Open Access | Original Research
International Journal of Social Sciences and Economic Review, 5(1), 2023 | PP: 30– 40
https://doi.org/10.36923/ijsser.V5i1.184

Environmental and Socio-economic Impact Assessment in Hazaribag Area of Dhaka for Tannery Relocation

Ashik Iqbal[1], Md. Hasibul Hasan[2], M. Rasheduzzman[3], Shuva Ranjan Paul[4], Rubaiya Hamid[5]

Article History:

Received: 13-02-2023
Accepted: 28-02-2023
Publication: 30-03-2023

Cite this article as:

Iqbal, A., Hasan, M.H., Rasheduzzman, M., Paul, S.R., Hamid, R. (2023). Environmental and Socio-economic Impact Assessment in Hazaribag Area of Dhaka for Tannery Relocation. International Journal of Social Sciences and Economic Review, 5(1), 30-40. doi.org/10.36923/ijsser.v5i1.184

Corresponding Author(s):

Ashik Iqbal
Institute of Water and Flood Management, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.
Email: iqbal.ashik.ce@gmail.com

Abstract: The study aims to assess the impact of tannery relocation on the environment, social and economic conditions, livelihood, and the perceptions of institutions and stakeholders in the Hazaribag area. This research seeks to understand both the positive and negative effects of relocation, particularly in terms of environmental improvement and socio-economic challenges. The study employs a mixed-method approach, including a field survey and Participatory Rural Appraisal (PRA) tools such as Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). This framework is designed to gather qualitative data from a wide range of stakeholders, providing a comprehensive understanding of the post-relocation scenario. The findings indicate that the relocation has led to significant improvements in the surrounding environment, including better air quality, reduced Odor, and enhanced surface water conditions. However, the relocation has also resulted in substantial socio-economic challenges. Many tannery workers have become unemployed or have been forced to take jobs outside their areas of expertise, leading to a decline in the local economy. Additionally, conflicts have emerged between tannery owners and workers. The government's management of the post-relocation situation in the brownfield has been inadequate. The study concludes that while tannery relocation has had a positive environmental impact, it has also created significant socio-economic issues that need to be addressed. The current management of the post-relocation scenario is insufficient, particularly in addressing the socio-economic needs of the affected population.

Keywords: Hazaribag, Tannery Industry, Relocation, Impact Assessment, Environmental Impact, Socio-Economic Impact

1. Introduction

Although Bangladesh is primarily an agriculture-dominated country, its development began to centre around the capital, Dhaka, which flourished in the 17th century (Azmat, 2009; Islam, 2014). This concentration led to significant industrialization within the city. The leather industry in Hazaribag was first established in 1960 and expanded following Bangladesh's independence in 1971 (Khan, 2017; Azom et al., 2012). From 1970 to 1995, the percentage of low- to middle-income countries contributing to the global production of light and heavy leather materials increased from 35% to 56% and 26% to 56%, respectively (Whitehead et al., 2019). However, when rapid industrial growth is concentrated in a particular region, pollution becomes inevitable (Whitehead et al., 2018; Iqbal and Swapnil, 2017). Among various industries, tannery effluents are particularly notorious for their high levels of toxicity and the extensive environmental and health hazards they cause, as argued by Whitehead et al. (2018). In Pakistan, for instance, nearly 600 tanneries in major cities such as Karachi, Kasur, and Sialkot have significantly increased environmental and human health risks (Syed et al., 2010). Similar consequences have been observed in Brazil, China, and India (Sankar, 2006).

The proliferation of the tannery industry in Hazaribag has drastically affected the environment due to untreated effluents being discharged into drains, rivers, and lakes. These pollutants leach into the groundwater or are emitted as particulate matter, leading to the accumulation of heavy metals in sediments, biota, and ultimately humans (DoE, 2003; Koukal et al., 2004; Hasan et al., 2019; Hossain, 2008; Huq, 1998). Poor environmental controls and the rapid establishment of tanneries in Hazaribag have exacerbated Dhaka city's pollution problem (Tinni et al., 2015).

Within the premises of the tanneries in Hazaribag, more than 200,000 residents were directly exposed to the hazards of tannery pollutants, while the broader population was affected through dietary intake and inhalation of pollutants (WHO, 2001; Fatema et al., 2018; Mohiuddin et al., 2016).

[1] Institute of Water and Flood Management, Bangladesh University of Engineering and Technology. Email: iqbal.ashik.ce@gmail.com
[2] School of Human Evolution and Social Change, Arizona State University, USA. Email: dezie@binus.edu2
[3] Institute of Water and Flood Management, Bangladesh University of Engineering and Technology. Email: rafi.cueturp@gmail.com
[4] Institute of Water and Flood Management, Bangladesh University of Engineering and Technology. shuvaranjanpaul@hotmail.com
[5] Institute of Water and Flood Management, Bangladesh University of Engineering and Technology. Email: erina_du@yahoo.com

The first tannery industry in Dhaka was established a century ago (Nur-E-Alam et al., 2018). Though bark tanning was initially practised successfully, the factory did not survive long. After the partition of the Indian subcontinent, 30 tanneries were built, eventually increasing to 343 (Khan, 2017). The Hazaribag tannery, established on the banks of the Buriganga River, is one such example. High population density, unsanitary conditions, poorly regulated industrial discharges, and untreated effluents have led to highly polluted rivers worldwide, posing significant threats to river users, groundwater, and associated water supply systems (Tinni et al., 2015). Due to the industry's high-risk nature, protective measures were never prioritized, allowing liquid effluents and solid waste to flow directly into the capital's main river, Buriganga, through sewers and adjacent regions (RAPID, 2019; Karim et al., 2013). Although policymakers first discussed the necessity of relocating the tanneries in 1991, it was challenging to implement these strategies within the city's core (Mohiuddin et al., 2016; Karim et al., 2013; Bhowmik, 2012).

