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# Industries' Location as Jeopardy for Sustainable Urban Development in Asia: A Review of the Bangladesh Leather Processing Industry Relocation Plan

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**Avit Kumar Bhowmik**

## Abstract

The article reviews the Bangladesh leather processing industries' relocation plan by applying the Social Theories of the City and the three environmental economics theories—Willingness to Pay, Pigovian Tax and Hedonic Pricing Method on the data collected by a questionnaire survey among the industries' owners and from the original project documents. Results prove the strong unwillingness of leather industries' owners to relocate and pay for relocation, failure at imposing Pigovian tax and the high hedonic prices of the houses including threats to inhabitants' health in the redeveloped residential area. In addition to high subsidy and compensation, historic growth trends and potential risks of flood and surface water resource pollution of Dhaka defy sustainability issues. Considering three consecutive failures to meet the relocation deadlines, these results claim that redeveloping an environment friendly leather processing zone at the present location will ensure sustainable urban development.

本文回顾了孟加拉国皮革加工产业的搬迁计划，采用了城市社会学理论和三个环境经济学的理论——支付意愿，庇古税和特征价格法，分析基于对各工厂业主的问卷调查和从原来的项目文件收集到的数据。结果证明了皮革行业业主强烈的不愿意搬迁和支付安置费用的意愿，征收庇古税失败和房屋的特征价格高，以及对重建住宅小区居民的健康威胁。除了高补贴和补偿以外，达卡洪水的历史发展趋势和潜在风险以及地表水资源污染都和可持续发展背道而驰。考虑到面对搬迁截止期限的连续三次失败，这些结果表明在现在的位置重建环境友好型皮革加工区将确保可持续的城市发展。

## Keywords

Urban growth, sustainability, leather processing, relocation, urban planning, environmental economics, redevelopment

## Introduction

Throughout the processes of industrialization in urban development history, 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 urbanization (Turner et al., 2007).

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 (Hossain, 2008). Among these industries, the 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 (Karn and Harada, 2001). A total of 249 tanneries which comprise 95 per cent of the tanneries in Bangladesh (Huq, 1998) distinguish Hazaribagh as the principle leather processing zone of the country. This zone fosters the total foreign currency earned by Bangladesh from the footwear and manufactured leather goods. In the economic year 2008–2009, the currency income was \$250 million and it shared 1.83 per cent of that annual national GDP (Aggarwal et al., 2009; Sharif and Mainuddin, 2003).

In contrast, the uncontrolled and unplanned expansion of this industrial zone has been extending its pressure on its physical environment. The noxious leather processing activity finally converted the zone into a brown field (Shams et al., 2009). 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 (Kashem and Singh, 1999; Maurice, 2001; Shams et al., 2008). All the liquid wastes carried by the city corporations’ drains are deposited to the low-lying lands of Hazaribagh and 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—the Buriganga River (Rahman and Karim, 1997). Thus, the noxious leather tanning industries along the river bank of Buriganga at Hazaribagh has turned out to be the principle threat to the sustainability of the capital city of 16 million people (Arias-Barreiro et al., 2010).

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 23 October 2003 (Rabbani, 2009). According to the agreement, the Hazaribagh tanneries should 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. Controversies have already been raised that to what extent this relocation project would contribute to the sustainability of the city (Hoque and Clarke, 2012; UNIDO, 2000).

Promoting sustainability in the project concerning urban development is a major challenge of the twenty-first century (Turner et al., 2007) and so it is in case of the Dhaka city (Rabbani, 2009). 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 (Hossain et al., 2007; Ilias et al., 2011; Zahid et al., 2006). It is evidenced in the literature that in similar contexts, attempts have also been made by governments to implement *top-bottom* leather processing industry relocation projects, like in Tamil Nadu, India (Kennedy, 1999); Cairo, Egypt (Bartone and Benavides, 1997) and in Mexico (Blackman, 2000), but all of them have failed. The reasoning of this failure goes back to the classical concept of environmental sustainability for urban development proposed by Goodland (2005). Goodland (2005) 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.

This paper, based on the Goodland (2005) proposed sustainable urban development parameters, reviews the Hazaribagh tannery relocation project plan proposed by the government of Bangladesh from

the urban planning and environmental economics points of view. It applies the Social Theories of the City and the three environmental economics theories—Willingness to Pay, Pigovian Tax and Hedonic Pricing Method. 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 sustainable urban growth 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.

