesh. Nevertheless, the real estate developers in Dhaka are highly keen for the tenders of the development of the proposed mixed land use area before implementing the technical and natural remediation. This is highly fatal for the environmental sustainability of the area since children will be in constant contact with the soil and water [31].

2.2. Data and Methodology

The study is based on both primary and secondary data which were collected from various sources. For the primary data collection, an extensive Questionnaire Survey [32] was carried out on the owners of 50 randomly selected tanneries in Hazaribagh which constitutes 25% of the total number of tanneries (249). The list of names and contact information of the tannery owners were collected from

the Bangladesh Tanners' Association (BTA) to conduct the survey. Figure 3 represents the distribution and location of the leather processing industries of which the owners were surveyed. To provide the readers with a better overview of the tanneries' production and environmental pollution, the daily production capacities of the surveyed tanneries and their daily solid and liquid wastes disposal to the surrounding environment are also represented in Figure 3. It is important to note that the minimum daily production capacity of the surveyed tanneries is 1000 sq.ft. and the minimum daily disposals of the solid and liquid wastes are 80 kg and 500 liters respectively. Some of the tanneries' buildings are clusters of four to five units of buildings (Figure 3). Some group meetings were also organized with several tannery owners and the president of BTA was interviewed to gather relevant and more information.

Figure 3. The distribution and locations of the surveyed leather processing industries among the leather processing industries in Hazaribagh with their daily production capacity, solid and liquid wastes disposal (assigned to the percentage of the surveyed tanneries).



Since the samples are evenly distributed in the Hazaribagh area and tanneries with varying production, processing and manufacturing capacities with varying plot areas have been taken as the sample; the survey result should be the actual representation of the perception of all the tannery owners in Hazaribagh. The secondary data i.e. relocation project description, stakeholders information, project cost, time phase etc. were collected by personal visit to the Institute of Water and Flood Management (IWFM) (http://www.buet.ac.bd/iwfm/), The World Bank Bangladesh (WBB) (http://www.worldbank.org/en/country/bangladesh), the Institute of Water Modeling (IWM) (http://www.iwmbd.org/), the Society for Environment and Human Development (SEHD) (http://www.sehd.org/), the Department of Environment of Bangladesh (DOE) (http://www.doe-bd.org/), the Bangladesh Small and Cottage Industries Corporation (BSCIC) (http://www.bscic.gov.bd/), Bangladesh Tanners' Association (BTA) (http://www.switchretiebd.org/partners/bta) and the Sheltech Consultants Pvt. Ltd.

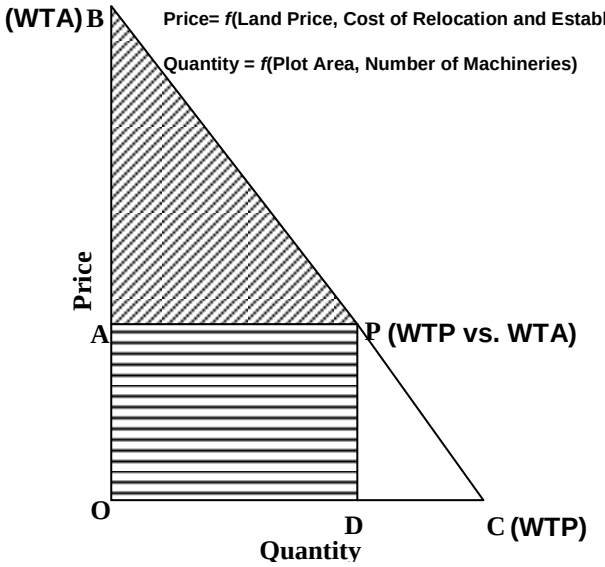
(http://www.sheltech-bd.com/#home). The data of the relocation project collected from these organizations are mostly publicly unavailable.

As a method for the review of the relocation plan to justify whether it is feasible from the urban planning point of view or not, social theories of the city [23] was applied. The theory discusses the stake of the industry owners in location decision of the industries. From the history of industrialization, the decision on the location of a particular industry was always made by the industry owner, neither by the government nor by any law enforcing agency [1, 22-23]. The tannery owners were surveyed according to the ideology that where they were willing to keep their tanneries. The reasons for the willingness and unwillingness of the tannery owners to relocate their leather industries are explored from the survey result. The contingency and alternative to the tannery relocation plan is also analyzed from the suggestions provided. Another important aspect of the social theories of the city is the harmony between the industrial growth and city expansion. The theory claims that the location of the industry depends on a lot of prerequisites, the most important ones are the access to transportation, availability of the equipments and raw materials at the locality. According to the rule of thumb, when all these prerequisites are met then the location of the industry can be in a fringe location away from the activity centers of the city. In such case, the city growth should be controlled; otherwise the activity centers will continue propagating and soon find the locations near the industries and include the industries inside the city again. The location of the industries always works as the attraction hub for activities. Nevertheless, the location of the industry should not violate the city master and structure plan and should not alter the assimilative capacity of the local environment to ensure environmental sustainability [22-23]. Therefore, the environmental impact of the proposed industrial land use in the new location is analyzed in contrast to the structure plan for Dhaka city and at the same time the potential environmental impact of Hazaribagh brown field to the proposed mixed land use is also analyzed.

To justify the relocation plan from the environmental economics point of view, three important economics concepts are applied – willingness to pay, pigovian tax and hedonic pricing [24-25]. A measure of an individual's preference for an option in the market place is his/her willingness to pay (WTP) for that particular option. Compensation cost and subsidy are two opportunities to provide to push people in the market to be willing to accept (WTA) an option for which people are not WTP [25]. As represented in Figure 4, BOC triangle represents the market of perfect competition; WTP and WTA vary with the price and quantity of a product in the market. In an ideal situation, at point B (where price of the product is zero and quantity is the maximum) the consumers are highly WTP whereas at point C (where the price is the maximum and quantity is zero) the consumers are highly WTA with high compensation and subsidy. C is therefore the point where a consumer is highly unwilling to receive an option available at market price. P is the point of negotiation, frequently appears in an ideal market, where both the price and quantity of the product in the market are reasonable for the consumer to be WTP and WTA simultaneously without any compensation and subsidy. The success of any project depends attaining the point P situation for the target group because WTP is highly unlikely to be happened. For this study, the target group is basically the tannery owners, who are supposed to pay for the relocation along with the government. From this perspective, the willingness to pay of the tannery owners for the relocation were analyzed from the surveyed data and in parallel their compensation and subsidy demands were also analyzed. The price is considered to be a function of

land price, cost of relocation and establishment and quantity to be a function of plot area of the tannery infrastructures and number of tannery machineries for this relocation project.

Figure 4. The perfect competition situation in the market described with the BOC triangle, consumers' willingness to pay (WTP) and willingness to accept (WTA) conditions are identified with appropriate functions.



