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METAL, PAPER, AND RUBBER WASTE RECYCLING SCENARIO; A CASE STUDY OF KHULNA CITY

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ABSTRACT

Because of modern day overpopulation, rapid industrial and lifestyle growth, and Khulna city's geographic location, natural resource consumption is rising while their availability is deteriorating. This paper has been designed with an attempt to inform the policymakers of Bangladesh regarding the potential of waste management and recycling as a renewable source of energy. Due to economic and environmental initiatives, metal, paper, and rubber waste recycling rates continue to rise. The total daily waste collection volume considering four areas of the city (Fulbarigate, Khalishpur, Sheikhpara, and Zero Point) was found to be 9.91tons. Its daily output is made up of metal (7.1tons), paper (2.2tons), and rubber (0.59tons). The substantial amount of these components in Khulna's waste composition emphasizes the significance of frequent collection and disposal. The current daily market value of this waste has been estimated to be BDT 4,36,879 in total. Each year, the income is close to BDT 160million.

***Keywords**: Waste Recycling, Natural Resource Consumption, Waste Management, Recycling Practices, Waste Collectors.*

INTRODUCTION

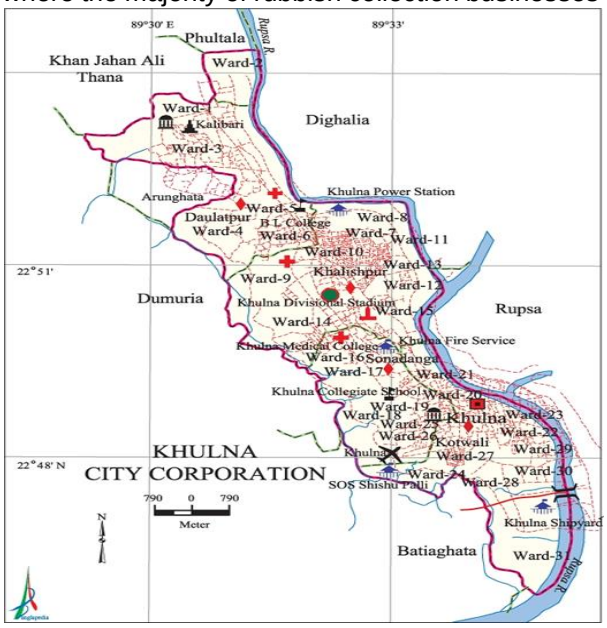
Now a days, waste is a global dilemma and generation of waste has been started from the very commencement of mankind and it is augmented with the advancement of mankind. Though some wastes are decomposed and stabilized, most of them are not, and they become harmful to the environment. With the progression of time, the quantity of waste is expanding at an alarming rate. Hence, it has become the predicament of mankind. As a result, it's important to control the growing amount of trash produced by both industries and human activities. To stabilize these phenomena, the process of reuse has been practiced. People are moving from rural areas to cities throughout Asia. As a result, cities are being transformed into more urban areas, while financial expansion has also occurred. As a result, solid waste generation is becoming more dominant and diverse than in Western countries (Tapan, 2009). In India, 90% of wastes are dumped in open spaces; therefore, waste management is an obstacle for this country, and the average waste generation rate is 0.3–0.6 kg/capita/ day, though this varies by citizen size (Dyson, 2005). In Malaysia, the waste generation rate is 0.5–0.8 kg/person/day (Latifa & Samah, 2009). The average household solid waste generation rate in Turkey is 0.6 kg/year per capita. Almost everyone in Turkey in the project regions is ready and intends to take part in individual collection programs (Metin et al., 2003). Due to the widespread system of transportation, collection, and disposal of solid waste, Bangladesh often experiences a rapid decline in environmental and sanitary conditions. At Dhaka in 2001, the average percentage of the wet weight of biodegradable waste was 70% (Zurbrügg, 2002). Considering Khulna City, nowadays, overpopulation and the rapid development of industries and lifestyles lead to an increase in the consumption of natural resources and a reduction of their availability. In Khulna, KCC is not able to motivate people to use dustbins regularly yet (Ahsan & Islam, 2009). In a fast-growing city, a system dynamics model should be used to predict future solid waste generation if there is less historical data (Dyson & Chang, 2005). The idea of sustainability in waste recycling has a quantifiable unit, which refers to three pillars: social, environmental, and economic. By providing waste-derived materials as production inputs, they help close the material use loop in the economy by focusing on environmental regulations that call for waste reduction, reuse, and recycling. The objectives of this research were to identify the total estimated