Over time, the tannery industry at Hazaribag caused tremendous environmental degradation due to the absence of proper treatment processes for heavy metals and other organic matter. China et al. (2020) highlight the significant environmental impact of conventional tanning methods, which include generating large amounts of solid and liquid waste, releasing hazardous chemicals, and consuming high levels of energy. Various chemicals, such as sodium sulfite, chromium sulfate, bactericides, ammonium sulfide, ammonium chloride, CaO, and different acids, are used regularly during tanning and soaking processes (Azom et al., 2012). During processing, only 20% of these chemicals are absorbed by the leather, while the remaining 80% become waste (WWPP, 2010). Hazaribag tanneries released 88 million tons of solid waste and 7.7 million litres of liquid manure daily (Azom et al., 2012). The direct discharge of these wastes into the environment has severely contaminated the surrounding ecosystems (Bhuiyan et al., 2011). A staggering 95% of the tanneries in Hazaribag were established without proper planning, processing 60,000 tons of raw hides and skins while releasing nearly 95,000 litres of untreated effluents. These wastes have severely polluted the Buriganga River over the past forty-five years (Rasul and Khan, 2006).

The government of Bangladesh introduced several strategies to improve the conditions surrounding the tanneries, but none proved fruitful (Sarker, 2013). As a result, the government relocated the tannery industry from Hazaribag to Savar in April 2017, leaving a profound environmental and social impact (RAPID, 2019). However, the relocation process was fraught with delays, and only in 2017 was the shift finally completed with strict legislative measures (Bhowmik, 2012). This relocation had significant consequences for the inhabitants of Hazaribag, affecting their lives, environment, and socio-economic conditions.

The environmental and human health impact of the tannery industry has been a longstanding concern. Over the past few decades, several studies have addressed issues such as heavy metal contamination, the effects of tannery waste, and the environmental quality analysis of the Hazaribag tannery (Koukal et al., 2004; Hasan et al., 2019; Hossain, 2008; Huq, 1998; Fatema et al., 2018). However, no studies have been conducted on the environmental assessment post-relocation of the tannery industry (Azom et al., 2012; Hasnat et al., 2013). Identifying the consequences of the long and exhausting relocation process is critical (Rahman, 2022). This study fills a gap in the literature by presenting the scenario after the relocation, addressing the impact of relocation in Hazaribag.

The study adopts a multidisciplinary approach to assess the impact of tannery relocation on the surrounding environment, social and economic conditions, livelihood, and institutional and stakeholder perceptions in the Hazaribag area. This research examines the changes that occurred during two distinct periods: when the tannery industry operated in Hazaribag and after its relocation. Although complete environmental recovery may not be possible in the short term following relocation, noticeable changes were assessed based on the experiences of Hazaribag residents. The study contributes to a comprehensive understanding of the impact of tannery relocation in the area and provides valuable insights for future policy decisions.

2. Methodology

2.1 Study Area

Hazaribag is a Thana of Dhaka District located at 23.734722°N to 90.369444°E, having a total area of 3.58 km^2 (BBS, 2014). The area is shown in Figure 01, which is located along the Buriganga River. A total of 249 tanneries, comprising 95% of the Bangladesh tanneries, were previously found here for more than 46 years (Huq, 1998). This more than 50-acre industrialized area is surrounded by Dhaka's prestigious residential areas, i.e., Dhanmondi, Rayerbazar, and Lalbag. After the relocation, the site has not yet undertaken any significant planning. The Hazaribag tannery industrial area is now considered a brownfield (Khan, 2017). In the Bangladesh government's Detailed Area Plan (DAP), the Hazaribag area is planned to furnish a residential area after the relocation. Still, the authority has not yet undertaken any measures (Khan, 2017).

2.2 Data Collection And Analysis

This study focuses on field investigation and data collection. The quantitative data collection questionnaire survey was used, as well as the qualitative data KII and FGD. In order to collect the data, random surveys were conducted where an open-ended questionnaire was used. Before beginning this study, two co-authors conducted a reconnaissance survey to understand better the various issues involved. The field survey was conducted at the beginning of January 2020 when there was no effect of COVID-19 in Bangladesh, so the data do not include any impact due to the COVID-19 pandemic. An extensive literature review was also carried out in order to identify the

pertinent issues. A random survey of 100 stakeholders from the Hazaribagh tannery industry who worked or are still working in the tannery industry was conducted. The interviews were conducted in Bengali.

Regarding ethical standards, the Helsinki Declaration was followed to ensure ethical principles. Furthermore, ethical issues were appropriately maintained during data collection, such as providing respondents with a consent letter stating that their participation was voluntary, that their personal information would be kept confidential, and that no findings would be presented individually. Participatory Rural Appraisal (PRA) techniques were also employed, with 5 Group Discussions (GD) with local residents and 3 Key Informant Interviews (KIIs) with various tannery owners (Figure 02).

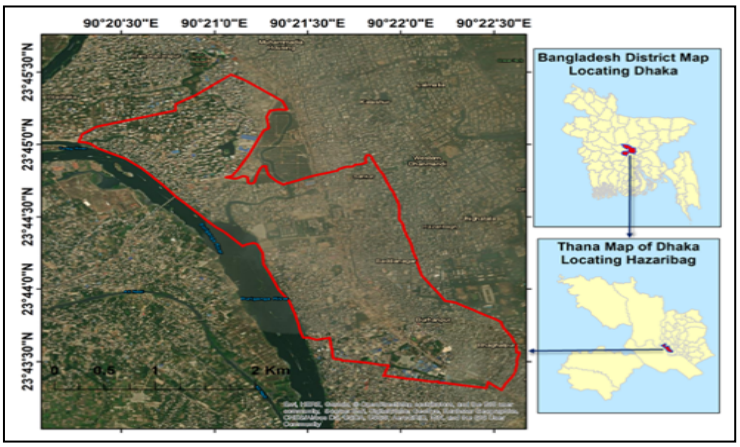

Figure 1: Study Area Map

Figure 2: Data collection of the study area (a) observing drainage conditions at Hazaribag while group discussion, (b) collecting information from the local businessman, (c) observing Buriganga river while survey, and (d) KII with a tannery owner.

Group Discussions (GDs) were held to identify tanneries' environmental and socioeconomic impacts and their relocations. GDs were carried out on various livelihood groups, particularly those who were directly or indirectly associated with the tannery industry. Most of the GDs have had a maximum of ten members. Out of these three KIIs, one was with the owner of the tannery, one was with the ward commissioner of the area, and lastly, with the official of the Department of Environment (DoE), Bangladesh. After aggregating all the information, the study results are prepared based on the collected perception of qualitative and quantitative data. All qualitative and quantitative data findings are described and graphically displayed using Microsoft Excel software for the result discussion section.