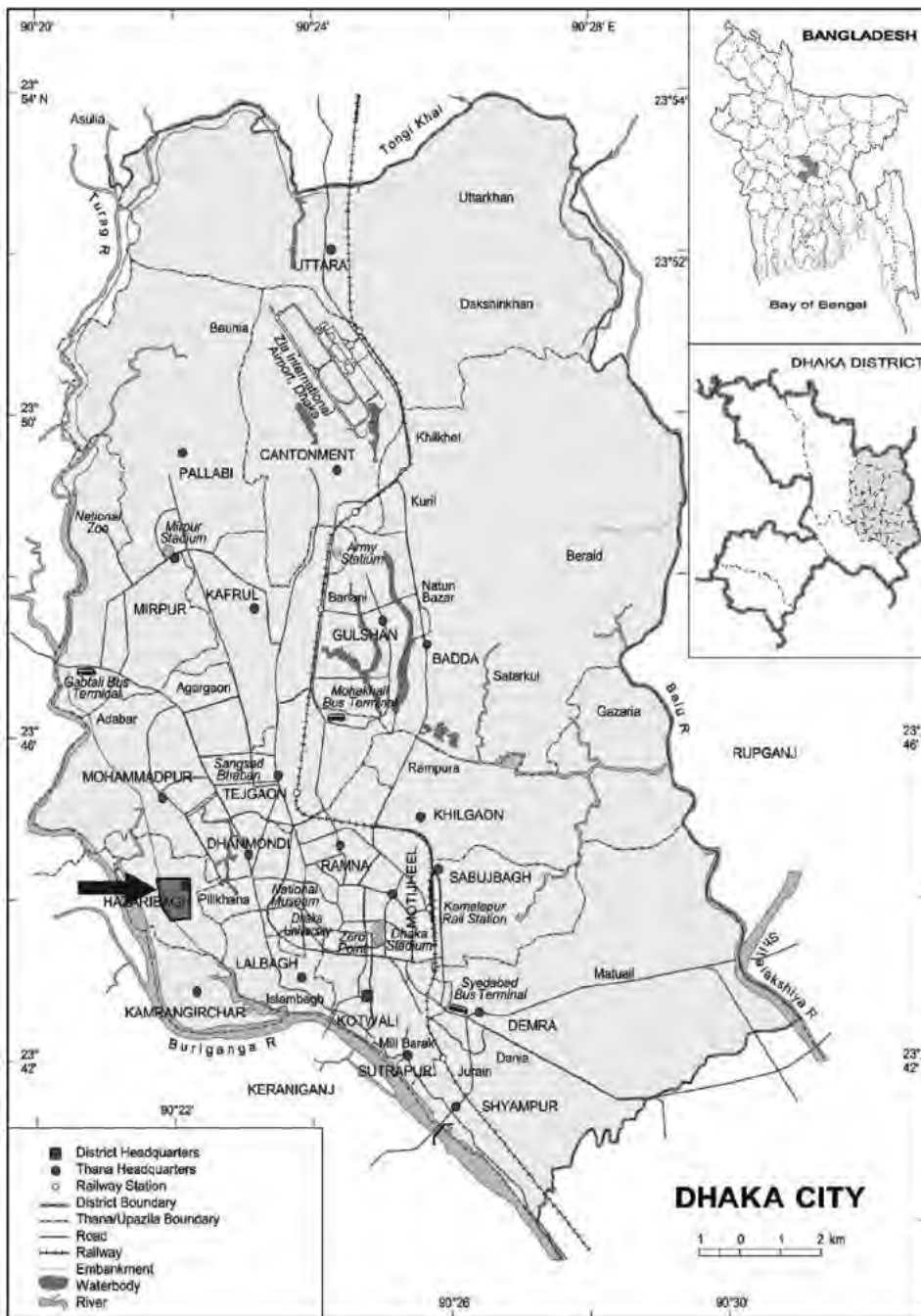
## Context and Methodological Framework

### 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, BFLFEA and BTA (BTA, 2009), a site at Chandranarayanpur of Savar *thana*, situated at the bank of Dhaleswari River; was selected for the development of the new tannery estate. The present location of Hazaribagh tannery area is shown on the administrative map of Dhaka city (ASB, 2012) (Figure 1(a)) followed by the detailed layout of the Hazaribagh tannery area (Figure 1(b)) and both the proposed site for relocated tanneries and the present tannery area located on the Dhaka Detail Area Plan Map (RAJUK, 2012a) (Figure 1(b)). The total area covered by the tannery structures at Hazaribagh is 61.75 acres. In the detailed area plan of the Dhaka city, the present Hazaribagh tannery location is demonstrated as a residential area whereas the proposed site for new tannery estate is identified as an industrial zone (Figure 1(b)) surrounded by agricultural land and water bodies at large extent. The layout design and plot allotment in the proposed site for relocated tanneries was performed by Sheltech Consultants Pvt. Ltd.<sup>1</sup> According to their project report (Sheltech, 2009), the planned area of this site is 187.90 acres with another 200 acres for future expansion. Fifty four tanneries in Hazaribagh were excluded in the project layout plan and no provision has yet been made for them.

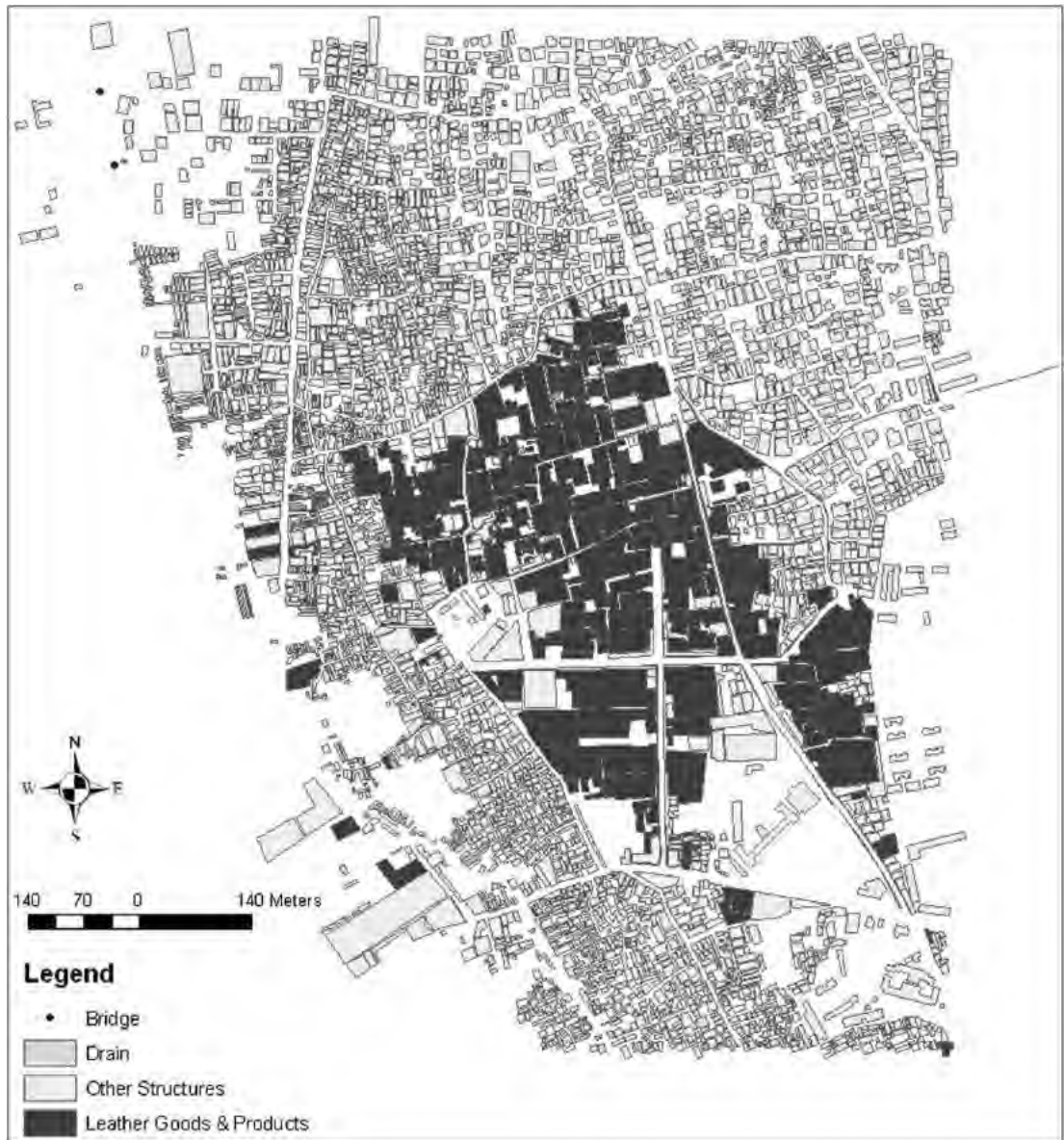
The original time period of the project was January 2003—December 2005, but later it was revised to January 2003—May 2009. Thus, the tanneries were to be relocated by December 2005, but the failure of the deadline due to the unwillingness of the tannery owners led to an extended deadline until May 2009 (BTA, 2009). The target was essentially failed again due to the disputes of the tannery owners with the project executers regarding different socio-political issues. On 13 May 2009, the Supreme Court of the People's Republic of Bangladesh gave a jurisdictional order to complete the relocation of the tanneries by 28 February 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 (Karim et al., 2012).