Early in the twentieth century, the English economist Arthur C. Pigou [33] argued for the imposition of taxes on generators of pollution. Since the social cost of pollution is in excess of the private cost to the polluter (actually polluters have a negative cost since they save money by polluting), the government should intervene with a tax, making pollution more costly to the polluter. If the pollution is more costly to produce, the polluter will produce less pollution and this tax came to be called as the Pigovian Fee or Pigovian Tax [24, 33]. There are different ways of calculating the Pigovian tax for a particular industry owner. One approach is to consider the Pigovian tax as a function of the total amount of goods and pollution produced from an industry where the marginal cost of the production of goods is equal to the price of goods. Thus, if the produced goods are eliminated from the calculation, then the marginal cost for producing one more unit of pollution is the determinant of the Pigovian tax. The idea is to determine the marginal savings from emitting one more unit of pollution. Another approach is to calculate the cost of reducing individual's exposure to a certain pollution form an industry, since the people cannot be locational in choice to reduce the amount of pollution they face. Thus there is nothing a person can do to reduce his or her exposure, therefore the industry owner should pay the amount that minimizes total costs of the damages occurred to the individuals due to the pollution. The Pigovian tax that can be imposed on the tannery owners for polluting the surrounding environment of Hazaribagh and for causing potential damages to the health of the inhabitants is identified applying both the approaches. The Pigovian tax is also calculated to prevent the pollution in the relocated site and the possible ways of imposing them are evaluated.

The hedonic pricing method (HPM) [24, 25, 34] attempts to evaluate environmental services, the presence of which directly affect certain market price. In practice, by far the most common application of HPM is to the property market. House price is affected by many factors: one such important factor

is the local environmental quality. If the non-environmental factors can be controlled, then any remaining difference in house price can be shown in the difference of the environmental quality [34]. In general the HPM has been applied to the evaluation of environmental costs [34]. The HPM relies upon the assumption that, among other factors, the local environmental quality or lack of it will determine the price of house as (4).

$$\text{House price} = f(\text{Rooms, Access, Environment}) \quad (1)$$

The equation (4) states that the house price is a function (f) of the number of rooms in the house, the distance to local facilities from the house and most importantly the measure of local environmental quality [34]. For example, if the environmental impact of local traffic noise has to be measured for determining the house price, then this could be done by valuating the decibel of traffic noise inside the house in question. It has been derived that if a new road scheme is likely to raise traffic noise by one unit in Washington DC, then a monetary value for preventing this increased noise pollution could be a 0.88% increase of the average house prices in the affected area [34]. Based on the hedonic pricing method, the potential price for the houses in Hazaribagh, redeveloped as a mixed use area after the relocation of the tanneries, is identified and evaluated according to the affordability of the future residents.

3. Results and Discussion

3.1. Justifying Relocation from the Urban Planning Point of View

The analysis of the willingness of the tannery owners to move to the proposed Savar tannery complex with their tanneries and installed machineries depict a controversial state of affairs in contrast to the political government's decision. As represented in Figure 5, there is a clear dominance of the tannery owners (82%) who are not willing to move to the proposed tannery complex. Only 18% of the surveyed tannery owners are willing to move under significant conditions; which is clearly identified as a refusal of the government decision for shifting the tanneries from Hazaribagh by the tannery owners' community. In a democratic society like Bangladesh, the plan should not be executed and more importantly this violates the interest of the tannery owners' community as described in the social theories of the city. Accordingly, since the majority of the tannery owners decided not to relocate their industries, it is obvious that the relocation project will be ended in a complete failure as happened worldwide before. The stake of the tannery owners is not served by this political decision and the government cannot essentially play and succeed against the decision of the industry owners.

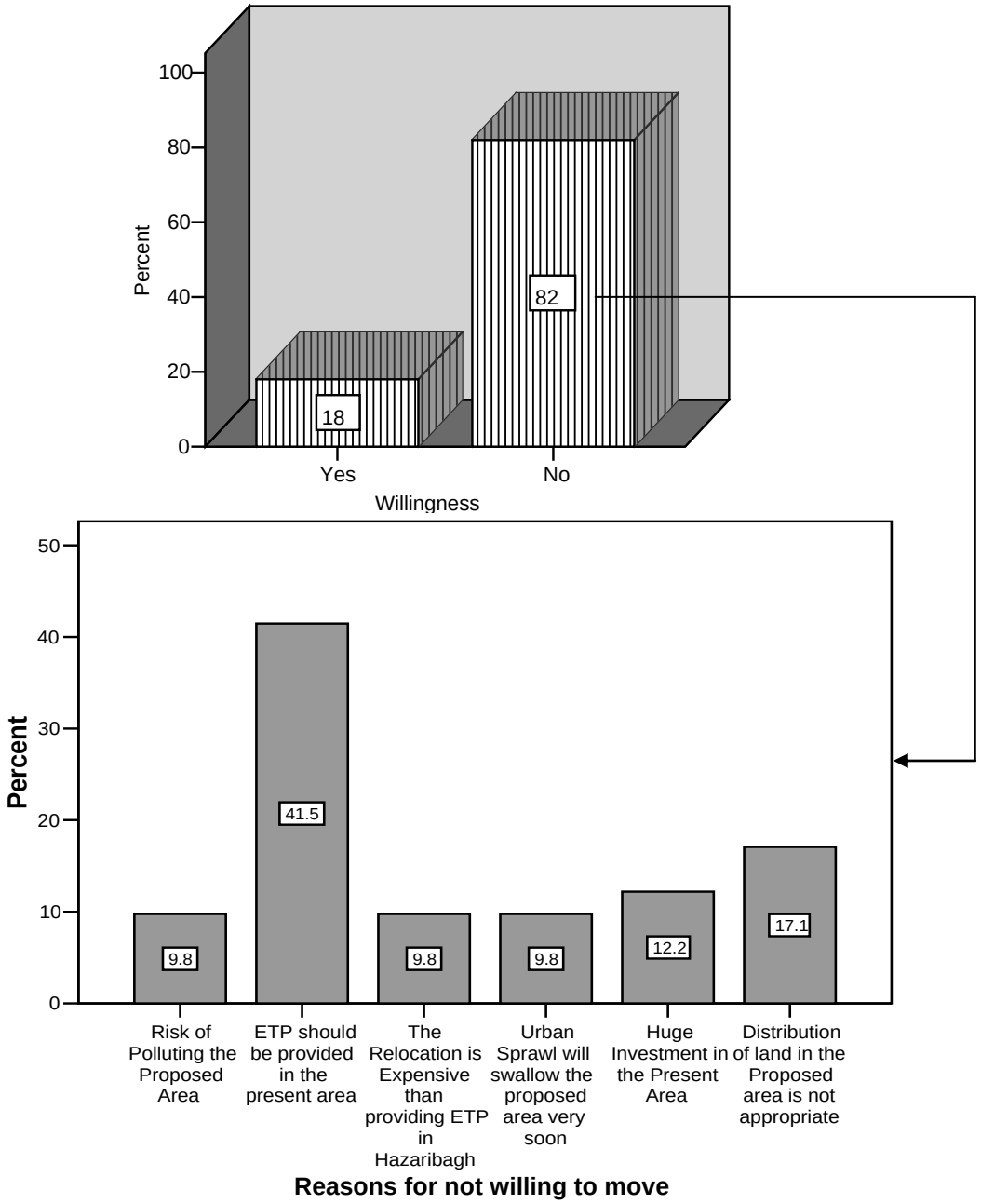
The reasons behind the tannery owners' willingness and unwillingness to relocate are also analyzed carefully to provide a comparative overview in light of the failed tannery relocation projects of India, Egypt and Mexico. The analysis reveals that the owners, who (18%) are willing to move to the proposed Savar tannery complex is pushed by only one reason, which is:

