PLASTIC RECYCLING BUSINESSES IN KHULNA: A STUDY ON MITIGATING CURRENT PROBLEMS

Philipp Lorber[1], Abdullah Al Hasan[2], Quazi Hamidul Bari*[3], Islam M. Rafizul[4] and Jobaer Ahmed Saju[5]

[1] *Research assistant, Bauhaus-Universität Weimar, Germany, e-mail: philipp.lorber@uni-weimar.de*
[2]*Postgraduate Student, Institute of Disaster Management, Khulna University of Engineering & Technology, Khulna, Bangladesh, e-mail: aahasan.esdm@gmail.com*
[3] *Professor, Department of Civil Engineering, Khulna University of Engineering & Technology, Khulna, Bangladesh, e-mail: qhbari@ce.kuet.ac.bd*
[4]*Professor, Department of Civil Engineering, Khulna University of Engineering & Technology, Khulna, Bangladesh, e-mail: imrafizul@ce.kuet.ac.bd*
[5]*Postgraduate Student, Department of Civil Engineering, Khulna University of Engineering & Technology, Khulna, Bangladesh, e-mail: jobaerahmed.ce@gmail.com*

***Corresponding Author**

ABSTRACT

This study presents a comprehensive analysis of the plastic recycling business of Khulna City, Bangladesh. Recycling Shops (RSs) are functioning as the main hubs of the plastic recycling practices of the city. By recycling a significant portion of the city's daily produced plastic waste, these RSs play an important role in reducing Municipal Solid Waste (MSW). Though the municipal authority is responsible body to managing plastic waste, but till now they do not have a sufficient system to handle this. This responsibility is replaced by RS recycling activities, but they don't get any support from Khulna City Corporation (KCC). Intending to listen to their problems and present them to KCC, RS owners of Khulna City are invited to the Awareness Center (AC) by Working Group (WG) II: Recycling Shop (RS) assessment of SCIP Plastics Project, KUET. RS owners share their roles in solid waste management, challenges they faced during recycling and requirements to improve the recycling practices in a discussion meeting with experts, and members of WG II of the project. During the discussion meeting among the 40 participants, 33 RS owners were surveyed by a structured questionnaire. In the methodology of the study, insights from the discussion meeting and survey are analyzed. All RS owners share that they play a crucial role in the solid waste management system through plastic recycling and also share that these recycling activities have a lot of positive aspects such as a positive impact on the environment, saving energy, reducing pressure on landfill and preventing blockage of the drain. The RS owners mention many challenges such as impurities in input materials, lack of technically qualified staff, policy-related barriers from municipal body, and lack of a specific industrial zone. They also include some demands to improve recycling practices such as recognition and support from KCC, an Environmental Clearance Certificate from the Department of Environment (DoE), and allocating specific places for their effective recycling practices. A clear gap in the existing policy and regulatory framework of municipal and government bodies to support and recognize these RSs of Khulna City. These policies and frameworks are recommended for reform and building collaboration between the RS owners and municipal, government bodies is crucial for the effective plastic recycling practices of Khulna City.

Keywords: *KCC, RS, Plastic, recycling, challenges, policy*

1. INTRODUCTION

The efficiency of Recycling Shops in Khulna City, Bangladesh is abundant for effective Municipal Solid Waste Management (MSWM) and to ensure a sustainable environment. The waste papers and plastics are a significant portion of daily produced Municipal Solid Waste (MSW) which is recycled through a complex system, that is operated by the recycling sector of the city (Ahmed & Moniruzzaman, 2018; Moniruzzaman et al., 2012). Implementing a sustainable and environmentally friendly MSWM system is emphasized, where the recycling sector plays a crucial role (Islam & Moniruzzaman, 2019). The recycling sector of Khulna City operates their recycling including reusing activities without any problems for many years to recycle or reuse paper, plastic, metal, books, garments, cement bags, bones and Furniture (Bari & Kamal, 2011; Siddique, et. al. 2015; Chakraborty et. al. 2017; Tabassum et. al. 2017; Roy & Bari 2019). This traditional efficiency makes them as the alternative formal sector (Raj et. al. 2017), since the municipal body has no formal recycling including reusing activities of solid waste in Khulna and other towns of Bangladesh (Mallick et. al. 2011; Bari et al., 2012a; Bipul et. al. 2013; Faisal et. al. 2013; Ashrafuddoula et. al. 2015). Despite this, they have no formal recognition from municipal and government bodies. The participation of these sectors creates opportunities for a more organized and effective reuse and recycling system for the city (Bari et al., 2012b). Moniruzzaman et al. (2011), mentioned that 7.2% of waste is recycled every day, which is a substantial portion of the daily produced MSW of Khulna City. Mainly, the all RSs of the plastic recycling sector make the flakes from plastic waste materials. Some flakes are used to produce new product such as threads, water pot etc. Sometimes they also sell grain to other RSs of Khulna City. They sell the PET flakes to the Dhaka City and also export to foreign countries. They can't process PET flakes due to limitation of advanced technology (Saju et al., 2023).