volumes of waste (metal, paper, and rubber) collected from selected zones of Khulna City. Following that, to assess the characteristics of metal, paper, and rubber waste recycling practices and how improved waste recycling practices can contribute to the sustainability of development processes in Khulna City's targeted areas, Finally, to understand the financial capacity of all relevant stakeholders involved in metal, paper, and rubber waste recycling and the economic impact of these specific zones.

METHODOLOGY

Topic Selection and Primary Assessment

The choice of the topic and the initial evaluation were done to comprehend waste collection and where the majority of rubbish collection businesses are situated in Khulna. It is a thorough investigation into a region that could be used for recycling garbage. In order to collect as much rubbish as possible, the study was carried out during a period of clear weather when waste collection vehicles and equipment were operating to the fullest extent possible. The amount of data that was analyzed was gathered throughout the entire month of February 2022.



Study Area Points

The reconnaissance survey was used as a basis for this, and the stretches transporting the most garbage were used to determine the key sites. The four sections of Khulna city where the majority of shops are located were chosen with consideration for waste collectors and collecting shops. Fulbarigate, Khalishpur, Sheikhpara, and Zero Point were chosen as the study points (figure 1).

Fulbarigate

Fulbarigate, a significant region in Khulna, is home to a variety of recycling and rubbish collection businesses. This place is within Khanjahan Ali Thana and is 12 kilometers from Khulna Town in Bangladesh. Coordinates: 22.898114°N 89.510168°E.

Khalishpur

Khalishpur is situated at 22.8500°N 89.5361°E and is also referred to as the "industrial area" of Khulna. Khalishpur covers a total area of almost 12.35 km2. There are lots of businesses that gather and sell trash there. Khalishpur is home to the majority of the city of Khulna's paper production facilities.

Sheikhpara

This region of the city is both residential and commercial. Sheikhpara is home to the biggest metal recycling market in Khulna as well as many important auto parts stores. Sheikhpara is located at 22.498°N 89.3320°E.

Zero Point

The Khulna Zero Point is a significant area inside the Khulna Division, and its coordinates are latitude 22.7983N and longitude 89.5287E. Since this location serves as the entry to Khulna City, it is known as the main gateway of Khulna. The largest rubber waste recycling market in Khulna is located in Zero Point.

Figure 1: Map of Khulna City (Source: Banglapedia)

Data Collection and Analytical Approach

A survey using the pre-printed questionnaire was carried out following the completion of the questionnaire. Survey information was collected from 20 primary collectors, 15 small shop keepers, 5 medium recycling shops, and 5 industry or large recycling shops. After the data was gathered, it was examined using the statistical program MS Excel to ascertain the amount of rubbish that was collected each day, the total number of primary, secondary, and mid-level waste collectors, and the amount of

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recyclable waste from the chosen areas of Khulna city. Additionally, identified the waste market value, daily waste market, and income of the relevant stakeholders and assessed the economic impact of these actors on the local community and its surrounding development.

RESULTS AND DISCUSSION

We have selected four areas within Khulna as a place for metal, paper, and rubber waste recycling. The four areas are Khalishpur, Fulbarigate, Sheikhpara, and Zeropoint. Recycling waste shops are scattered in different parts of Khulna city. Considering the specific waste, a detailed explanation is given below with the diagram.

Metal Waste

Recycling waste metal means less metal will end up taking up space in landfills that should be reserved exclusively for non-recyclable items. Metals may all be recycled and turned into new materials, including steel products, tin cans, copper wiring and pipes, and more. They cause groundwater and air pollution when thrown into a landfill, where they emit methane. Recycling waste metal preserves natural resources that naturally occur in nature and aren't renewable.

Paper Waste

Paper recycling is the appropriate method for individuals who want to reduce the waste stream. especially considering how much paper was wasted throughout the year. This process entails recovering a significant amount of fiber from paper, which can be recycled and made into cardboard, new paper, or other paper products. Even though recycling paper isn't as efficient as recycling glass or metal, it's still a great way to protect the environment and the environment's resources.