The Government Policy Pressure to Relocate

They claim that the government has been blaming them for environmental pollution and degradation of Hazaribagh for a long time and has also been refusing to provide them with financial assistance for establishing an environment friendly leather processing system and CETP at Hazaribagh, which persuades them to decide to relocate. They were not willing to move at the beginning but due to denying they had to face a lot of bureaucratic troubles relating their business and finally they were

forced to change their mind. The UNIDO, after a comprehensive study, showed their keen interest in the implementation of environment friendly leather processing at Hazaribagh in 2000, but government did not co-operate with them and refused to accept their plan because of the political pressure of the local leaders and international buyers.

Figure 5. The willingness of the leather industry owners of Hazaribagh to relocate and the reasons claimed for not willing to relocate. Data source is the questionnaire survey.



As illustrated in Figure 5, the tannery owners identified six concrete reasons for their unwillingness to relocate to the proposed Savar tannery complex. The reasons are stated below:

1. There is a tremendous risk of polluting the proposed area at Savar by the tannery waste despite provision of the CETP. It might be the case that another brown field like Hazaribagh will be created at Savar due to the disturbance in the local physical environment.

2. The provision of CETP should be established at Hazaribagh but relocating, which would be the most cost-effective option for both the government and the tannery owners. The acquisition of land and establishment of CETP is still possible at the embankment area of Hazaribagh.

3. The owners consider the relocation is more expensive than providing CETP in Hazaribagh as they have to stop the leather production for several months during the relocation. Moreover, the relocation of all the equipments and structures are extremely expensive.

4. One major push from the side of the supporters of the relocation project that the tanneries' location is at the center of Dhaka city and they should be away from any of the activity centers. The tannery owners' argument is that putting the noxious leather industries at the urban fringe area would not be successful because the rapid urban growth will swallow the proposed area very soon and Savar will also be at the activity centers of the Dhaka city within a few years.

5. The tannery business is a traditional one and has been practiced by the owners by generation at the Hazaribagh area. The basic requirements for flourishing the industry i.e. access to water resources and transportation, infrastructure etc. exist in the present location which needs to be reestablished in the proposed location. Besides, the owners made a huge investment at the Hazaribagh and do not want to lose the return due to the relocation.

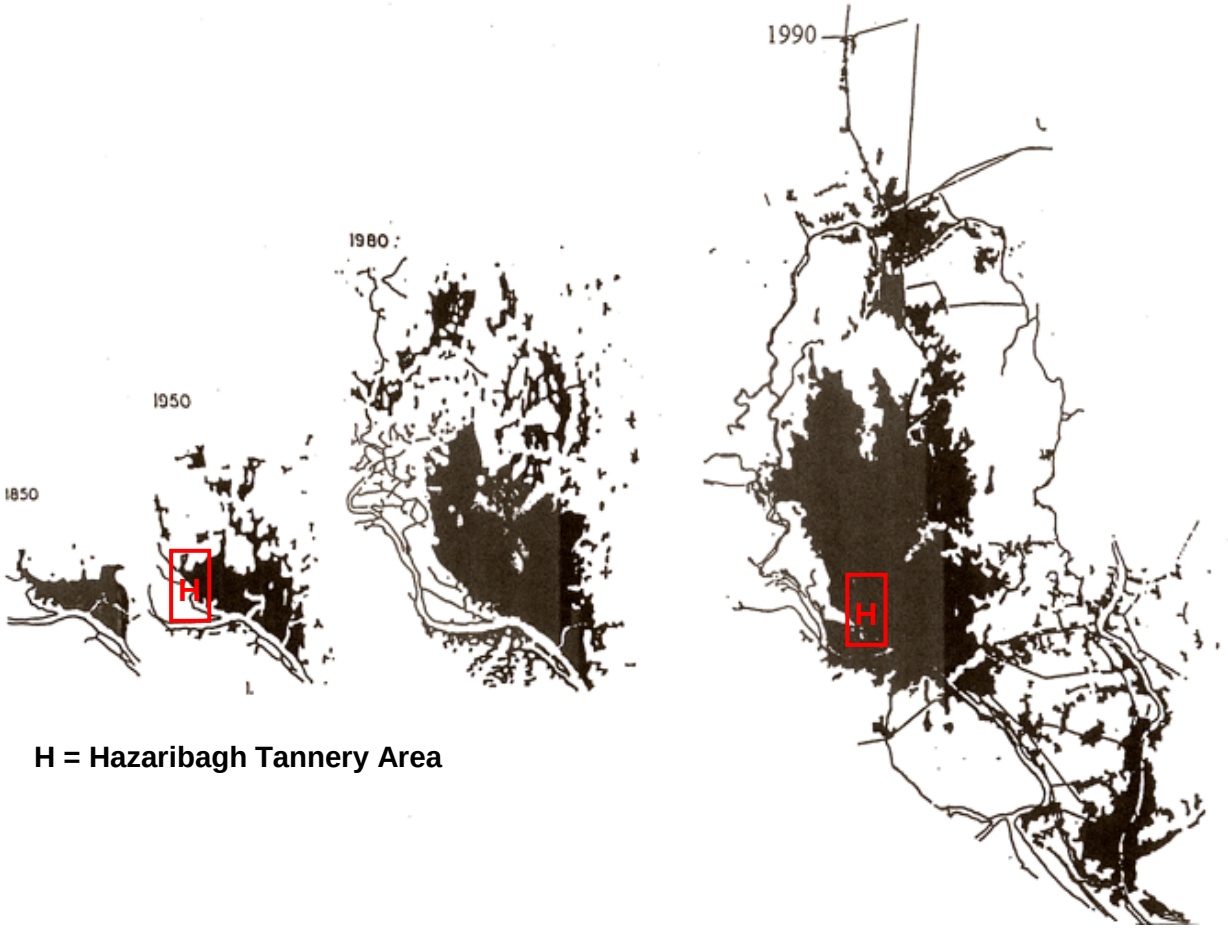
6. The owners who own larger plots at Hazaribagh claim that the distribution of plots in the proposed area by government is not appropriate. They complained that the owners of the smaller plots at Hazaribagh received larger plots at the savar tannery complex but the owners of the larger plots did not receive the plots of adequate size.