Table 1: Data Collection and Purpose

Data Collection	Number	Purpose and Respondent
Target group survey	100	Inhabitants or stakeholders of the Hazaribagh tannery industry who were present in both phases (during the tannery industry at Hazaribagh and after the relocation of the tannery industry to Savar).
Field Reconnaissance	1	Field reconnaissance was conducted to identify the potential areas which were impacted due to tannery relocation. Different livelihood groups who were linked with the tannery industry for the conduction of Group Discussions (GDs) later were also identified.

Group Discussions (GDs)	2	Group Discussions (GDs) were conducted to identify the social and environmental impacts of tannery relocations. Different GDs were conducted on different livelihood groups, especially those directly or indirectly linked with the tannery industry. A maximum of ten members have participated in most of the GDs.
Key Informant Interviews (KIIs)	3	Three KIIs were carried out. One of these three meetings was with the owner of the tannery, another with the ward commissioner of the area, and the third with a representative of Bangladesh's Department of Environment (DoE).

3. Results And Discussions

3.1 Personal Information Of The Respondents

Among the total respondents, 52% were male, and the rest, 48%, were female, where the maximum number of respondents (62%) were elderly (aged over 40). The average monthly income was 15,001-25,000, and 80% lived in the pucca house. 32% of respondents were labourers 36 were small businessmen (e.g. storekeepers), and the remaining were housewives (5%) and tannery owners (16%). Though 19% of people had no formal education, the rest had an educational background.

Table 2: Personal Information of the Respondents

Variable	Type	Frequency
Gender	Male	52
	Female	48
Education	Illiterate	19
	Primary	36
	SSC	25
	HSC	19
	Graduation	11
Housing Condition	Katcha/Slum	14
	Semi-Pucca	26
	Pucca	60
Occupation	Small Businessman	36
	Housewife	5
	Labour	32
	Tannery Owner	03
	Tannery Worker	24
Age Group	<18	14
	18-40	54
	41-59	20
	60+	12
Monthly Income	<10,000	16
	10,001-15,000	14
	15,001-25,000	41
	25,001-50,000	15
	>50,000	14

3.2 Environmental Impact

3.2.1 Outdoor Environment And Drainage

Figure 03 shows that the outdoor environment and drainage system in the Hazaribagh area was in a worse situation due to chemical wastes, as reported by nearly 100% of the respondents. Even the people of the site could not walk on the roads alongside the drains, which coincides with the Azom et al. (2012) and Karim et al. (2013) findings. The study found that the tanning industry was a significant source of pollution in the area, with high levels of heavy metals and organic compounds in soil, water, and air, which aligns with the findings of Parvin et al. (2022), Paul et al. (2022), Rahman et al. (2022). Hossain et al. (2021) provide a comprehensive review of the environmental pollution caused by the tanning industry.

Though the outdoor environment quality of Hazaribagh has improved after the tannery relocation, the quality is still not good enough. Rahman et al. (2022) demonstrated that the new tannery city, Savar, has started to increase its metal concentration (Cr, Pb, Mn, etc.) more than the recommended value. Some people in the surrounding areas of Hazaribagh feel the environment is right compared with their previous worse experiences, which supports the result of Hossain et al. (2021). According to people's responses, about 35% of people said this is better than before, and 15% are satisfied with the present situation. Besides, 5% of people are not satisfied with the condition and

reply to a worse situation. The findings of Haque et al. (2019) are closely related to our results, which highlighted the government's decision to relocate the tanneries to Savar to ensure environmental sustainability. Shifting the tannery industry frees the area from discharging wastes of alkaline beans and acidic tan into the residential area. However, municipal and household wastes still obstruct the creation of a healthy and beautiful outdoor environment. Those wastes make their way to the area's drainage system, thus obstructing the potentiality of creating a healthy and beautiful outdoor environment after the tannery relocation (Source: GDs and KIIs). On the other hand, the area was highly contaminated by prior activities, hazardous substances, and pollutants. Yet the pollution has not reverted to a fresh environment, and the area is considered a brownfield (Khan, 2017). While the relocation of the industry has led to some improvements in the outdoor environmental quality of the area, the lingering effects of pollution emphasize the need for continued monitoring and remediation efforts to ensure a healthy and sustainable outdoor environment in Hazaribag.

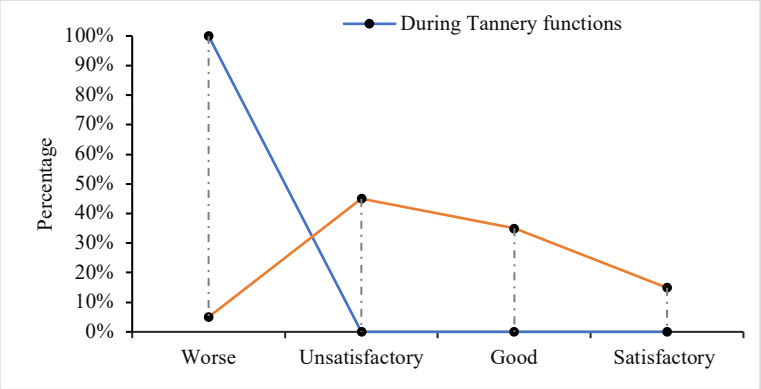

Figure 3: Change in Outdoor Environment and Drainage in Hazaribag

3.2.2 Odour In The Surrounding Area

During the tannery function, the area's odour was so intolerable and extreme that even the people living there and working in tanneries felt sick. Figure 04 represents about 80% of respondents as the worst situation and 20% as unsatisfactory. Many people had reported that the outsider people often vomited because of the foul odour of the tannery when they passed through the tannery area. Mainly, during summer (April-June), the odour spread surrounding Hazaribag regions due to high organic matter decomposition. China et al. (2020) indicate that the odour generated from tanneries affects physical and mental health. The reference study notes that the leather industry generates various pollutants such as heavy metals, chemicals, and organic compounds, that pose a significant threat to the environment. Uddin et al. (2022) found that air pollution increases during the soaking process and leads to a worse odour. This finding is consistent with this study, which found that the area's odour was intolerable and extreme during tannery operations. Bad smell is mostly created due to some composite wastes that are produced from the tannery, especially alkaline, having a large number of dissolved and suspended metals (Source: GDs and KIIs). This bad smell generated from the area not only affects physical health but also deteriorates the mental health of the human being. Muhammad and Haque (2012) argued that both the mental and physical health of the tannery workers is poorer than the residents of that area.