Rubber waste

Rubber is a polymer that can stretch and contract; it can be produced synthetically as well as organically. Since the beginning of time, people have used rubber products. However, it developed into a very useful industrial raw material for a variety of uses during the 19th century.

Statistics for Waste Collectors

In our study, we conducted a survey with the various types of waste collectors in different areas of Khulna city. We conducted an interview with about 45 primary, secondary, third-level, and industry-level waste collectors and recyclers to identify and understand the daily waste generation and the estimated population and stakeholders involved in these industries and professions.

Table 1: Information for primary waste collectors

Sl#	Name of zone/are	Number of Primary collectors			Total in (Person)
		Metal	Paper	Rubber	
1	Fulbari Gate	85	65	10	160
2	Khalishpur	120	80	8	208
3	Sheikhpara	175	0	0	175
4	Zero Point	0	0	5	5
Total		**380**	**145**	**23**	**548**

According to table 1, we have finally found that a total of 548 primary level collectors are involved with these industries. If we elaborate a little bit, especially considering the waste category, then metal, paper, and rubber waste collectors are 380, 145, and 23, respectively, in these four areas of Khulna city (Fulbarigate, Khalishpur, Sheikhpara, and Zero Point).

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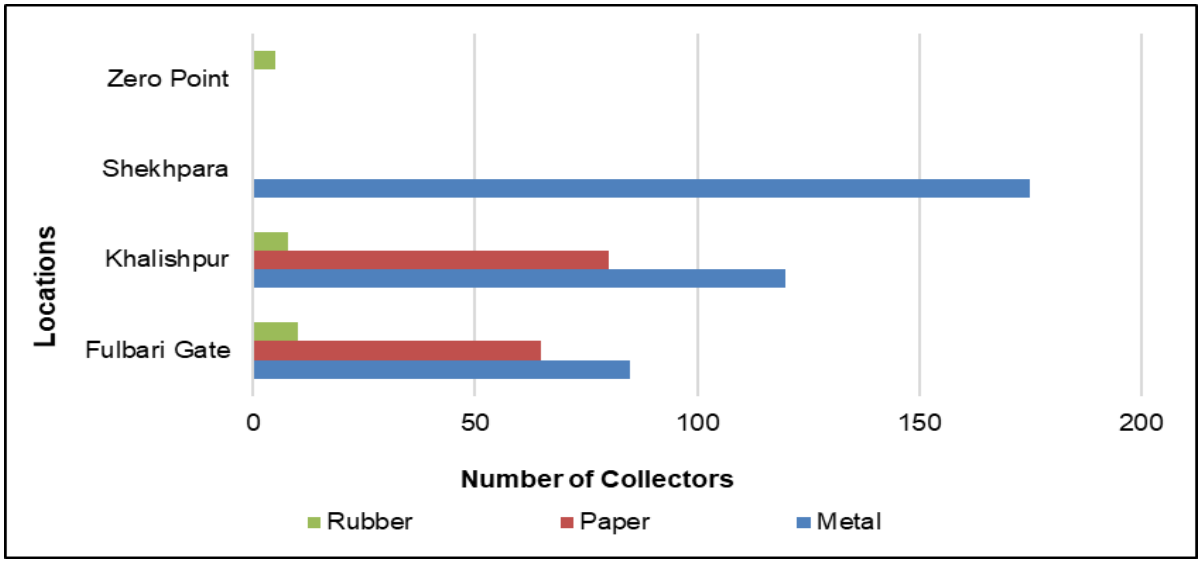

Figure 2: Number of primary collectors

Considering the study areas of Fulbari Gate, Khalishpur, Sheikhpara and Zero Point, it was found that a total of 548 primary level waste collectors who are fully or partially involved in this profession. Basically, they are the key actors in this industry. Some of them are Tokai, Feriwala, and small shop owners. If we consider the area specific numbers, then it will be Fulbari Gate 160, Khalishpur 208, Sheikhpara 175 and Zero Point is 05 persons are collecting waste (figure 2).