It is clearly depicted that the tannery owners made strong reasoning for their unwillingness and some of them can be strongly justified from the aspects of the assimilative capacity of the local environment in the proposed area in Savar and the existing urban growth of the Dhaka city. As described in section 2.1 and illustrated in Figure 1, the proposed industrial use of leather processing in the proposed Savar location is a serious violation of Dhaka Structure Plan. The plan recommended only agricultural land use in that area because of its being a flooded regularly during the wet seasons and a flood retention pond is proposed in its proximity. Therefore the assimilative capacity of this area serves the flood mitigation purpose and contributes to the agricultural production. The modification of the land use by the noxious leather processing industry will seriously disturb this assimilative capacity and therefore the environmental harmony of the location and eventually of the entire city. Moreover, the proposed location is at the upstream of Dhaleswari river, which eventually flows into the Buriganga river (Figure 1). Thus, apart from the installation of CETP, there is a high risk of polluting the entire surface water sources of the Dhaka city. The surrounding agriculture which solely depends on these water sources will also be largely affected. And in the worst case, it will not contribute to the recovery of the Buriganga river from the polluted state. Finally, since there is a dilemma present in the provision of CETP in the proposed location, it might be a catalyst to create another brown field.

In addition, as represented in the scanned map of the Dhaka city growth during 1850-1990 in Figure 6, which was collected from RAJUK (http://www.rajukdhaka.gov.bd/rajuk/webHome), the growth rate of the Dhaka city has been drastically increased during the recent decades. In 1965, when the tannery industries in Hazaribagh started to flourish, Hazaribagh was a fringe location of Dhaka city as observed in the growth status of 1950. But by 1990, Hazaribagh became a part of the main activity centers of Dhaka city and the city expanded beyond Hazaribagh area on the other side of the Buriganga river (Figure 6). Now-a-days, Hazaribagh is situated at almost the center of the Dhaka city. It took only

40 years for the growth of Dhaka city to swallow the Hazaribagh area inside it. Therefore it is quite obvious that following the current trend of city growth towards the north-west direction and considering the fact that urbanization has already started in Savar area [2], eventually the proposed area for tanneries will also be a part of main activity centers of the Dhaka city within next ten years. The industrial activities in the proposed area will certainly work as huge attraction for diversified activities. In a nutshell, relocating the industries to the proposed location without supervising the zoning principle of the Dhaka city is not a sustainable decision to make.

Figure 6. The scanned map of the growth of the Dhaka city during 1850-1990, showing the changing location of Hazaribagh from the fringe to the activity center. The map was collected from the Capital Development Authority of Bangladesh (RAJUK).

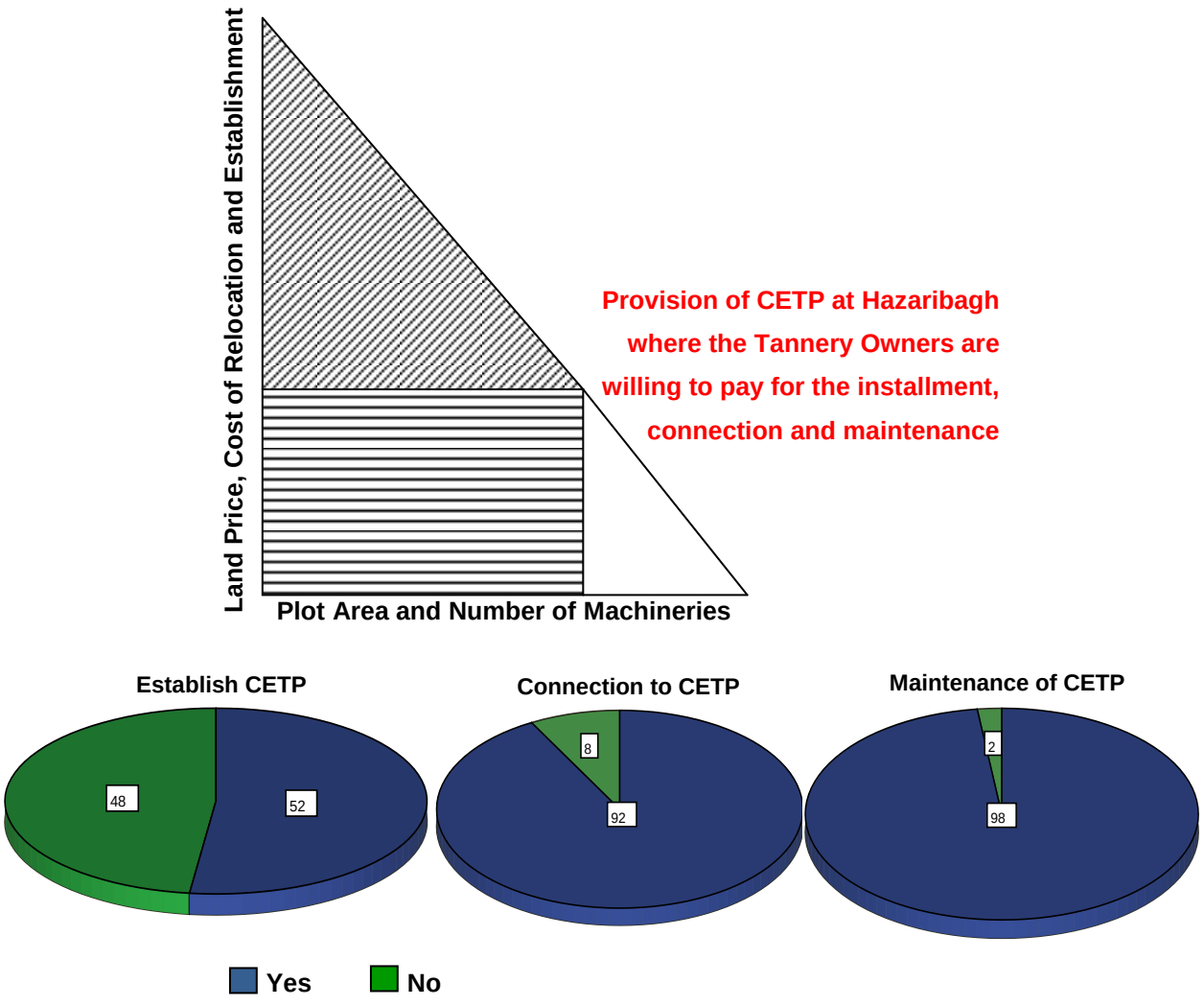


The review of the failures of the leather industry relocation projects in India, Egypt and Mexico also depicts the issues of the huge investments of the tannery owners in the existing tanneries, their dissatisfaction with the plot distribution in the proposed locations and their strong unwillingness to relocate and demand of the assistance to incorporate the environment friendly tanning process. Similar issues are raised by the tannery owners' community of Hazaribagh in Dhaka and therefore the relocations project clearly shows its future in failure. In addition, the review of the plan from the urban planning point of view states that the project does not meet the sustainability standard of the Dhaka city. The environmental harmony and the assimilative capacity of the local environment will be seriously hampered by the relocation project.