On the other hand, due to tannery relocation, respondents argued that the worse situation was diminished somewhat, where 15% replied for unsatisfactory 35% for good, and the rest 50% for satisfactory in the sense of odour. After the relocation, the odour condition is far better than in the experience. Also, air quality has improved compared to the previous time. Still, a few respondents of the study revealed that the air quality of the area has not improved up to the mark as expected. People still felt bad odour in this area that made them uncomfortable, but people hardly reported vomiting after the tannery relocation. One of the GD respondents said that, apart from the improvement of people's physical and mental health, the relocation of the tannery industry from a residential area like Hazaribag will help to improve children's as well as students' mental health.

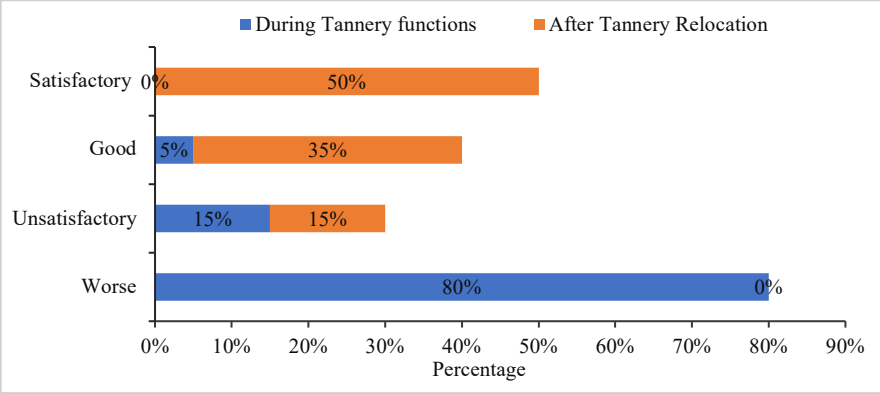

Figure 4: Change of Odor Condition in Hazaribag

3.2.3 Condition Of Surface Water

For the processing of leather, a lot of salt and other chemicals like hydrogen sulfides were produced as waste that may badly affect surface water quality (e.g., creating bad odour and taste, high hardness, and turbidity with toxicity) (Huq, 1998). Besides, a huge number of suspended materials (hairs from leather, fleshing, suspensions of lime, etc.) increase the turbidity of surface water. Resulting in the hamper of the water ecosystem and destroying fish species, fauna, and flora. Buriganga River is the best example said by the respondents (Mondal et al., 2014). Besides, sulfides are highly toxic to aquatic fishes and human health that were generated from tannery wastes. Chromium that is used in the tanning process could be highly toxic for the human body and water species, as there is a probability of forming highly toxic hexavalent chromium. Parvin et al. (2022) found that the Hazaribag tannery area is one of the major sources to produce chromium that feeds the water bodies of Dhaka. Additionally, other dissolved and suspended solids, chlorides, and ammonia were being discharged into different adjacent water bodies which decreased the water quality. However, the respondents revealed that the pollution trend for the tannery is starting to decrease after relocating the industry, and concerned authorities are trying to restore the Buriganga River water quality (Source: KIIs).

As the Buriganga River is just beside the Hazaribag area, the tannery wastes somehow drained into Buriganga and thus polluted a lot. There were 343 tannery industries situated in Hazaribagh that discharged about 21,600 cubic meters of liquid wastes per day, including harmful effluents such as Chromium, lead, sulfur, ammonium, salt, and others (Huq, 1998). People reported that the water was black in colour and had a nasty smell when the tannery functioned. The Hazaribagh tannery complex and other industries, primarily the glue and paint industries located in the same general area, have affected water and air quality in the poorly drained area (Azom et al., 2012). Disposal of a heavy quantity of liquid and solid waste in the Buriganga River without treatment severely destroyed the river ecosystem (Hasan et al., 2019; Tinni et al., 2015). Respondents revealed that people who are using Buriganga river water for different purposes (e.g., bathing, washing clothes, dishes, etc.) are facing different health problems like respiratory illnesses, asthma, skin diseases, etc. (Source: GDs and KIIs).

Islam (2018) showed that the waste discharge to the Buriganga River had decreased a lot after the tannery relocation, and so the ultimate BOD, TSS, NH3-N, NO3-N, and PO4 concentrations have decreased. However, the condition of DO and chlorophyll-a along the river has not improved even after the relocation (Islam, 2018; Rafi et al., 2021). Presently Buriganga is reviving from the deteriorated phase; it has undergone many years of pollution. The study by Paul et al. (2022) provides an overview of recent advances in the application of nanomaterials in wastewater treatment which can be useful for the relocated Savar Tannery industry. People of the riverside area have reported that the water's colour has been improving in the last three years. They use the river water only for bathing during the monsoon period, but not in other seasons or for other purposes. People of the locality even found fish in the river after many years.

3.3 Socio-Economic Impact

3.3.1 Migration And House Rent

The relocation of the tannery impacted the inhabitants of Hazaribag as they were mostly tannery workers. During the tannery establishment, many people shifted to work in tanneries in the Hazaribag area from outside the capital, mostly from the southern part of Bangladesh. Some of them shifted to their native place after the relocation due to unemployment problems. From the field survey, it is found that house rent, both sublet and the shared room, has fallen from 1500 taka (Bangladeshi currency) to 1000 taka after relocation (Figure 05). Individuals who were associated with the tannery industry intended to shift their residence from the surrounding Hazaribag to their new workstation. Again, single room and small flat rent also fell from 6000 takas to 5000 takas and 15000 takas to 10000 takas respectively. As people who live here with their family members are either shifted and/or the daily income of the present people has fallen then before. But the luxury flat rent has risen in the selected area.