Estimated Quantity of Waste

Lack of proper management at waste collecting shop, a few wastes such as paper and rubber has disintegrated into several parts in presence of biodegradation activities at source. Additionally, some of them have been lost as a result of soil and organic decomposer contamination. When compared to developed countries, the categorical feature of waste generation rate progressively reaches its peak. Around 44 waste collection shops were observed in the targeted area. A variety of solid waste is collected from waste collectors and others at different prices based on market demands.

Table 2: Estimated volume of different waste collection in daily

Sl#	Name of zone/are	Volume of waste in KG			Total in (KG)
		Metal	Paper	Rubber	
1	Fulbari Gate	1245.5	973	231.5	2450
2	Khalishpur	2149.5	1290	204.5	3644
3	Sheikhpara	3665	0	0	3665
4	Zero Point	0	0	150	150
Total in KG		**7060**	**2263**	**586**	**9909**

The study area's rate of solid waste creation has risen as a result of population growth and associated socioeconomic activity. Table 2 depicts that the solid waste generation was recorded on a daily basis at around 9.91 tons. It consists of metal (7.1 tons), paper (2.2 tons), and rubber (0.59 tons). The income level and consumption rate coincide with one's life style which may be expedited to waste generation rate.

Economic Impact

Despite the fact that recycling is well known for its environmental advantages, which include resource conservation, energy conservation, and decreases in water and air pollution, including decreases in greenhouse gas production, it also has substantial economic advantages, many of which are frequently disregarded. Recycling is an important segment of the national and local economies because it creates jobs and saves money for waste generators. Recycling makes both economic and

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environmental sense, as recognized by the enterprises, organizations, and municipal governments mentioned in this research. Since the environmental benefits of recycling are often the focus of much of the recycling discussion.

Table 3: Approximate income for primary waste collectors in daily

Sl #	Name of zone/are	Number of Primary collectors	Average Dependent	Dependents	Average Daily Income	Average Daily Total Income (BDT)
1	Fulbari Gate	160	4.5	720	500	80000
2	Khalishpur	208	4.5	936	500	104000
3	Sheikhpara	175	4.5	787.5	500	87500
4	Zero Point	5	4.5	22.5	500	2500
Total		548		2466		274000

Considering table 3, on average, each collector is able to earn BDT 500 in a day. So, we can consider the estimated amount of BDT 2,744,000 earned collectively per day by the mentioned collectors. For Fulbarigate, there are a total of 160 primary collectors, and their incoming total is 80, 000 BDT per day. There are a total of 208 primary collectors in Khalishpur, and they receive a total of 104, 000 BDT per day. For Sheikhpara, there are a total of 175 primary collectors, and they bring in a total of 87500 BDT per day. At Zero Point, there are a total of 05 primary collectors, and their incoming total is 2500 BDT per day.