In the value chain of plastic recycling of Khulna city, the engagement level of RSs is at top. The ultimate destination of collected waste of Recycling Waste Traders (RWT) and Waste Collectors (WC) to confinement of RSs. These facilities are vital to reducing the amount of waste and management effectively. In this way, they play positive roles to the MSWM system of the city. However, their contributions are ignored by the authorities most of the time (Ahsan et al., 2009; Rahman & Kamol, 2017). The RSs, which also include the recycleng of waste paper and metal, have proven crucial in terms of economic significance in developing countries, where the integration of these types of traditional recycling in solid waste management is still evolving (Roy & Bari, 2019; Saroar et al., 2010). The stakeholders of plastic recycling sector play an important role to reduce the greenhouse gas emission. They also gain the economic benefits by recycling of plastic waste and reduce the pressure on virgin plastic grains (Hasan et al., 2023). Furthermore, the proportional rate of production of MSW and the amount of waste reuse were studied, highlighting the important impact of reuse practices on the city's overall waste management scenario (Bari et al., 2012). These studies collectively emphasize the fundamental role of RS owners in improving urban waste management in Khulna city and their contribution towards environmental sustainability.

The importance of finding practices, challenges and conceptions of RS owners is emphasized in several studies. Though researches indicate that there are some studies on the primary conceptions of RS owners, there are lack of insight into their specific recycling operations, this gap is important for the evaluation of their particular roles in handling different waste types like paper, metal and plastic (Roy & Bari, 2019). However, there are economic viabilities and environmental sustainability of the recycling sector of the city, in this context the roles of RSs are not well explored which indicates a fundamental area for further research (Saroar et al., 2010). Due to the deficiency of acknowledgement, these shops are considered as informal. As a result, they face a lot of challenges which indicates the need for specific research on these issues (Rahman & Kamol, 2017). The roles of RS owners in the MSWM system of the city, especially in the context of a high waste generation rate, is another vital area for further investigation (Ahsan et al., 2009). Finally, there is a noticeable gap in research on RS owners' self-perceptions, their roles, challenges and their views on contribution to

waste management, which can provide fundamental insights for policy formulation and improving recycling practices (Moniruzzaman et al., 2012).

The investigation of RS owners of the plastic recycling sector is significant and has a great impact on policy formulation, recycling operations, and wider environmental goals. It will provide valuable insights for policymakers, and will also provide support to make specific policies in solving challenges regarding the sector. As a result, the integration and support of RS owners in traditional waste management systems will be easier. This study also sheds light on the operational strategies of these owners, which provides opportunities for the improvement of recycling practices throughout the city. It will similarly include the improvement of the collection, segregation and processing of waste, which can be the new standard of the recycling sector. Furthermore, the insight of this study is crucial for sustainable urban development and contributes to reducing waste and environmental conservation efforts. The economic aspects mentioned in this study emphasize the importance of this sector to local economic development, which offers ways to increase the sustainability of RSs and support the livelihoods of the people involved. This study aims to understand the roles of RS owners in the MSWM system holistically. The primary objectives of this study are to the evaluation of their contributions to the MSWM system and identify challenges such as impurities in input materials, workforce skill shortages, and investigate RS owners' perceptions of their role and need for formal recognition. Secondary objectives include assessing the impact of municipal and infrastructural challenges and the impact on RS owners' environmental clearance certificate and improved industrial facility requirements.

2. METHODOLOGY

A structured questionnaire is applied to survey 33 shop owners of Khulna City and insights from a discussion meeting are utilized in this study. The meeting was held between RS owners of Khulna City and experts, members of Working Group (WG) II: Recycling Shop (RS) assessment of SCIP Plastics Project from the KUET side. Both are employed to know the RS owners' roles in MSW management of Khulna City, perceptions, challenges which they face during recycling, administrative hurdles, certification problems, lack of recognition from KCC, requirements for effective plastic waste recycling etc. The meeting was arranged at the Awareness Center (AC) which is operated by SCIP Plastics Project in KCC's official building with the assistance of AC team members of the project on 10 April 2023. WG II has been engaged through collaborative efforts with the RS owners of Khulna City for almost 1.5 years, since beginning the relationships, they were invited to share their opinions. A total of 33 shop owners actively participated in the survey out of about 40 RS owners in the target group.

Two analytical approaches are utilized to process and understand the collected information from the discussions and surveys of RS owners. One is a descriptive analysis was conducted, focusing on the use of frequency counts and percentages to summarize the sectional data collected from the survey. This method provides a clear and simple depiction of the distribution and frequency of the answers, offering an overview of the common trends and patterns among the participants' answers. Cross-tabulation analysis was specifically used to gain a deeper understanding of the relationship between the frequency of pollutants in the input material and their source.

3. RESULTS AND DISCUSSIONS

3.1 Perceptions and Practices of RS Owners

3.1.1 Perceptions of Solid Waste Management

To evaluate the perceptions of RS owners in the MSWM system, which is a fundamental aspect of environmental sustainability, an analysis is conducted and yields an amazingly unanimous answer. All

participants (n=100) acknowledged their involvement in the solid waste management process of the city. The rate of this agreement is measured as 100%, which indicates their overall awareness and responsibility to achieve a sustainable environment.