3.2. Justifying Relocation from the Environmental Economics Point of View

As described in section 2.2, the WTP and WTA of the tannery owners for the relocation project can be seen as an inverse function between the price variable consist of land price, transfer and reestablishment cost and the quantity variable consists of plot area and number of machineries. The function illustrates in Figure 7 that obviously neither the WTP nor the point of negotiation for the tannery owners is attainable in the relocation project. The only possible stage is the WTA where the tannery owners accept all the price variables as zero i.e. they do not need to pay at all for the purpose of relocation. The tannery owners who are willing to relocate (18%) demand complete compensation and subsidy to accept the relocation project. Moreover, as described in the previous section, majority of the tannery owners (18%) is not willing to move to the new location and therefore neither WTP nor WTA are attainable even with compensation and subsidy.

Figure 7. The point of negotiation is attainable by providing CETP at Hazaribagh instead of relocating the industries since majority of the tannery owners is willing to bear the cost for establishment, connection and maintenance of CETP at Hazaribagh.



The WTA of the tannery owners is attainable under the following conditions that are documented in the memorandum of understanding [26]. The conditions exclude the actual project cost i.e. land development, infrastructure provision, CETP installation, connection and maintenance etc.

1. Any bank loan that was and will be taken by the owners in the preceding period of relocation regarding the industrial issues in Hazaribagh should be waived as soon as the tanneries will be relocated to the Savar tannery complex. Any bank loan regarding the relocation process taken by the owners should be free of interest according to the Project Concept Paper (PCP) approved before 15th August 2002. The loans should be allowed to be paid back by installments of 20 years.

2. The land prices described seem unreasonable to the tannery owners and they ask for reconsidering them. The tannery owners are ready to pay the actual price for purchasing the land which excludes the infrastructure development costs.

3. The wooden *drums and pedals* used in the tanneries are immoveable and therefore these expensive drums and pedals should be reinstalled at the new location. So, subsidy of BDT 250000 should be provided as compensation for each drum and pedal. The foundation, gas, electricity and water supply connection to each tanning machine will be damaged because of relocation and they should be reestablished at the new location. So, BDT 200000 should be provided as subsidy for the reestablishment of the machineries.

4. The investment on the existing tannery buildings at Hazaribagh should be returned as a compensation of 50% of the present market value of these buildings.

Thus, the tannery owners demand huge amount of money from the government regarding the compensation of loss and the subsidy for transfer and reestablishment in addition to the condition that they will not contribute holistically or partially to the actual project cost. Therefore their standpoint regarding relocation is an expensive WTA. Table 1 represents the expenditure of the government as subsidy and compensation to the tannery owners in addition to the actual project cost. For comparison, it also provides the actual expenditure of government if it redevelops Hazaribagh as an environment friendly leather processing zone instead of relocation.

As illustrated in Table 1, on one hand, the actual expenditure of the government of Bangladesh for the relocation project is BDT 11.38 billion including the subsidy and compensation (in addition to the actual project cost of BDT 5.45 billion). On the other hand the total expenditure of the government to redevelop Hazaribagh as an environmentally sustainable leather processing zone with adequate equipments is fairly lower in comparison – only 30% of the relocation project cost. The total area of Hazaribagh tannery is 61.75 acre which is 31% of the total land area of the proposed Savar tannery complex. Therefore the proper infrastructure development should not cost more than 31% of the infrastructure development cost at Savar. As depicted in Figure 7, the majority of the tannery owners are willing to pay for the establishment of CETP at Hazaribagh, installing connection to it and for its maintenance in the long run. Since 42% of the surveyed tannery owners denied paying for the CETP establishment, government might need to bear the total establishment cost, but it is included in the analysis of the cost. Therefore the point of negotiation is attainable for the tannery owners being simultaneously WTP and WTA if the government redevelops Hazaribagh with providing the CETP, proper infrastructure and environment friendly tanning equipments instead of relocating the tanneries. In that case, government does not need to pay any subsidy or compensation rather can save a lot of money earned from the people's tax.

Table 1. The estimated expenditure of the government as subsidy and compensation in addition to the actual relocation project cost and for the redevelopment of Hazaribagh as an environment friendly leather processing zone instead of relocation. The expenditures are calculated according to the Regional Program for Pollution Control [14] and the Memorandum of Understanding [26] for Hazaribagh.

Subsidy and Compensation should be Provided in addition to the actual Relocation Project Cost **Should be carried by the government**			**Redevelopment of Hazaribagh as an Environmental Friendly Leather Processing Zone** **Can be imposed as Pigovian Tax on the owners**		
Component and Quantity	Unit Cost	Total Cost	Component and Quantity	Unit Cost	Total Cost
1. Drums and Pedals - 60 on average for each tannery	BDT 250000	BDT 3.74 billion	**1.** CETP and Landfill Site - 1	BDT 2.45 billion	BDT 2.45 billion
2. Reestablishment of Machineries – 20 on average for each tannery	BDT 200000	BDT 0.99 billion	**2.** Infrastructure Development – 31% of the Savar site	-	BDT 0.9 billion
3. Compensation on the investment at Hazaribagh – 50% of the present market value of the buildings	-	BDT 1.2 billion	**3.** Environment friendly tanning process in each industry	BDT 1783100 for each big tannery	BDT 0.22 billion
Total		**BDT 5.93 billion**	**Total**		**BDT 3.57 billion**

Determining the Pigovian tax for imposing on the tannery owners for polluting the surrounding environment of Hazaribagh since 1965 is a complicated task, the tannery industries have been gradually flourished and the amount of pollution has also been gradually increased. But the pigovian tax can be calculated for the future to prevent the tanneries from polluting, which is the total establishment cost of the CETP, the regular maintenance cost of the CETP and cost for any remediation at Hazaribagh site. Establishment of CETP and its successful operation will prevent every single more unit of pollution of environment and damage to the public health. The remediation of Hazaribagh soil and water will stop the exposure of the Hazaribagh users to the pollution that have been accumulated and foster the natural recovery process. The annual operation and maintenance cost of CETP is estimated as 30% of its establishment cost [26]. According to this conjecture, the operating and maintenance cost of CETP is BDT 0.735 billion annually. Therefore the total Pigovian tax that can be imposed on the tannery owners at Hazaribagh can be determined as:

Pigovian Tax = BDT 2.45 billion + BDT 0.735 billion (annually) + cost of any remediation for soil and water at Hazaribagh

This Pigovian tax cannot totally be imposed on the tannery owners if they relocate with their industries to Savar for two reasons – (i) they have not been polluting the new site and to prevent the future pollution the only imposable tax then is the annual BDT 0.735 billion (ii) they will not be responsible for the life threatening pollution in Hazaribagh anymore since they accept to be relocated. In contrast, if the leather processing industries stay in Hazaribagh, the government has the legal right to impose this tax on them as a penalty for polluting the environment for last 47 years. Hence the analysis of the willingness of the tannery owners depicts that the clear majority of the tannery owners

are willing to pay for the operation and maintenance of CETP if it would be installed at Hazaribagh location. Besides, imposing this BDT 0.735 billion as maintenance and operation cost will be difficult in Savar in the beginning since the tannery owners have already estimated immense loss in relocating their industries.