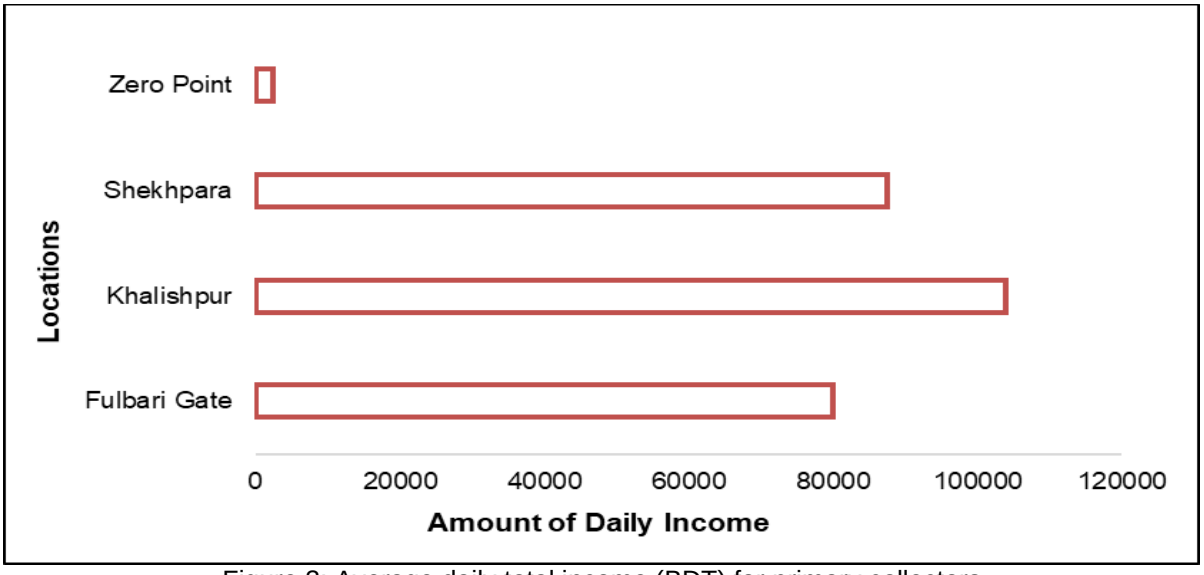

Figure 3: Average daily total income (BDT) for primary collectors

Similarly, figure 3 illustrates the positive impact of earning money was not only for the collectors; it also benefited their families as well. From the 548 primary collectors, a total of 3000 people benefited through

their dependents. It is a huge amount if we count it all together. The amount of income is close to 100 million Tk a year, through which it is directly and indirectly contributing to the development of these targeted locations in Khulna City and its surroundings.

Market Value of the Collected Waste

Considering the previous data, we found a total of 9.91 tons of waste (metal, paper, and rubber waste only) being collected daily at our study site. It consists of metal (7.1 tons), paper (2.2 tons), and rubber (0.59 tons). As per the information in the above-mentioned table, we found a total of BDT 4,36,879 as the current daily market value of this waste material in our targeted four waste markets in Khulna city.

Table 4: Estimated market value of waste material in daily

Sl #	Name of zone/are	Metal (KG)	Avg. unit rate/KG	Sub Total (BDT)	Paper (KG)	Average unite rate/KG	Sub Total (BDT)	Rubber (KG)	Avg. unitrate/ KG	Sub Total (BDT)	G. Total (BDT)
1	Fulbari Gate	1245.5	58	72239	973	9	8757	231.5	12	2778	83774
2	Khalishpur	2149.5	58	124671	1290	9	11610	204.5	12	2454	138735
3	Sheikhpara	3665	58	212570	0	9	0	0	12	0	212570
4	Zero Point	0	58	0	0	9	0	150	12	1800	1800
Total		7060		409480	2263		20367	586		7032	436879

Table 4 delineates, for Fulbarigate, there is a total of 2.45 tons of daily waste collection, collectively, and the total market value is 83,774 BDT per day. For Khalishpur, there is a total of 3.64 tons of daily waste collection, collectively, and the total market value is 1,38,735 BDT per day. For Sheikhpara, there is a total of 3.65 tons of daily waste collection collectively, and the total market value is 2,12,570 BDT per day. For Zero Point, there is a total of 150 KG of daily waste collection, collectively, and the total market value is 1,800 BDT per day.