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 budget estimation (BTA, 2009), 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.

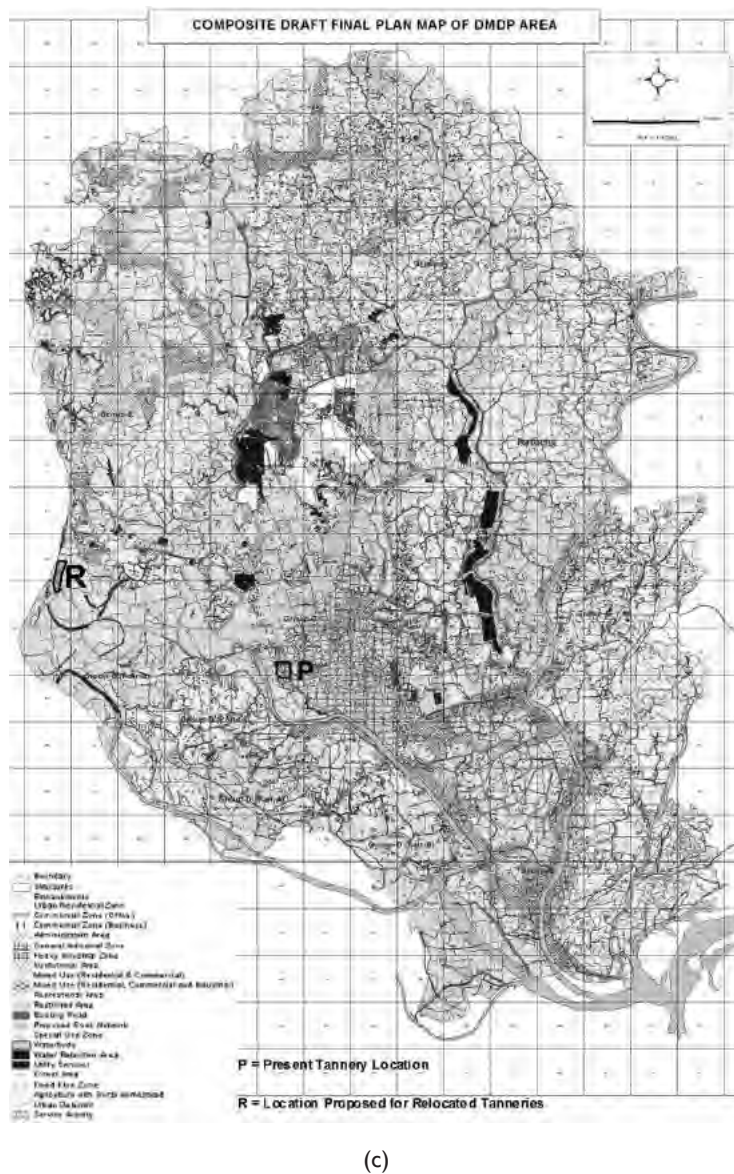


(a)





(b)



**Figure 1 (a).** The present Location and Boundary of the Hazaribagh Tannery Area identified on the Dhaka City Administrative Map (ASB, 2012); **Figure 1(b).** The detailed Layout of Hazaribagh Tannery Area Representing the Buildings and Structures Used for Leather Goods and Products Manufacturing; **Figure 1(c).** The Present Location—P, and the Proposed Site for the Relocated Tanneries of Hazaribagh—R, Identified on the Dhaka Detailed Area Plan Map (RAJUK, 2012a). The Original Map Legends are Available in the Original Project Plan (RAJUK, 2012a)

**Source:** Field Survey, 2009.

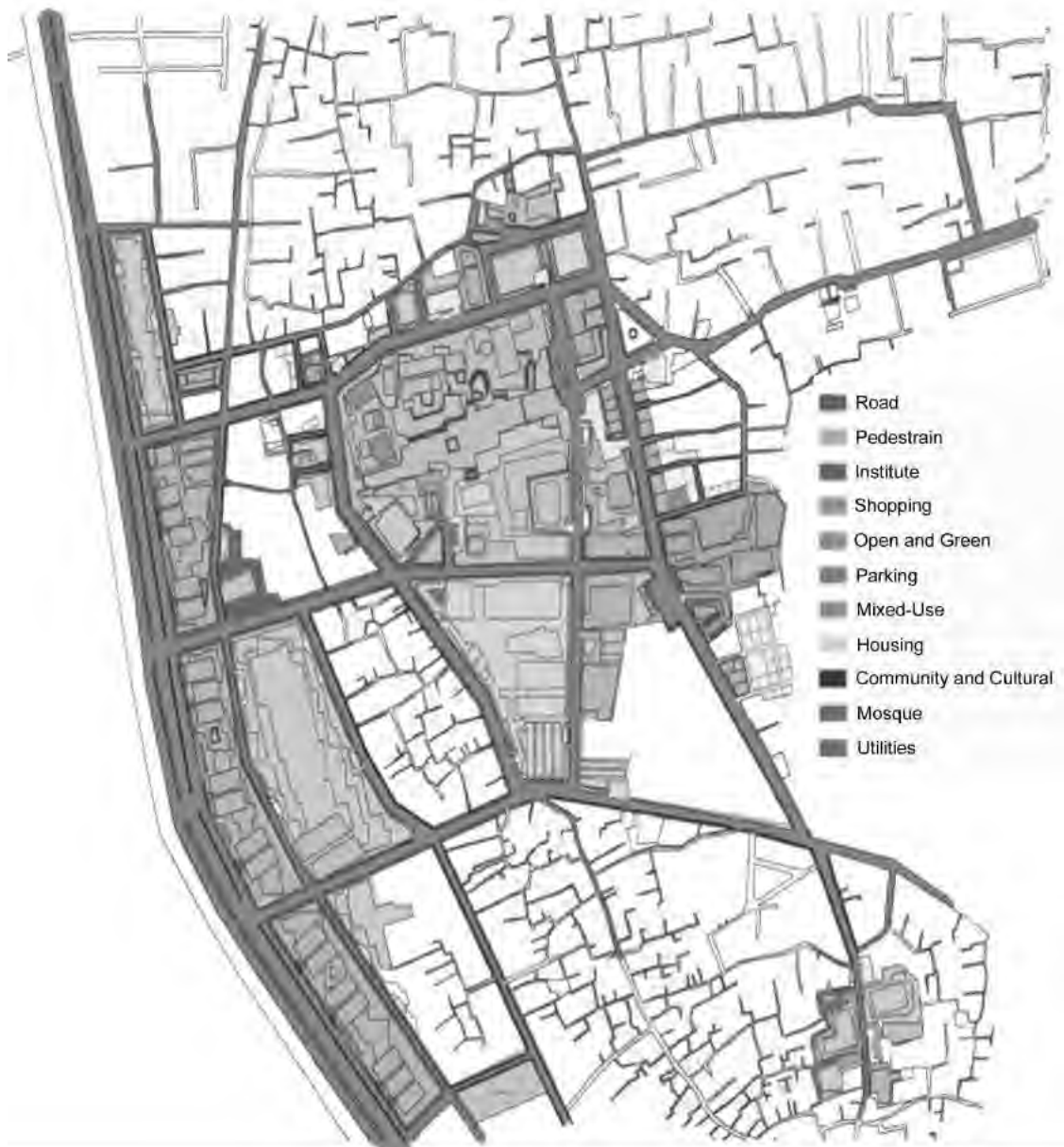
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After the completion of the relocation of the tannery industries to the Savar Tannery complex; the government of Bangladesh has a redevelopment plan for the Hazaribagh area which is undertaken within the framework of the Dhaka detailed area plan (RAJUK, 2012a). Figure 2 represents the existing land use in the Hazaribagh tannery area and the proposed redevelopment plan after the relocation of the tanneries.