Another key aspect for justifying the relocation plan is to determine the hedonic prices of the houses that would be provided in the proposed mixed use area, which will be developed in Hazaribagh after the relocation of the tanneries. Although several compatible land uses have been recognized for Hazaribagh tannery area after relocation; the remediation processes required before implementing such land uses are extremely expensive, time consuming and are suffering from the local unavailability of the technologies. More importantly, the extensive remediation process suggested by ACLIMA [31] applies restrictions of uses on several sites and water bodies for a long period. A summary of the physiochemical composition of the soil and water of Hazaribagh is presented in Table 2 which is retrieved from the ACIMA prepared remediation report [31].

Table 2. The physiochemical composition of the **(a)** soil in Hazaribagh measured in four different stations and of the **(b)** water in Hazaribagh averaged from the measurements of 15 different stations. The table is a summary made from the report *Site Remediation and Management Guidelines for Hazaribagh* prepared by ACLIMA [31].

(a)

Station	Suad %	Silt %	Clay %	pH		Organic Matters %	Exchange Capacity dS/m	Cation Exchange Capacity meq/100g	Each Cation meq/100g				Cl mg/l	Available Content ppm		
				S/E	$CaCl_2$				Ca	Mg	K	Na		N	P	K
1	40.6	44.9	145	7.3	7.1	10.3	4.3	39.0	38.5	8.3	0.9	19.2	50.5	2343	5.7	285
2	-	-	-	7.3	6.9	1.5	4.5	7.0	8.5	1.9	0.3	3.9	64	280	1.1	98
3	-	-	-	7.3	6.8	1.2	3.9	8.4	5.8	2.1	0.4	3.0	69	245	3.3	145
4	30.3	51.7	18.3	7.0	6.6	0.5	0.4	29.0	6.3	2.0	0.4	1.5	6	26	0.6	31

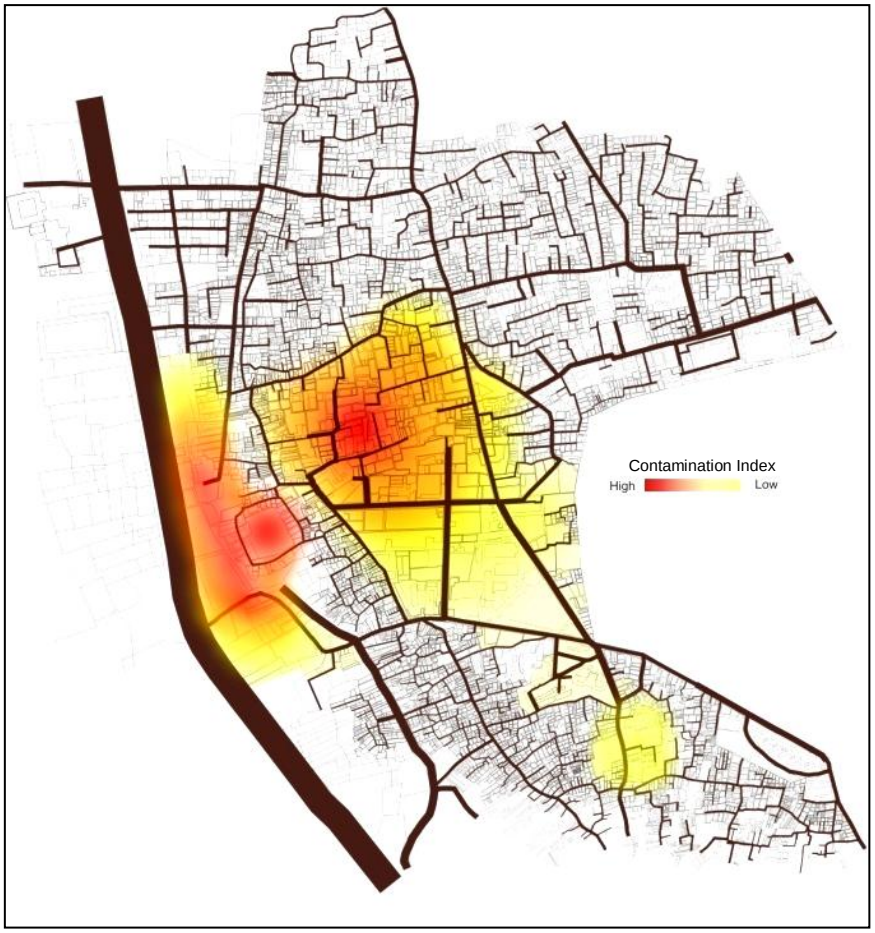
(b)

pH	Total Suspended Solids mg/L	Biological Oxygen Demand	Chemical Oxygen Demand	Alkalinity mg/L	Chloride mg/L	Chrome total mg/L	Oil and Grease mg/L	Phenol Compounds mg/L	Sulphide mg/L
7.9 - 8.2	2000 - 3500	1000 - 1800	2400 - 4250	900 - 1600	5600 - 9500	60 - 150	50 - 125	10 - 15	75 - 180

Comparing the threshold of tolerance for human being to the physiochemical substances present in the soil and water of Hazaribagh, ACLIMA [31] also calculated a contamination index for the Hazaribagh sites in a scale of high to low. The high indexed contamination can cause immediate death to human being due to direct contact whereas the low indexed contamination can cause serious health injury [31]. For more information on the concept and methodology of calculating contamination index, readers are referred to the Bokar et al. and the Backman et al. [35-36] which are cited by ACLIMA in their report. The contamination indices calculated for Hazaribagh at different station points by

ACLIMA are interpolated using inverse distance weighting and thus a continuous map of contamination index in Hazaribagh is prepared and presented in Figure 8. As represented in Figure 8, a significant number of sites in Hazaribagh are too fatal to promote a mixed land use without major remediation.

Figure 8. The interpolated contamination index, which is calculated by comparing the physiochemical composition of Hazaribagh soil and water to the human tolerance threshold [31]. It The interpolated surface is presented on the map of Hazaribagh.