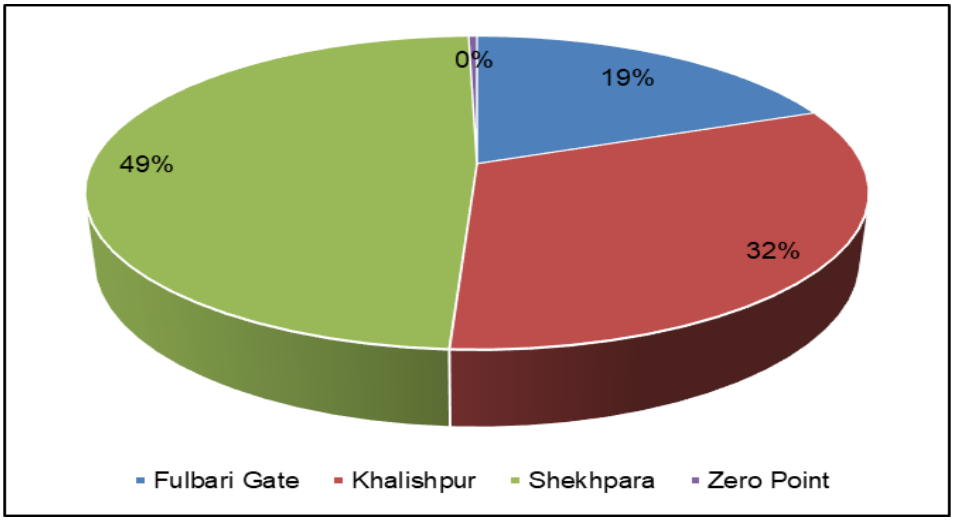

Figure 4: Percentage of Waste market value in targeted location

So that, if we consider the economic impact of the market, it was not only for the waste recycling business holders; it also benefited the local market, their catchment area development, government tax departments, and local people as well. It is a huge amount if we count it all together. The amount of income is close to about 160 million Tk a year. through which it is directly and indirectly contributing to the development of these targeted locations in Khulna City and its surroundings.

As we show in the prior figure, which indicates the total market value of these four categories of waste from our three locations of study, considering the total amount of market value of these wastes, an area-specific percentage is given below for the daily total market price or value:

Fulbari Gate: 19%; Khalishpur: 32%; Sheikhpara: 49%; Zero Point: 00%

The facility has made money because of the recycling scheme that has been put in place, and the business has also saved money because disposal costs have been reduced. The avoided cost of disposal in this example alone strongly supports recycling, despite the sizeable cash earned from the sale of its recyclable materials. Recycling has promoted the development of an industry and produced jobs on a national level.

CONCLUSION

This study identified how much waste is collected daily from selected areas of Khulna city. The total estimated volume of waste is as follows: Metal: 7060 KG/day; paper: 2263 KG/day; rubber: 586 KG/day. The characteristics of metal, paper, and rubber waste recycling practices in the targeted area of Khulna City have been assessed. At our study site, a total of 9.91 tons of waste (metal, paper, and rubber waste only) was collected on a daily basis, along with recycling. It consists of metal (7.1 tons), paper (2.2 tons), and rubber (0.59 tons). The percentages of waste collection and recycling are as follows: Fulbari Gate 18%, Khalishpur 30%, Sheikhpara 50%, and Zero Point 0%. This study assesses how improved recycling practices can contribute to accelerating the development process. We found a total of 548 primary-level waste collectors directly involved in this profession in our four targeted locations in Khulna city. On average, each collector is able to earn BDT 500 in a day. So, the estimated amount of BDT 2,744,000 earned by the collectors collectively per day. Their dependents benefited a total of 3000 people. The amount of income is close to 100 million Tk a year, through which it is directly and indirectly contributing to the development of these targeted locations in Khulna City and its surroundings. The financial capacity of all relevant stakeholders involved in metal, paper, and rubber waste recycling has been determined, as has the economic impact of these specific zones of Khulna City. It has been found that a total of BDT 4,36,879 is the current daily market value of this waste material in our four targeted waste markets in Khulna city. The amount of income is close to about 160 million Tk a year, through which it is directly and indirectly contributing to the development of these targeted locations in Khulna City and its surroundings.

RECOMMENDATIONS

To mitigate the waste recycling challenges in Khulna city, the following measures could be taken: Increase the facility of house-to-house collection in all areas of KCC. Implement a proper 3R strategy for waste recycling, guaranteeing consistency in the removal and transportation of solid waste from homes, containers, and key dumping sites. Separating waste into its several categories is necessary, including plastic, organic, and chemical waste. When disposing of solid waste, it should be done in a secluded area and conveyed at a predetermined time rather than being randomly collected. Government officials should put in place an appropriate mechanism for disposing of waste, and they should urge waste collectors to handle rubber, paper, and metal debris with caution. Increase the remuneration and safety of the laborers who work in the solid waste industry, especially metal, paper, and rubber waste recycling. It is improbable that government organizations could solve this issue entirely on their own. Garbage recycling should be included in municipal waste management ordinances. Modification of municipal ordinances is needed to accommodate the inclusion of NGOs, CBOs, and microenterprises into the main stream of solid waste management and recycling. Public awareness of waste segregation, recycling, and reuse should be raised through public campaigns and media demonstrations through NGOs and electronic and print media. To efficiently manage small-scale garbage recycling, community-based organizations should get assistance in setting up co-operatives and microbusinesses.

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