This is identified for better facilities than before as the main cause and replacement of elite group people for better environmental conditions. The study by Fatemi and Rahman (2015) highlights the need for sustainable urban development to address the issue of brownfield sites in Hazaribag, which can have a positive impact on the overall life quality of the local inhabitants. Insight should be given into how sustainable urban development can be achieved in areas like Hazaribag, which has been affected by unsustainable practices.

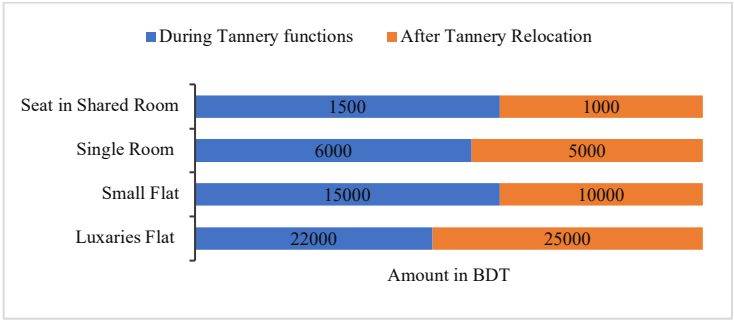

Figure 5: Change in House Rent in Hazaribag

3.3.2 Employment And Livelihood Pattern Change And Impact On Local Economy

The relocation of the tannery has a significant impact on the livelihood of the workers (Sarker and Akter, 2018). Many people became unemployed, and a lot of them got involved in professions of their non-expertise fields. After the relocation, all the workers did not get a job at the relocated Savar tannery, supported by Sarker and Akter (2018). The findings of the study show that the overall change in livelihood is adverse to the people of Hazaribag. Figure 06 shows that 30% of people were unemployed and migrated from the Hazaribag area after the relocation. People who worked in the tannery on a part-time or contractual basis in the peak season have failed to manage their jobs in the Savar tannery after relocation. Besides, some migrated in search of new jobs as there were very limited or no livelihood options in the area. 15% started working as rickshaw pullers, 15% started tea stalls, and 20% started working as servants, which are not fields of their expertise, so they are not earning well. Only about 20% of people got a job at the relocated Savar tannery, and of them, only a few, about 1%, were kept at Hazaribag at the old tannery to do the post-production functions. These people are facing obstacles at Savar Tannery, like transportation problems and conflicts with the local workers, which are making their job life miserable. Due to the traffic jams within Dhaka city, people whose workplaces are far from their residences find it difficult to manage tight work schedules as they have to start their journey very early in the morning to join the office within the time frame and too late to return home. As a result, they could not manage enough family time.

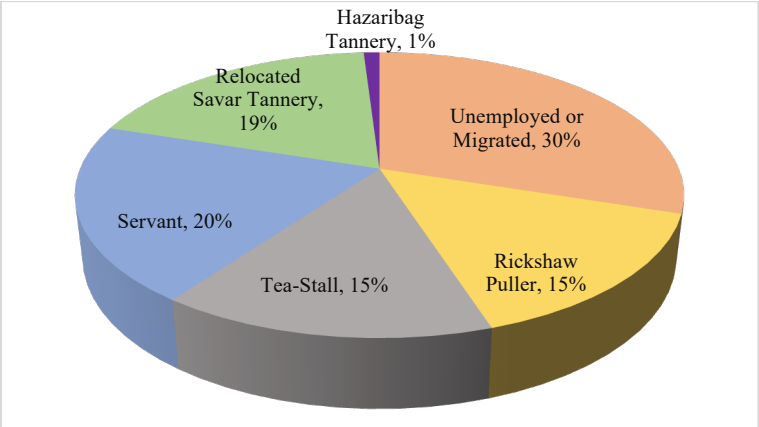

Figure 6: Change in Employment and Livelihood Pattern

Hazaribag tanneries were one of the important considerations for the local as well as the national economy. The economic activities, especially the local economy of the area, are being impacted due to the tannery relocation. The economic activities decreased enormously both for local labour and business sectors (Source: GDs and KIIs). Sarker and Akter (2018) found that due to the shifting of tanneries from Hazaribag to Savar, many tannery owners faced extensive losses. Since no or very few employment opportunities limit the local economy of the area, respondents added that not only factory owners but also many workers had to take loans from different banks or NGOs, which led them to the vicious cycle of debt. The findings shed light on the inadequate human resources management practices in the tannery industry, which further worsens the situation for workers. The study's findings emphasize the need to improve the working conditions of tannery workers and implement policies that support their job security and social protection. Many workers became unemployed, and some had to switch to non-expertise fields after the relocation, supported by Sarker and Akter (2018).

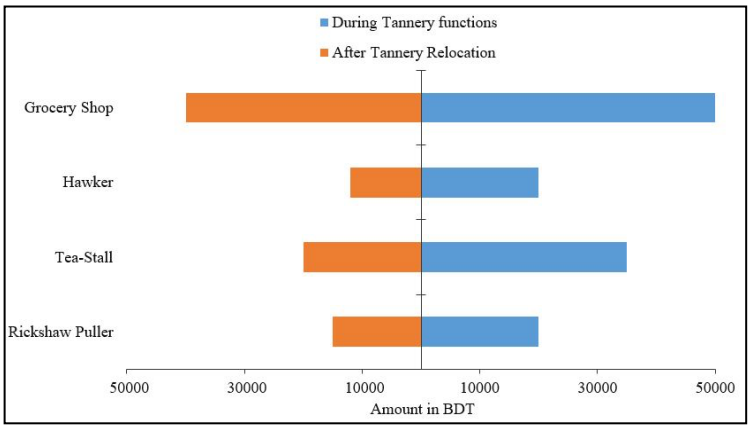

Figure 7: Change in Local Economy and Business

Figure 07 shows that all the business sector depends on tannery employers like rickshaw pullers, Tea stalls, Hawker and Grocery Shop income have tremendously fallen. Rickshaw puller income has decreased by 5000 takas than before, Tea stall income has fallen by 15000 takas, Hawker income 8000 takas less than before, and Grocery shop income by 10000 takas less than before. Due to relocation, people doing small businesses faced a significant setback. The monthly income of all groups of people in the area has decreased after the tannery relocation as there

is now a vacuum in the economic activities of this area. The government of Bangladesh is planning to redevelop the Hazaribag area through a detailed area Plan (DAP) that needs a lot of investment and time time-consuming (Khan, 2017).