(a)





(b)

**Figure 2 (a).** Existing Land uses in the Hazaribagh Area (Author-Produced from the Land Use Data Provided by Sheltech (2009); **Figure 2(b).** The Proposed Land Uses for the Redeveloped Hazaribagh Area After the Relocation of the Tanneries According to the Dhaka Detailed Area Plan (RAJUK, 2012a)

**Source:** Field Survey, 2009.

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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)<sup>2</sup> with collaboration of the Khulna University, Bangladesh<sup>3</sup>. The project report (ACLIMA, 2007) outlined a very complicated, time consuming and expensive procedure to get rid of the environmentally threatening elements in Hazaribagh.

### *Data and Methodology*

For the primary data collection, an extensive Questionnaire Survey (Suskie, 1992) was carried out on the owners of 50 randomly selected tanneries in Hazaribagh which constitutes 25 per cent of the total number of tanneries (249). Figure 3 represents the distribution and location of the leather processing industries (tanneries) 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.

The secondary data, that is, relocation project description, stakeholders information, project cost, time phase, etc., were collected by personal visits to the Institute of Water and Flood Management (IWFM)<sup>4</sup>, The World Bank Bangladesh (WBB)<sup>5</sup>, the Institute of Water Modeling (IWM)<sup>6</sup>, the Society for Environment and Human Development (SEHD)<sup>7</sup>, the Department of Environment of Bangladesh (DOE)<sup>8</sup>, the Bangladesh Small and Cottage Industries Corporation (BSCIC)<sup>9</sup>, Bangladesh Tanners' Association (BTA)<sup>10</sup> and the Sheltech Consultants Pvt. Ltd.<sup>1</sup>

The involvement of the stakeholders especially the social community, which in case of the leather processing industries is the tannery owners' community, is analyzed by applying the famous urban planning theory—Social theories of the City introduced by Bowley et al. (1997). The tannery owners were surveyed according to the ideology that where they were willing to keep their tanneries (Bowley et al., 1997; Goodland, 1995; Turner et al., 2007). 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 are 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. When all these prerequisites are met then the location of the industry can be in a fringe location away from the activity centres of the city. In such case, the city growth should be controlled. Otherwise, as the location of the industries always works as the attraction hub for activities, the activity centres will continue propagating and soon find their locations near the industries and include the industries inside the city again. 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 (Bowley et al., 1997; Goodland, 1995). 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 (will be discussed in detail in the result section) and at the same time the potential environmental impact of redeveloping the Hazaribagh brown field to the proposed residential area is also analyzed.

To analyze the economic sustainability, three primary concepts of environmental economics are applied—Willingness to Pay, Pigovian Tax and Hedonic Pricing Method as proposed by Kolstad (2011)

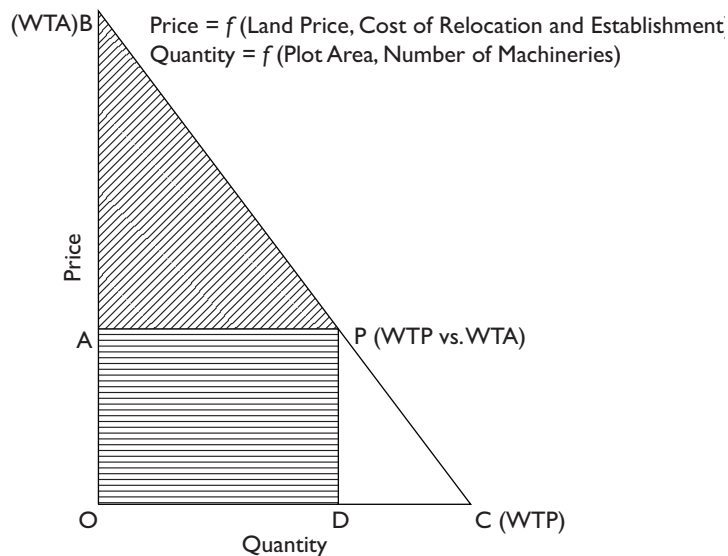


**Figure 3.** The Distribution and Location of the Surveyed Leather Processing Industries among the Leather Processing Industries in Hazaribagh with their Daily Production Capacity, Solid and Liquid Wastes Disposal (Assigned to the Percentage of the Surveyed Tanneries)

**Source:** Field Survey, 2009.

and Turner et al. (1994) and Goodland (2005) conformably. A measure of an individual's preference for an option in the market 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 (Turner et al., 1994). 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. 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. The willingness to pay of the tannery owners for the relocation was analyzed from the surveyed data and in parallel their compensation and subsidy demands were also analyzed. To be simplistic, 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.

Pigovian Fee or Pigovian Tax is a tax imposed by the government to make pollution costly to polluters so that polluters produce less pollution (Kolstad, 2011; Pigou, 2002). There are two approaches 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



**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

**Source:** Turner et al., 1994.



Pigovian tax. Another approach is to calculate the cost of reducing individual's exposure to certain pollution from an industry; since there is nothing a person can do to reduce his or her exposure 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 it is evaluated.

The hedonic pricing method (HPM) (Conrad, 2010; Kolstad, 2011; Turner et al., 1994) attempts to evaluate environmental services; the presence of which directly affects certain market price. If the non-environmental factors in (1) can be controlled, then any remaining difference in house price can be shown in the difference of the environmental quality (Conrad, 2010).

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

Based on the hedonic pricing method, the potential price for the houses in Hazaribagh, redeveloped as a residential area after the relocation of the tanneries, is identified and evaluated according to the affordability of the future residents. A contamination index (Backmann et al., 1998; Bokar et al., 2004) for the Hazaribagh area based on the measurements from the stations sanctioned by ACLIMA (2007) and comparing to the human tolerance threshold is calculated 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. The contamination indices calculated for Hazaribagh at different station points are interpolated using inverse distance weighting and thus a continuous map of contamination index in Hazaribagh is prepared.