Due to this highly toxic composition of the soil and water of Hazaribagh as described in Table 2 and Figure 8, ACLIMA [31] proposed a multistep and wide-ranging treatment of the Hazaribagh *lagoons* (closed water sources) and the isolated pollution sources. In addition, ACLIMA also proposed restrictions on several sites for particular uses in short term and long term duration. A summary of the ACLIMA proposed pollution sources treatments and sites restrictions are represented in Table 3. The treatment includes extensive soil excavation and refilling and removal of sludge from the lagoons. The treatment of these water bodies, excavation and soil replacement processes and the land filling technology demand extensive time, money and effort. ACLIMA [31] describes the monetary value of the total remediation process that needs to be undertaken in Hazaribagh as a summation function of the time required, personnel (wages), equipment costs and analysis costs. The final monetary value has not been determined yet and it could not be calculated within the limited scope of this study. But undoubtedly, the cost of remediation of Hazaribagh through these sophisticated processes should be very high and result into a huge sum of money.

Table 3. A summary of the remediation procedure, including treatment of water and soil and the restrictions on use, essential for the Hazaribagh area before developing it to a mixed use area proposed by ACLIMA [31].

Remediation Procedure of Hazaribagh Soil and Water	
Treatment of Hazaribagh Lagoons and Isolated Pollution Sources	**Restriction on uses because of the diffused Pollution Sources**
• Removal of superficial wastes - sludge in lagoons and wastes on dump sites. • Excavation of the visible soil pollution - buried wastes, organic soils. • Excavation of the rest of the soil pollution -based on chemical analysis. • Covering the soil with a concrete layer or a foil. • Removal of several meters of topsoil as a remediation work before constructing new buildings. • For deeper soil layers, in situ techniques that treat the contamination in place.	• Restriction to grow vegetables on the site. • Restriction to use groundwater for drinking. • Restriction to pump groundwater. • Restriction to live on some parts the site. • Restriction to enter some parts of the site. • Tube well Protection. • Reactive Barrier or Reactive Zone.

Nevertheless, as suggested by ACLIMA [31], the contamination in Hazaribagh accumulated for 47 years should go through the natural recovery process even after the extensive remediation process takes place. The whole technology should be imported from outside the country along with the foreign experts. So, the conclusion is that either the government has to spend a huge sum of money for the remediation of Hazaribagh to make it habitable for future inhabitants of the proposed mixed use area or the site should be abandoned for a long period of time for the natural recovery. The actual cost of remediation of Hazaribagh has not been determined by ACLIMA and it cannot be calculated within the scope of this study. But agreeably the cost of remediation is very expensive. Accordingly, the environmental variable to determine the hedonic prices of the houses will include unaffordable prices of the housings which would be developed in the site. Both the public and private sector that will deal with the development of the mixed use area will try to recover the cost of redevelopment through the selling of developed plots and housings. Eventually the prices of the housings will be incompatible with the regular prices of housings of the Hazaribagh area and prices of the surrounding area. And the people will not be interested to buy plots or houses in this area unless and until the government, again, offer a huge amount of subsidy. This will add another huge expenditure on the part of government for the relocation project. Even thereafter, there is always the risk of an unhealthy and threatening living environment in Hazaribagh due to these excavation and demolishing processes; which are not at all necessary if the tanneries in Hazaribagh stay where they are with the CETP and the landfill site established. Few lands filling will be necessary to break the connections of the users of this area to the toxic materials and the whole recovery process can be accomplished naturally. And generally, what happens in the developing economy like Bangladesh, real estate sector always tries to maximize their benefit with minimum investment. Following the trend, if the Hazaribagh area will be redeveloped without proper remediation, the future inhabitants will suffer from serious health hazards. And according to the Hedonic Pricing Method, in such case the degraded environment would highly reduce

the prices of housings and plots which will attract the mass people with low affordability, which entails a serious threat to the social and environmental sustainability.

3.3. Discussions

Review of the Hazaribagh tanneries' relocation plan from the urban planning and environmental economics points of views clearly depicts that the project is not justified at all, especially from environmental sustainability aspect. As illustrated in the classical definition of environmental sustainability [22] and in the modern urban planning challenges for ensuring sustainable development [37], an urban planning project should ensure that the waste emissions should be kept within the assimilative capacity of the local environment without unacceptable degradation of its future waste absorptive capacity to meet the environmental sustainability. Hazaribagh tannery relocation project certainly does not meet the criteria since it is resulted from the analysis that the proposed location for the relocated tanneries will be hampered in its assimilative capacity since the Dhaka structure plan protected it as a flood flow zone with a flood retention pond [27]. In parallel, in Hazaribagh, where the absorptive capacity has already been degraded, the process of redevelopment of the mixed land use and implementation will highly degrade the local environment. Goodland [22] proposed social framework also supports the failure of the project because of the unwillingness of the majority of the tannery owners to relocate and to pay for the CETP and landfill site construction at the proposed location. Refusal of cooperation from this actively participated social community and major stakeholder will not contribute at all to the environmental sustainability. Moreover, the analysis of the failure of the tannery relocation projects worldwide in the similar contexts, as represented in Table 4, indicates that due to the tannery owners' strong unwillingness, the workforce, property and monetary issues involved in the relocation of Hazaribagh tanneries will entail another failure in Bangladesh.

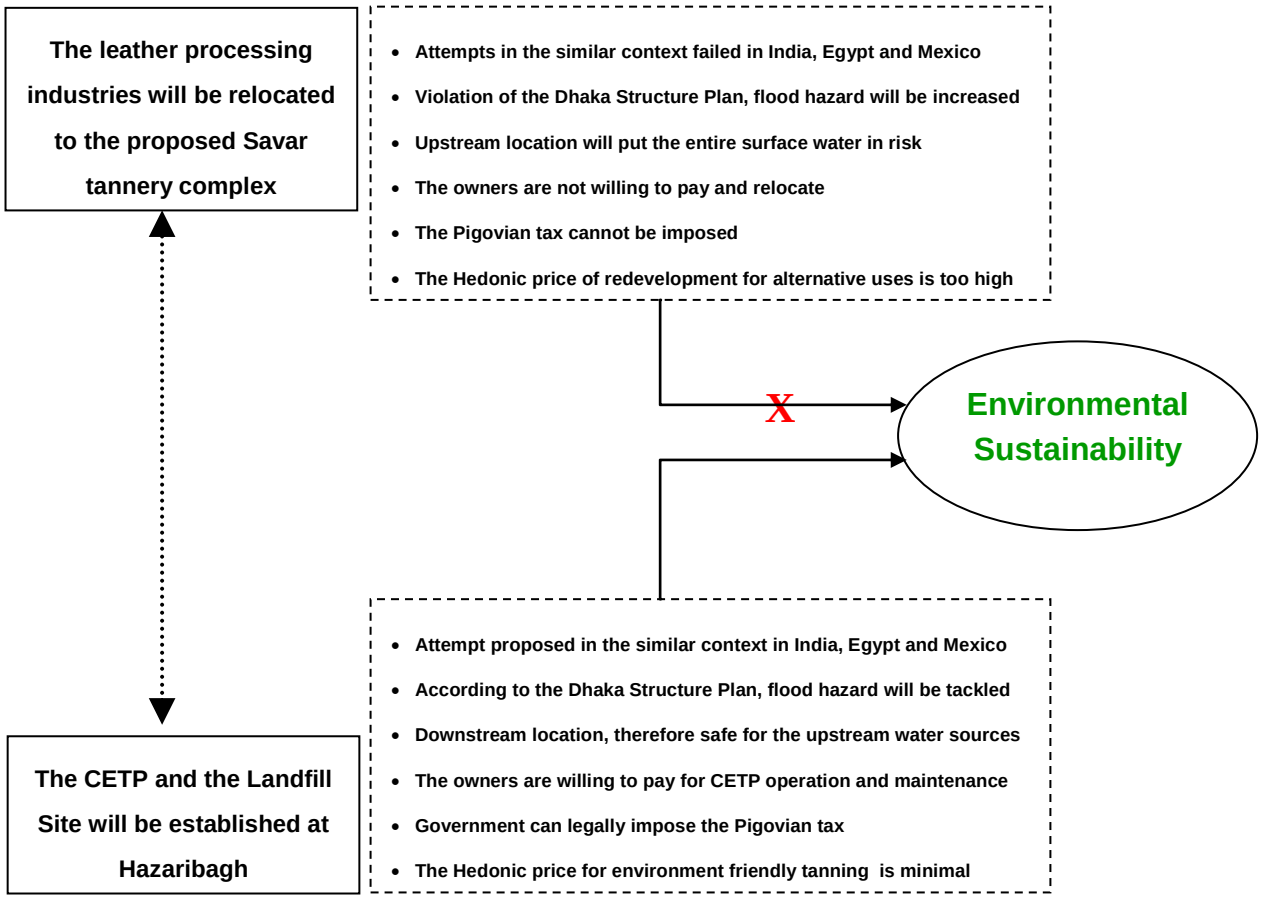
Table 4. A comparative overview of the tannery relocation projects in India, Egypt and Mexico that have been failed. The property and circumstances involved are mentioned along with the causes of failure.