3.4 Institutional Issue

3.4.1 Stakeholder's Conflicts

Shakil et al. (2016) have examined some empirical evidence of the policy measures for relocating the tannery industry. They found some implementation snags and extreme stakeholder negotiation behind stakeholder conflict in the tannery industry of Dhaka. One of the respondents illustrated during group discussions (GDs) that the tannery industry owners cannot cope with the new situation after the relocation. They cannot provide proper job security for the workers and labour groups as well in the new location.

Moreover, conflicting issues and social unrest happened when community consent had not been addressed while undertaking the decision on tannery relocation (Shakil et al., 2016). Some tanneries had to shut off as they did not have enough opportunity to shift at Savar. Even Some tanneries could not pay the pending wages of their labourers (Source: KIIs and GDs). Labour groups protested against the owner for justice, which was promised by the authority (Figure 08). According to Human Rights Watch (2012), the government did this action to ensure environmental sustainability but selected policy options for the tannery relocation without considering alternatives and adequate research about probable further risk and socio-economic sustainability. KII respondents said that due to the new environment and lack of facilities at Savar, they could not make perfect production and could not ensure the worker's monthly salaries. However, the condition was a bit different a few years ago in Hazaribag.

Figure 8: Poster of Labor Protest Against the Owner in front of the Main Gate of the Closed Industry at Hazaribag

However, the peak time of the tanneries is Eid-ul-Adha, the biggest Muslim festival. At this time, owners of these tanneries were trying to recruit lots of workers with low salaries and fired them as soon as the peak time was over. Besides, several well-established tannery factories were providing some facilities. But smaller ones were not in good condition with the relocation. According to KIIs and GDs respondents, the demand for leather is increasing, but the market for raw leather has been decreasing in trend from the last decades. As a result, local sellers and dealers of the raw leather were very unsatisfied with tannery owners, as they had to sell their raw leather to the tannery owner at a low price. Where tannery owners tended to sell the processed leather with a big profit, continuing this process created conflicts between dealers and tannery owners. Sometimes, a few labour rights organizations tried to raise the issue, but this matter was covered up by the influence of powerful owners. These situations created agitation among the workers as well (Source: KIIs and GDs).

However, as our study found, the decision was made without adequate research and consideration of the socio-economic sustainability and potential consequences for the workers and labour. The conflicts between tannery owners and local sellers and dealers of raw leather, as well as labour organizations, are also mentioned in the study by Sarker and Akter (2018). The conflicting issues and social unrest mentioned in this study occurred when community consent was not addressed while making decisions on tannery relocation, and the authorities selected policy options for the relocation without considering alternatives and adequate research about probable further risks and socio-economic sustainability.

4. Conclusions

The impact of relocating the tannery from Hazaribag is complex, with both positive and negative effects on the environment and society that must be carefully managed and planned by the authorities. There have been significant improvements in the surrounding environment and air quality, as well as a reduction in population density and the cost of living, leading to a more comfortable and convenient lifestyle for residents. However, the relocation has had a severe negative impact on the economic and employment situation, with many people either leaving the area or being left unemployed. Additionally, some individuals have had to take up jobs outside their

area of expertise. Unfortunately, the government has not adequately managed the post-relocation situation, and urgent action is needed to address these issues.

While the tannery relocation has had a positive impact on the environment, it has significantly negatively affected society. The findings suggest that tannery relocation has the potential to mitigate environmental pollution and improve public health, but the unintended consequences of relocation also need to be carefully considered and monitored. It should be done in a way that accounts for the broader socioeconomic implications and considers the interests of all stakeholders, including workers, labour groups, and local communities. Therefore, a more comprehensive and collaborative approach involving all stakeholders is necessary to ensure sustainable and equitable development.

The findings of this study can inform the legislative authority's understanding of the environmental possibilities of future eco-cities and help plan for better outcomes. Effective and interdisciplinary collaboration among the government, NGOs, and relevant stakeholders in the area are essential to improving the situation quickly..

5. Limitations And Future Recommendations

The study's limitations include reliance on respondents' perceptions and opinions and the lack of chemical analysis. Continuous monitoring of the changes is needed to assess the impact in the long run. Further improvement of the environmental and social conditions in the area needs to be assessed over time to observe the long-term impact, as this study was conducted within 3-4 years after the relocation.

Acknowledgment: Alhamdulillahi Rabbil Alamin. We praise and glorify the Lord, Allah Subhanahu wa Taala, as He ought to be praised and glorified. This research was a part of my MSc study at the Institute of Water and Flood Management, Bangladesh University of Engineering and Technology. The authors would like to thank all the Hazaribag area respondents for their cordial support during data collection.

Funding: No funding was received for this study.

Conflict of interest: Authors declare no conflict of interest.

Data availability statement: Data is available at request. Please contact the corresponding author for any additional information on data access or usage.

Disclaimer: The views and opinions expressed in this article are those of the author(s) and contributor(s) and do not necessarily reflect IJSSER's or editors' official policy or position. All liability for harm done to individuals or property as a result of any ideas, methods, instructions, or products mentioned in the content is expressly disclaimed.

References

Azmat, F. (2009). Reforms in the Bangladesh agriculture input sector: room for complacency? *Contemporary South Asia*, 17(4), 379-398. https://doi.org/10.1080/09584930903071929

Azom, M., Mahmud, K., Yahya, S., Sontu, A., & Himon, S. (2012). Environmental Impact Assessment of Tanneries: A Case Study of Hazaribag in Bangladesh. *International Journal of Environmental Science and Development*, 3(2), 152-156. https://doi.org/10.7763/IJESD.2012.V3.206

BBS. (2014). Bangladesh Population and Housing Census 2011. Ministry of Planning, Government of the People's Republic of Bangladesh.

Bhowmik, A. (2011). Relocation of Hazaribagh Tannery: Myth or Reality? *LAP Lambert Academic Publishing*.