## Results and Discussion

### *Jeopardy of 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 per cent) who are not willing to move to the proposed tannery complex. Only 18 per cent 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. The stake of the tannery owners is not served by this government policy. The analysis also reveals that the owners, who (18 per cent) are willing to move to the proposed Savar tannery complex is pushed by only one reason, which is:

#### *The Government Policy Pressure to Relocate*

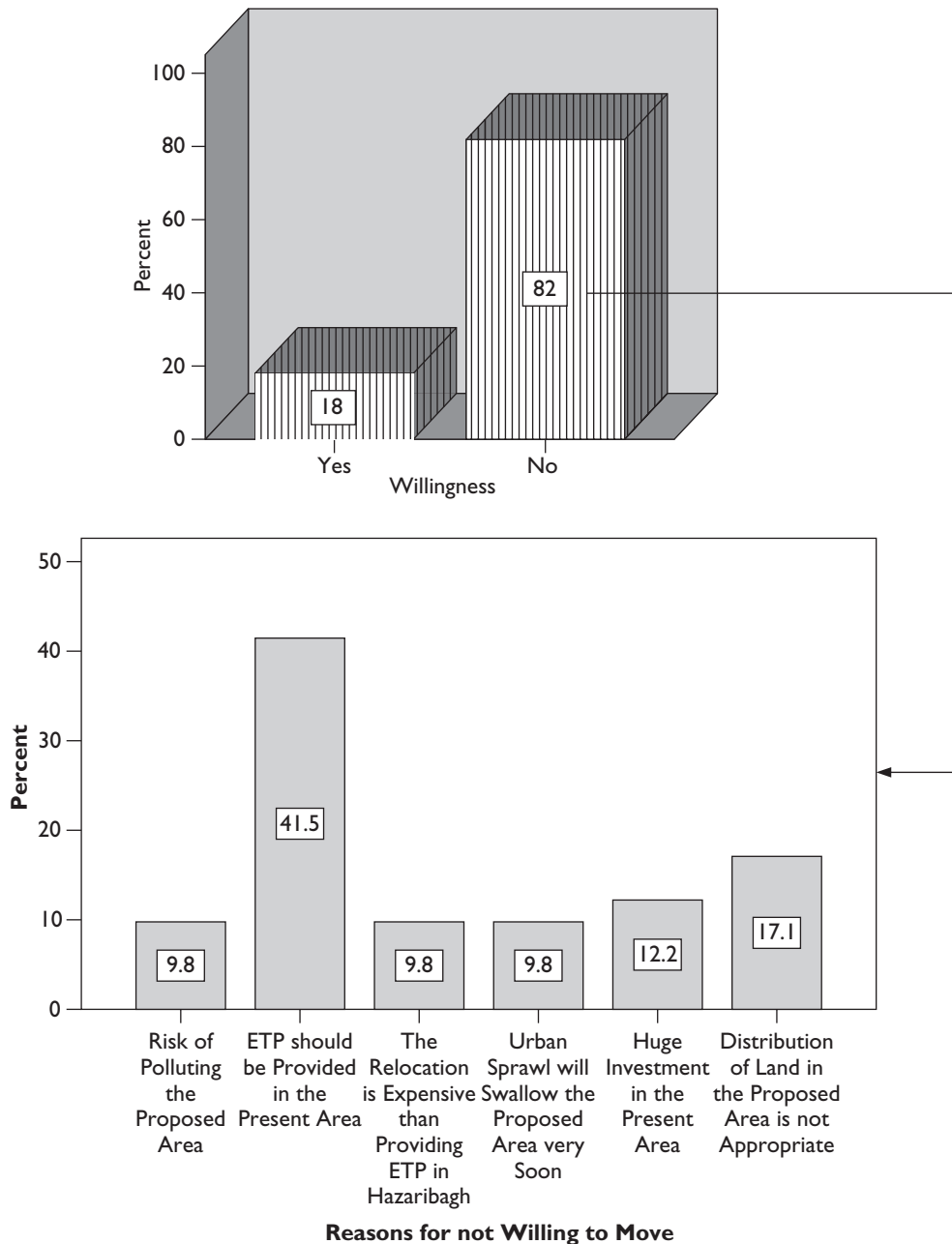
They claim that the government has been blaming them for environmental pollution and degradation of Hazaribagh for a long time and has also been refusing to provide them with financial assistance for

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.

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

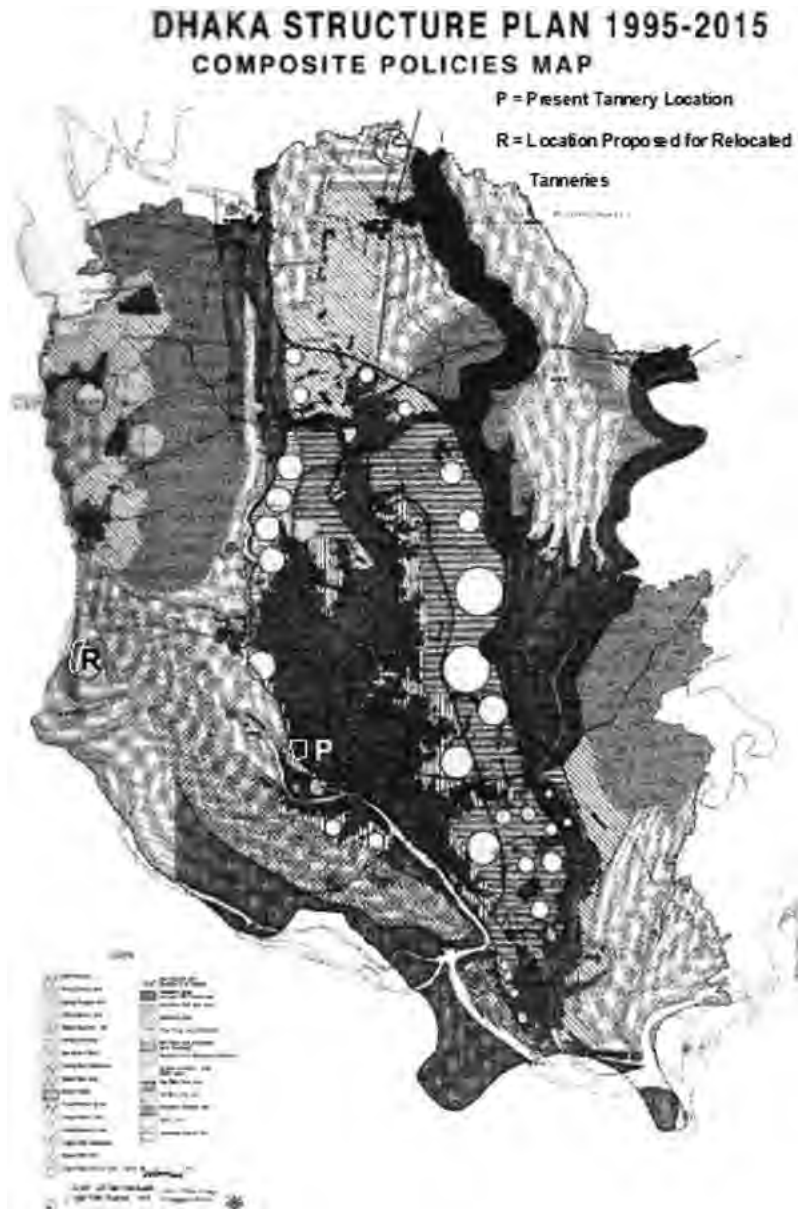
1. There is a tremendous risk of polluting the proposed area at Savar by the tannery waste despite provision of the CETP. It might be the case that another brown field like Hazaribagh will be created at Savar. The tannery owners are afraid that they would be blamed again for that environmental pollution.
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 as 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 is that the tanneries' location is at the centre of Dhaka city and they should be away from any of the activity centres. The tannery owners' argument is that the rapid urban growth will swallow the proposed area 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. 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 the 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 the section 'Context: A Brief Description of the Relocation Plan' and illustrated in Figure 1, the proposed industrial use of leather processing in the proposed Savar location is surrounded by the agricultural lands and water bodies at a large extent. While analyzing the justification of such a disputing land use, this appears to be a serious violation of the Dhaka Structure Plan (RAJUK, 2012b) as illustrated in Figure 6. The plan recommended only agricultural land use in that area because of its being flooded regularly during the wet seasons and a flood retention pond is proposed in its proximity (Figure 6). 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(c) and 6). Thus, apart from the installation of CETP, from any disturbance at the extreme upstream there is a high risk of pollution of the entire surface water sources of the Dhaka city. The surrounding agriculture which solely