Country	**India**	**Egypt**	**Mexico**
City	**Tamil Nadu**	**Cairo**	**Leon**
Number of Tanneries	577	320	675
The River Polluted	Palar	Nile	Gomez
Causes of Failure of Relocation Projects	Involves the movement of thousands of families, settlements and machines. But ultimately got a hunch back by Supreme Court because of appeals from social communities including tannery owners.	US$ 150 million project in a desert location 70 km away from Cairo. Unwillingness of the tannery owners to assist the government in ownership and transfer issues led to failure.	Only managed to sign a number of voluntary agreements to comply with written regulations. But no progress at all because of the unwillingness of the tannery owners.

In addition, the failure of imposing the Pigovian tax and extremely high hedonic prices of the alternatives of the tannery industries in Hazaribagh also claim the project's failure from the economic

aspect of the environmental sustainability. In a nutshell, the comparison of the options - relocation and not relocation in Figure 9 adds weight to the later one.

Figure 9. A comparison of the potentiality of the Hazaribagh leather processing industry relocation plan to the alternative of redevelopment of Hazaribagh as an environment friendly leather processing zone to attain environmental sustainability of Dhaka city.



The comparison clearly indicates that it is more appropriate from the environmental sustainability aspect to keep the tannery industries in the present location rather than relocating; and redevelop the tannery area as an environment friendly tannery estate. The monetary evaluation shows a cost of BDT 11.38 billion for the relocation whereas the cost of redevelopment of the Hazaribagh as a planned industrial estate is approximately BDT 3.57 billion, which is partially or totally imposable as Pigovian tax on the tannery owners.

The land acquisition process for developing the CETP and landfill site can be immediately started because the area proposed by the UNDIO for development is a government *khas land* near the embankment. This is the area where now the tannery wastes are regularly being dumped and a fruitful usage of this expensive piece of land in the city of land crisis should be appropriate. From the perspective of the welfare economy, government should always go for the option which better utilize the public taxes. Since the leather processing sector has been continuously contributing to the national economy of Bangladesh, a comprehensive, cost worthy and environmentally sustainable decision is expected from the government to be executed. Therefore, it is seamless to demand that the tannery industry should be redeveloped in the present location of Hazaribagh with an efficient CETP rather than relocating it to a new location.

4. Conclusions

This paper reviewed the Hazaribagh leather processing industry relocation plan from the urban planning and environmental economics points of views applying the concepts of the social theories of the city, willingness to pay, Pigovian tax and hedonic pricing method. The data for conducting the study were collected by an extensive questionnaire survey among the owners of the leather processing industries at Hazaribagh and direct contact with the project executing bodies from the original project documents. Due to the proper data and methods unavailability and within the limited scope of the study, a lot of aspects cannot be covered but they are subject to future studies. Neither the actual Pigovian tax that can be imposed on the tannery owners and the hedonic price of the houses in future alternative land use of Hazaribagh can be concretely determined. Determination of both the Pigovian tax and hedonic price is highly dependent on the calculation of monetary value of the complete remediation cost of Hazaribagh and the time of natural remediation. The process was started in the project conducted by ACLIMA and the Khulna University [31] but a concrete value has not been determined yet. Consequently, a concrete value of the Pigovian tax and especially of the hedonic price cannot be presented in this study but would be very interesting for the future studies. Nevertheless, the results made by the analysis are negotiable since they are highly supported by the literature and the local authorities. The determination process of the pigovian tax described in the paper is the most convenient one though it partly depends on the remediation cost. Interested readers are requested to keep track of the regular update of the report by ACLIMA [31]. The paper deals with the soil and water pollution in Hazaribagh, but the leather processing has also been polluting the air in Hazaribagh area. This should be taken into account in any further analysis on the relocation plan. The impacts of the noxious leather processing activity on its workers is also a major issue for the future studies and the health cost of the tannery workers and neighboring residents due to tannery pollution should also be determined.

The results obtained in this study clearly depicts that the establishment of the CETP and the landfill site in Hazaribagh is the preferable option over the relocation to ensure environmental sustainability. Due to heterogeneous political situation the political government is pushed by the decision of relocation of the Hazaribagh tanneries. But from the scientific point of view, the relocation plan is not justified for ensuring the environmental sustainability in Dhaka city. Extensive studies are required for proper allocation of the CETP in Hazaribagh, ensuring the natural recovery of the site and rivers along with the cost worthy technical steps. Decreasing the population density in and around Hazaribagh is another option to be considered to reduce the health impacts of the tannery hazards on the inhabitants' health. To conduct the implementation another extensive study on the health impact of the tannery hazard is also urgently required. And at last but not the least, the compromise between the political decision and scientific aspects of environmental sustainability is still an issue for developing economies and when push comes to shove a mutual decision is expected where political government should not be conflicted.

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Conflict of Interest

The scientific results of this study might be conflicted to the political interest of the government of Bangladesh for relocating the tannery industries, since it has been ordered by the Bangladesh Supreme Court. But the author declares that no political affiliation has worked as the motivational factor for this study, the motivation is merely scientific. All the published data and maps in this study are either author created or substantially modified; in some cases the maps are publicly available for use.

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