Bhowmik, A. (2012). Environmental Sustainability vs. Political Decision: a Review of the Bangladesh Leather Processing Industry Relocation Plan. *Proceedings of the 2nd World Sustainability Forum*, 1-30 November 2012. 10.3390/wsf2-00885. https://doi.org/10.3390/wsf2-00885

Bhowmik, A. (2013). Industries' Location as Jeopardy for Sustainable Urban Development in Asia: A Review of the Bangladesh Leather Processing Industry Relocation Plan. *Environment and Urbanization ASIA*, 4(1), 93-119. https://doi.org/10.1177/0975425313477749

Bhuiyan, M. A. H., Suruvi, N. I., Dampare, S. B., Islam, M. A., Quraishi, S. B., Ganyaglo, S., & Suzuki, S. (2011). Investigation of the possible sources of heavy metal contamination in lagoon and canal water in the tannery industrial area in Dhaka, Bangladesh. *Environmental monitoring and assessment*, 175(1), 633-649. https://doi.org/10.1007/s10661-010-1557-6

China, C. R., Maguta, M. M., Nyandoro, S. S., Hilonga, A., Kanth, S. V., & Njau, K. N. (2020). Alternative tanning technologies and their suitability in curbing environmental pollution from the leather industry: A comprehensive review. *Chemosphere*, 254, 126804. https://doi.org/10.1016/j.chemosphere.2020.126804

DoE. (2003). A Compilation of Environmental Laws of Bangladesh. (2nd Ed.). Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka.

Fatema, K., Begum, M., Zahid, M., & Hossain, M. (2018). Water quality assessment of the river Buriganga, Bangladesh. J*ournal of Biodiversity Conservation and Bioresource Management*, 4(1), 47-54. https://doi.org/10.3329/jbcbm.v4i1.37876

Fatemi, M. N., & Rahman, T. (2015). Regeneration of the Hazaribagh urban brownfield: An imperative for Dhaka's sustainable urban development. *Urbani izziv,* 26(2), 132-145. https://doi.org/10.5379/urbani-izziv-en-2015-26-02-004

Haque, M. E., Islam, M. N., & Nabi, M. N. (2019). Environmental Impact of Tannery Effluent on Soil and Groundwater Quality in Hazaribagh, Bangladesh. *International Journal of Environmental Science and Technology*, 16(1), 253-264.

Hasan, M., Shahriar, A., & Jim, K. (2019). Water pollution in Bangladesh and its impact on public health. *Heliyon,* 5(8), e02145. https://doi.org/10.1016/j.heliyon.2019.e02145

Hasnat, A., Rahman, I., & Pasha, M. (2013). Assessment of environmental impact for tannery industries in Bangladesh. *International Journal of Environmental Science and Development,* 4(2), 217. https://doi.org/10.7763/IJESD.2013.V4.338

Hossain, A., Munira, S., & Nessa, M. (2021). Perception of Local People Towards Tannery Industrial Waste: A Cross-Sectional Study on Hazaribagh Areas of Dhaka City. *Asian Journal of Social Science Studies*, 6(4), 1. https://doi.org/10.20849/ajsss.v6i4.950

Hossain, M. S., Rahman, M. M., Uddin, M. K., Akter, M., & Ali, M. A. (2021). Assessment of environmental pollution caused by the tanning industry in Bangladesh: A review. *Journal of Environmental Science and Health*, Part A, 56(9), 937-952.

Hossain, S. (2008). Rapid urban growth and poverty in Dhaka city. *Bangladesh e-Journal of Sociology*, 5(1), 1-24.

Human Rights Watch. (2012). Toxic Tanneries: The Health Repercussions of Bangladesh's Hazaribagh Leather. United States of America: Human Rights Watch. https://www.hrw.org/report/2012/10/08/toxic-tanneries/health-repercussions-bangladeshs-hazaribagh-leather

Huq, S. (1998). Critical environmental issues relating to tanning industries in Bangladesh. In Towards Better Management of Soils Contaminated with Tannery Waste, 31st January - 4th February 1998, Tamil Nadu Agricultural University, Coimbatore, India.

Iqbal, A., & Swapnil, F. J. (2017*). Sustainable Green Materials for Building Construction. International Conference on Mechanical, Industrial and Materials Engineering 2017* (ICMIME2017), 28 December 2017. RUET, Rajshahi.

Islam, M.R. (2018). Effects of relocation of tannery industries from Hazaribagh on water quality of Buriganga River. MSc Thesis, Department of Civil Engineering, *Bangladesh University of Engineering and Technology*, Dhaka. http://lib.buet.ac.bd:8080/xmlui/handle/123456789/4886

Islam, N. (2014). Towards Creating Better Cities: Problems and Potentials of Transit Oriented Development as Community Development Tool in Dhaka. Proceedings of the International Conference on 'Cities, People and Places'-ICCPP-2014, 31 October – 02 November 2014, Colombo, Sri Lanka.

Karim, M., Manshoven, S., Islam, M., Gascon, J., Ibarra, M., Diels, L., & Rahman, M. (2013). Assessment of an Urban Contaminated Site from Tannery Industries in Dhaka City, Bangladesh. *Journal of Hazardous, Toxic, and Radioactive Waste*, 17(1), 52-61. https://doi.org/10.1061/(ASCE)HZ.2153-5515.0000139

Khan, N. (2017). SCP in Bangladesh: The Brown Hope of Hazaribagh and the Golden Fibre of Bangladesh. In P. Schroeder, K. Anggraeni, S. Sartori & U. Weber, Sustainable Asia (pp. 105-131). *World Scientific Publishing Company*. https://doi.org/10.1142/9789814730914_0005

Koukal, B., Dominik, J., Vignati, D., Arpagaus, P., Santiago, S., Ouddane, B., & Benaabidate, L. (2004). Assessment of water quality and toxicity of polluted Rivers Fez and Sebou in the region of Fez (Morocco). *Environmental Pollution*, 131(1), 163-172. https://doi.org/10.1016/j.envpol.2004.01.014

Mohiuddin, K., Alam, M., Ahmed, I., & Chowdhury, A. (2016). Heavy metal pollution load in sediment samples of the Buriganga River in Bangladesh. Journal of the Bangladesh Agricultural University, 13(2), 229-238. https://doi.org/10.3329/jbau.v13i2.28784

Mondal, M.S., Salehin, M., & Huq, H., (2014). Evaluation of Institutional Arrangements for Governance of Rivers Surrounding Dhaka City. In Globalization of Water Governance in South Asia. https://doi.org/10.4324/9781315734187

Muhammad, N., & Haque, M. (2012). Physical and Mental Health of Tannery Workers and Residential People of Hazaribag Area in Dhaka City. *ASA University Review*, 6(2), 161-169.