**Figure 5.** The Comparative Willingness and Unwillingness of the Leather Industries' Owners of Hazaribagh to Relocate and the Reasons Claimed for Not Willing to Relocate

**Source:** Questionnaire Survey, 2009.



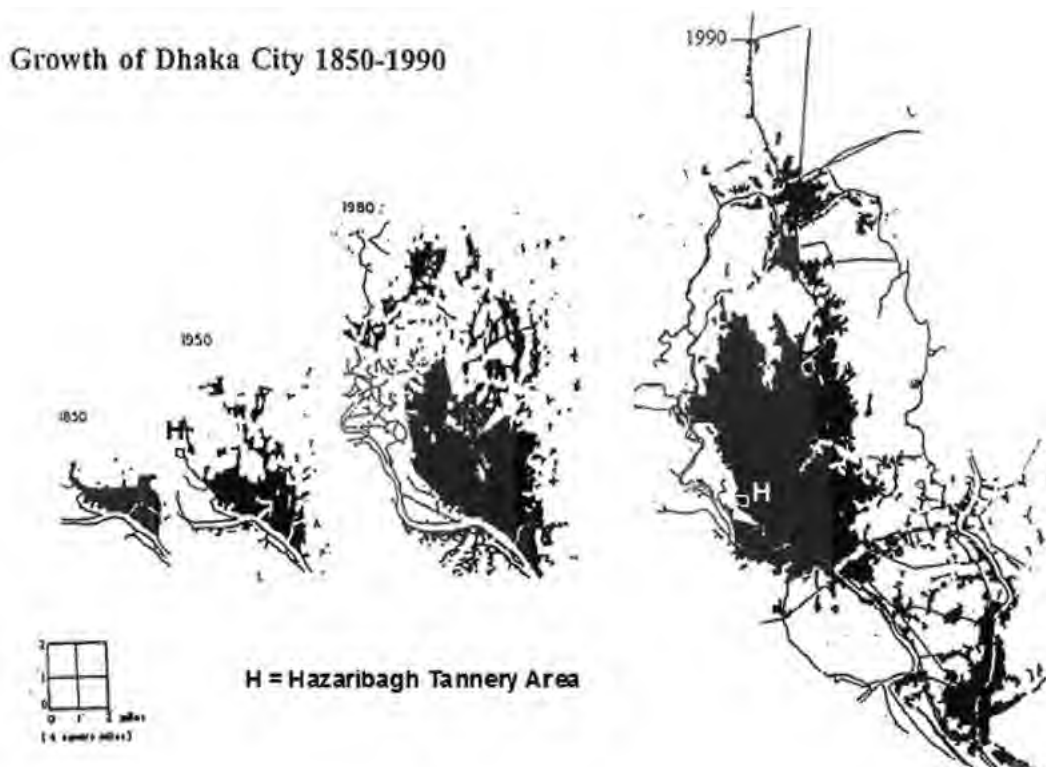
**Figure 6.** The Present Tanneries' Location at Hazaribagh—P and the Proposed Site at Savar for the Relocated Tanneries—R, Identified on the Dhaka City Structure Plan Map (RAJUK, 2012b). The Hazaribagh Location Depicts the Proposed Built up Area for Urban Development Whereas the Savar Area Depicts the Flood Flow Zone facilitating a Flood Retention Pond. For the Original Legends, Readers are Referred to the Original Project Plan Map (RAJUK, 2012b)

**Source:** Field Survey, 2009.



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.

In addition, as represented in the scanned map of the Dhaka city growth during 1850–1990 in Figure 7, which was collected from RAJUK, 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, it became a part of the main activity centres of Dhaka city and the city expanded beyond Hazaribagh area on the other side of the Buriganga river (Figure 7). Now Hazaribagh is situated at almost the centre 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 (Hossain, 2008), eventually the proposed area for tanneries will also be a part of main activity centres of the Dhaka city within next ten years. In a nutshell, relocating the industries to the proposed location without supervising the zoning principle of the Dhaka city, which is illustrated in the structure plan, is not a sustainable decision to make.