Nur-E-Alam, M., Mia, M. A. S., Ahmad, F., & Rahman, M. M. (2018). Adsorption of chromium (Cr) from tannery wastewater using low-cost spent tea leaves adsorbent. *Applied Water Science*, 8(5), 1-7. https://doi.org/10.1007/s13201-018-0774-y

Parvin, F., Haque, M. M., & Tareq, S. M. (2022). Recent status of water quality in Bangladesh: A systematic review, meta-analysis and health risk assessment. *Environmental Challenges*, 6, 100416. https://doi.org/10.1016/j.envc.2021.100416

Paul, A. K., Mukherjee, S. K., & Hossain, S. T. (2022). Application of nanomaterial in wastewater treatment: recent advances and future perspective. *Development in Wastewater Treatment Research and Processes*, 515-542. https://doi.org/10.1016/B978-0-323-85583-9.00003-X

Rafi F., Iqbal A., Islam M.R., Sheonty S.R., Armin R. (2021). *Drinking Water Quality Assessment of Public Tube-Wells and Their Spatial Distribution in the Rangpur City of Bangladesh*. In: Kolathayar S., Mondal A., Chian S.C. (eds) Climate Change and Water Security. Lecture Notes in Civil Engineering, vol 178. Springer, Singapore. https://doi.org/10.1007/978-981-16-5501-2_28

Rahman, M. A., Islam, M. S., Habib, M. A., Uddin, M. K., Rahman, M. M., & Islam, M. S. (2022). Assessment of heavy metal pollution in soils and vegetables around tannery industrial area in Savar, Bangladesh. *Environmental Science and Pollution Research*, 29(5), 5705-5718.

Rahman, M. S., Ahmed, Z., Seefat, S. M., Alam, R., Islam, A. R. M. T., Choudhury, T. R., & Idris, A. M. (2022). Assessment of heavy metal contamination in sediment at the newly established tannery industrial Estate in Bangladesh: A case study. *Environmental Chemistry and Ecotoxicology*, 4(1), 1-12. https://doi.org/10.1016/j.enceco.2021.10.001

Rahman, M.R. (2022). Future of Flood Control Projects in Bangladesh Considering the Health of Its Floodplain and Inhabitants. In: Leal Filho, W. (eds) Handbook of Human and Planetary Health. *Climate Change Management. Springer, Cham*. https://doi.org/10.1007/978-3-031-09879-6_4

RAPID. (2019). Promoting Decent Work and Acceptable Working Conditions in the Tannery Sector in Bangladesh: Tannery Sector and its Relocation. The Asia Foundation.

Rasul, M. G., Faisal, I., & Khan, M. M. K. (2006). Environmental pollution generated from process industries in Bangladesh. *International journal of environment and pollution*, 28(1-2), 144-161. https://doi.org/10.1504/IJEP.2006.010881

Sankar, U. (2006). Trade liberalisation and environmental protection: responses of the leather industry in Brazil, China and India. *Economic and Political Weekly*, 41(24), 2470-2477.

Sarker, A. R., & Akter, S. (2018). Impact of Human Resource Management Practices on the Working Life of Tannery Workers in Bangladesh. *Dhaka University Journal of Management*, 12(1), 161-170.

Sarker, P.K. (2013). Hazardous Hazaribagh. Dhaka Tribune, 5 June 2013. http://www.dhakatribune.com/uncategorized/2013/06/05/hazardous-hazaribagh. Date accessed: 08 January 2022.

Shakil, S., Labib, S. M., & Khan, M. (2016). Stakeholder Debate in Policy Implementation: An Evaluation of Bangladesh Leather Processing Industry Relocation Policy. *Bangladesh e-Journal of Sociology*, 13(1), 126-137.

Syed, M., Saleem, T., Shuja-ur-Rehman, Iqbal, M. A., Javed, F., Khan, M. B. S., & Sadiq, K. (2010). Effects of leather industry on health and recommendations for improving the situation in Pakistan. *Archives of environmental & occupational health*, 65(3), 163-172. https://doi.org/10.1080/19338241003730895

Tinni, S., Islam, M., Fatima, K., & Ali, M. (2015). Impact of Tanneries Waste Disposal on Environment in Some Selected Areas of Dhaka City Corporation. *Journal of Environmental Science and Natural Resources*, 7(1), 149 -156. doi: 10.3329/jesnr.v7i1.22164. https://doi.org/10.3329/jesnr.v7i1.22164

Uddin, M. M., Hasan, M. J., Mahmud, Y., Uddin, N., Rahman, K. T., Nishad, I. J. A., & Shamsuddin, S. M. (2022). A cleaner goatskin preservation with leaf paste and powder; an approach for salinity remediation in tannery wastewater. *Cleaner Engineering and Technology,* 6(1), 100357. https://doi.org/10.1016/j.clet.2021.100357

Whitehead, P., Bussi, G., Hossain, M., Dolk, M., Das, P., Comber, S., Peters, R., Charles, K., Hope, R., & Hossain, M. (2018). Restoring water quality in the polluted Turag-Tongi-Balu river system, Dhaka: Modelling nutrient and total coliform intervention strategies. *Science of the Total Environment*, 631-632(1), 223-232. https://doi.org/10.1016/j.scitotenv.2018.03.038

Whitehead, P., Bussi, G., Peters, R., Hossain, M., Softley, L., Shawal, S., Jin, L., Rampley, C., Holdship, P., Hope, R., & Alabaster, G. (2019). *Modelling heavy metals in the Buriganga*

WHO. (2001). *Bulletin of the World Health Organization,* 79(1). https://apps.who.int/iris/handle/10665/268244

WWPP (2010). *Blacksmith Institute's World's Worst Pollution Problems Report, Top Six Toxic Threats: Six pollutants that jeopardize the health of tens of millions of people*, pp. 39. https://www.worstpolluted.org/files/FileUpload/files/2010/WWPP-2010-Report-Web.pdf