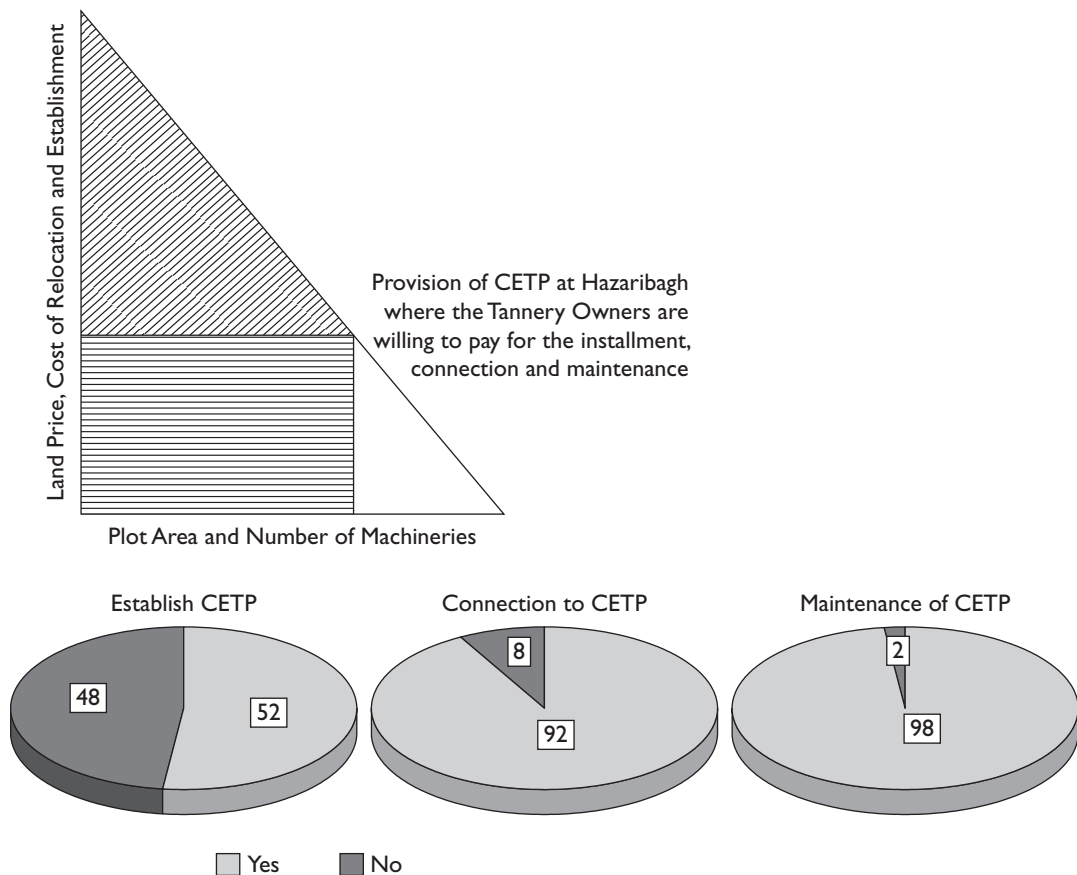


**Figure 7.** The Scanned Map of the Growth of the Dhaka City During 1850–1990, Showing the Changing Location of Hazaribagh from the Fringe to the Activity Centre

**Source:** Field Survey, 2009.

### Jeopardy of Relocation from the Environmental Economics Point of View

As described in the section 'Data and Methodology', 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 8 that obviously neither the WTP nor the point of negotiation for the tannery owners is attainable in this relocation project. The only possible stage is the WTA where the tannery owners accept all the price variables as zero, that is, they do not need to pay at all for the purpose of relocation. The tannery owners who are willing to relocate (18 per cent) demand complete compensation and subsidy to accept the relocation project. Moreover, as described in the previous section, majority



**Figure 8.** The Point of Negotiation is Attainable by Providing CETP at Hazaribagh Instead of Relocating the Industries Since Majority of the Tannery Owners are Willing to Pay for the Establishment, Connection and Maintenance of CETP at Hazaribagh

**Source:** Questionnaire Survey, 2009.

of the tannery owners (82 per cent) is not willing to move to the new location and therefore neither the point of negotiation nor WTA is attainable for them even with compensation and subsidy. Hence, 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.

The WTA of the tannery owners is attainable under the conditions that exclude the actual project cost, that is, land development, infrastructure provision, CETP installation, connection and maintenance, etc.

1. The wooden 'drums and pedals' used in the tanneries are immovable 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 of the drums and pedals. The foundation, gas, electricity and water supply connection to each tanning machine will be damaged at Hazaribagh because of relocation and they should be re-established at the new location. So, BDT 200000 should be provided as subsidy for the reestablishment of each of the machineries of each industry.
2. The investment on the existing tannery buildings at Hazaribagh should be returned as a compensation of 50 per cent of the present market value of these buildings.

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. 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 (including 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 per cent of the relocation project cost. The total area of Hazaribagh tannery is 61.75 acre which is 31 per cent of the total land area of the proposed Savar tannery complex. Therefore the proper infrastructure redevelopment should not cost more than 31 per cent of the infrastructure development cost at Savar given that the infrastructures have already been developed at Hazaribagh. Since 42 per cent of the surveyed tannery owners denied paying for the CETP establishment, government might need to bear the total establishment cost (Figure 8), therefore it is included in the analysis of the cost. Therefore, the point of negotiation is attainable for the tannery owners if the government redevelops Hazaribagh tanneries with environment friendly tanning equipments instead of relocating.

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 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 per cent of its establishment cost (BTA, 2009). 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:

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

**Table 1.** The Estimated Expenditure of the Government as Subsidy and Compensation and for the Redevelopment of Hazaribagh as an Environment Friendly Leather Processing Zone.

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 - I	BDT 2.45 billion	BDT 2.45 billion
2. Reestablishment of Machinery—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
<b>Total</b>		<b>BDT 5.93 billion</b>	<b>Total</b>		<b>BDT 3.57 billion</b>

**Source:** Questionnaire Survey, 2009.

**Notes:** The expenditures are calculated following the Regional Program for Pollution Control (UNIDO, 2000) and the Memorandum of Understanding (BTA, 2009) for Hazaribagh.

This Pigovian tax cannot totally be imposed on the tannery owners if they relocate with their industries to Savar for two reasons—(a) 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; (b) they will not be responsible for the life threatening pollution in Hazaribagh anymore since they have accepted 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.

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. The physiochemical composition of the soil and water of Hazaribagh is presented in Table 2 which is calculated from the measurements of 15 stations sanctioned by ACLIMA.

The surface of the contamination index, as represented in Figure 9, reveals that a significant number of sites in Hazaribagh are too lethal to human body to promote a residential land use inhabiting children without major remediation.



**Table 2.** The Physio-chemical Composition of the (a) Soil and (b) Water in Hazaribagh Averaged from the Measurements of 15 Different Stations (ACLIMA, 2007)

Station	Suad %	Silt %	Clay %	pH		Organic Matters %	Exchange Capacity dS/m	Cation Exchange Capacity meq/100g	Each Cation meq/100g			Available Content ppm				
				S/E	CaCl <sub>2</sub>				Ca	Mg	K	Na	Cl	N	P	K
	35.5	48.3	81.7	7.3	6.9	3.4	3.3	20.9	14.8	3.6	0.5	6.9	47.4	723.5	2.7	139.8

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



**Figure 9.** The Interpolated Contamination Index, Which is Calculated by Comparing the Physio-chemical Composition of Hazaribagh Soil and Water to the Human Tolerance Threshold

**Source:** Backmann et al., 1998; Bokar et al., 2004.

Due to this highly toxic composition of the soil and water of Hazaribagh as described in Table 2 and Figure 9, a multistep and wide-ranging treatment of the Hazaribagh is essential in the 'lagoons' (closed water sources) and the isolated pollution sources. In addition, restrictions on several sites for particular

uses in short-term and long-term duration are also applicable. The required 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.

Accordingly, the environmental variable will highly increase the hedonic prices of the houses of the housings which would be developed in the site. 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. Even thereafter, there is always the risk of an unhealthy and threatening living environment in Hazaribagh due to these excavation and demolishing processes. Most importantly, what happens to 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 as a residential area without installing proper precautionary measures, a serious threat will be entailed to the social and environmental sustainability.

### Discussions

Review of the Hazaribagh tanneries' relocation plan from the urban planning and environmental economics points of view clearly depicts that the project is not justified from sustainability aspect. As illustrated in the classical definition of environmental sustainability (Goodland, 1995) and in the modern urban planning challenges for ensuring sustainable development (Campbell, 1996), 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

**Table 3.** The Remediation Procedure, Including Treatment of Water and Soil and the Restrictions on Use, Essential for the Hazaribagh Area Before Developing it to a Residential Area

Remediation Procedure of Hazaribagh Soil and Water	
Treatment of Hazaribagh Lagoons and Isolated Pollution Sources	Restriction on Uses because of the Diffused Pollution Sources
<ul style="list-style-type: none"> <li>• Removal of superficial wastes - sludge in lagoons and wastes on dump sites.</li> <li>• Excavation of the visible soil pollution - buried wastes, organic soils.</li> <li>• Excavation of the rest of the soil pollution -based on chemical analysis.</li> <li>• Covering the soil with a concrete layer or a foil.</li> <li>• Removal of several meters of topsoil as a remediation work before constructing new buildings.</li> <li>• For deeper soil layers, in situ techniques that treat the contamination in place.</li> </ul>	<ul style="list-style-type: none"> <li>• Restriction to grow vegetables on the site.</li> <li>• Restriction to use groundwater for drinking.</li> <li>• Restriction to pump groundwater.</li> <li>• Restriction to live on some parts of the site.</li> <li>• Restriction to enter some parts of the site.</li> <li>• Tube well Protection.</li> <li>• Reactive Barrier or Reactive Zone.</li> </ul>

Source: ACLIMA, 2007.

in its assimilative capacity since the Dhaka structure plan protected it as a flood flow zone with a flood retention pond (ASB, 2012). In parallel, in Hazaribagh, where the absorptive capacity has already been degraded, the process of redevelopment of the residential use and implementation will highly degrade the local environment. Goodland (Goodland, 1995) 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 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 Failed

Country	India	Egypt	Mexico
<b>City</b>	<b>Tamil Nadu</b>	<b>Cairo</b>	<b>Leon</b>
<b>Number of Tanneries</b>	577	320	675
<b>The River Polluted</b>	Palar	Nile	Gomez
<b>Causes of Failure of Relocation Projects</b>	Appeals from social communities including tannery owners.	Unwillingness of the tannery owners to assist the government in ownership and transfer issues.	No progress because of the unwillingness of the tannery owners.

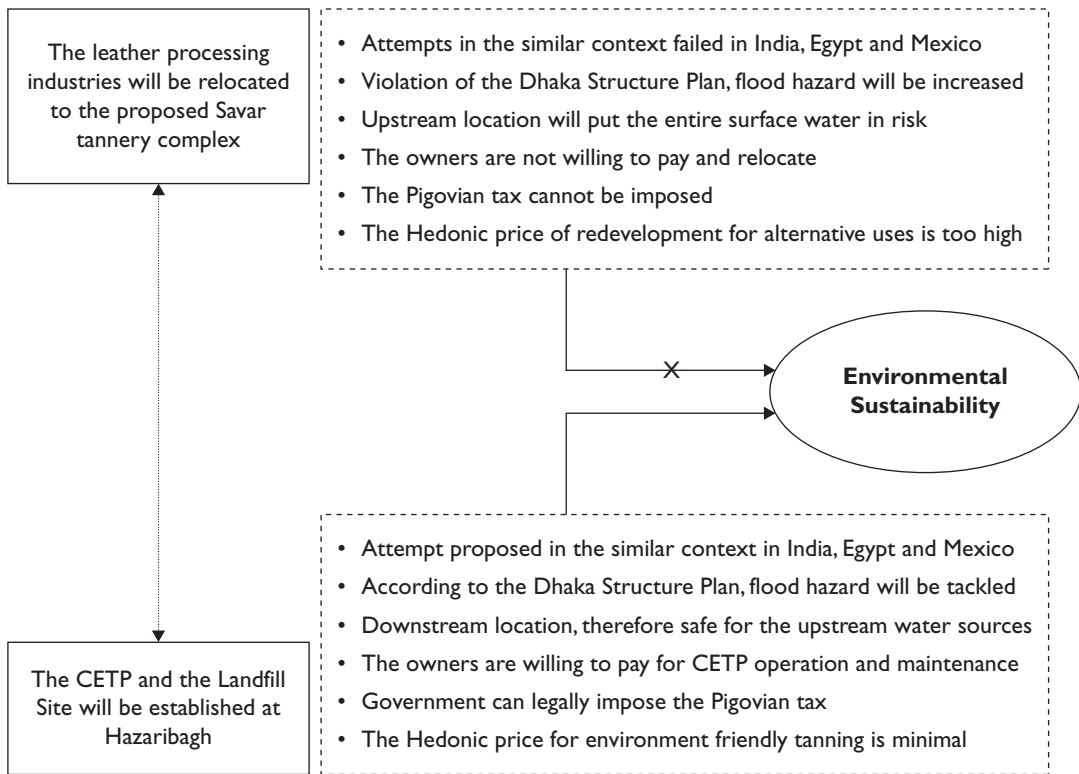
**Source:** Bartone and Benavides, 1997; Blackman, 2000; Kennedy, 1999.

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 sustainability. In a nutshell, the comparison of the options—relocation and not relocation in Figure 10 adds weight to the latter.

## Conclusions

This paper reviewed the Hazaribagh leather processing industry relocation plan from the urban planning and environmental economics points of view applying the concepts of the social theories of the city, willingness to pay, Pigovian tax and hedonic pricing method. Within the limited scope of the study, a lot of aspects cannot be covered but they are subject to future studies. 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 (ACLIMA, 2007) 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. The monetary values calculated for subsidies and compensations regarding relocation and for the redevelopment of





**Figure 10.** 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

**Source:** Questionnaire Survey, 2009 and Literature Review, 2012.

Hazaribagh as an environment friendly zone are negotiable though they are highly supported by the literature and the local authorities. 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 neighbouring 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 sustainable development of Dhaka city. 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 sustainable urban growth 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. At last but not the least, to compromise between the political decision and scientific aspects of sustainable urban development is still a major 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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## Notes

1. <http://www.sheltech-bd.com/#home>
2. <http://www.aclima.net>
3. <http://www.kuet.ac.bd/>
4. <http://www.buet.ac.bd/iwfm/>
5. <http://www.worldbank.org/en/country/bangladesh>
6. <http://www.iwmbd.org/>
7. <http://www.sehd.org/>
8. <http://www.doe-bd.org/>
9. <http://www.bscic.gov.bd/>
10. <http://www.switchretiebd.org/partners/bta>

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