All the participating RS owners in the discussion meeting, as revealed in the study, recognized their contribution consensually to solid waste management, which indicates a crucial cultural change among the local recycling communities. This recognition specifies a reflection of their roles in solid waste management and also mentions the replication of overall consciousness and concern for sustainable plastic recycling practices. Participation in the recycling process is considered as an active commitment to environmental conservation and resource conservation. In this context, the recognition and support from the policymakers are crucial for these recycling activities, which can lead to improved efficiency and greater environmental sustainability. These findings show that these RSs are functioning as significant contributors to achieving an environmentally friendly and waste-free urban and this model of Khulna City may inspire similar initiatives in other municipal settings.

3.1.2 Positive Aspects of Plastic Recycling

This finding also highlights the various positive aspects of plastic recycling by RS owners of Khulna City. The RS owners think that the crucial positive aspects of their recycling activities include reducing environmental impact (96.97%, n = 32), preventing drainage blockage (87.88%, n = 29), saving energy by recycling new products (84.85%, n = 28), and reducing landfill capacity (78.79%, n = 26) which is shown in Figure 1

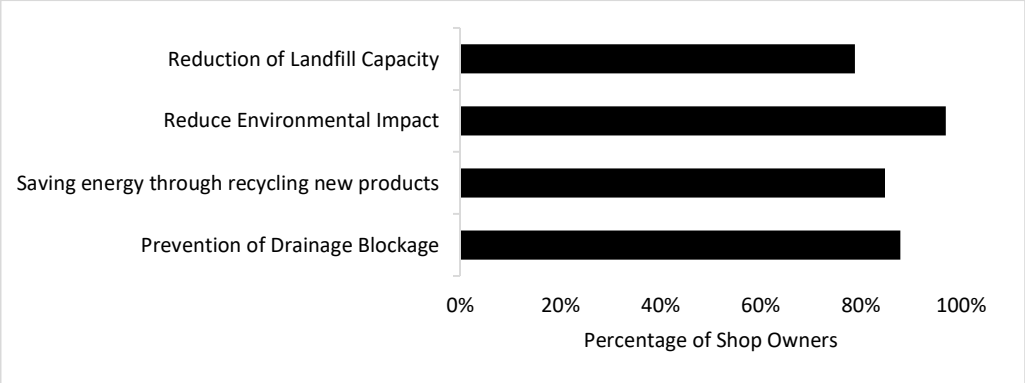

Figure 1 Positive aspects of plastic recycling

3.1.3 Sources of Raw Materials

The analysis of sourcing practices for RSs showed a varied scenery. Every surveyed shop owner (100%, N = 33) collects their raw materials from local RWTs or WCs. It is noticed that the use of imported plastic in their value chain is absent. A smaller fraction of RS owners (15.15%) collect plastic waste from 'Other' sources, lot of them source from outside of Khulna City (66.67%), as well as from other RSs of the city areas (42.42%). These findings are visually represented in Figure 2, which shows the diverse sourcing practices.

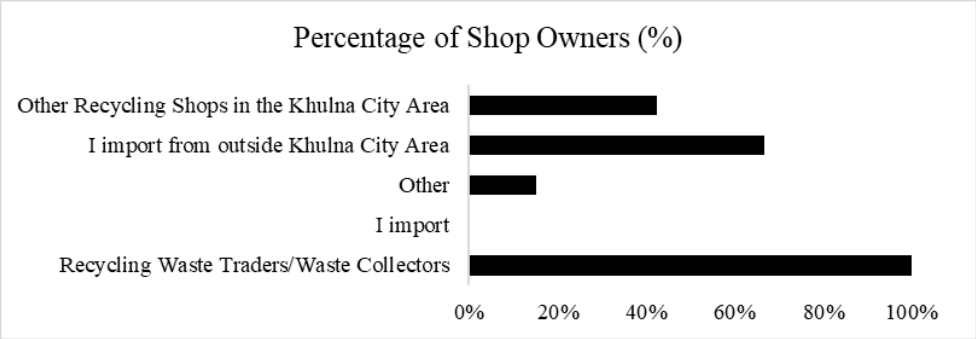

Figure 2 Sources of Input Materials

The common dependence on local RWT/WC sources among RS owners is clear. This trend highlights a deep relationship with local RWT/WC, where RS owners often engage in advance payments to RWTs. This ensures a stable material supply, although sometimes it hampers due to the impartial pricing, constrained by the RWTs' financial limitations and the variable nature of waste availability. While sourcing locally supports in limiting transportation costs and environmental footprint, it also presents challenges in maintaining material quality and consistency, due to the RWTs' limited capacity and unpredictability of waste collection. The exclusion of imported materials in plastic recycling practices indicates that, the recycling activities of the city is solely dependent on the locally generated waste. Environmentally, this approach is better, reducing the impacts associated with long-route transportation of materials. However, this could constrain the variety and quality of recyclable materials, potentially limiting the diversity of plastic waste that can be recycled. The practice of obtaining materials from a mix of sources, though makes some complexity but enriches the recycling process. Collecting materials from outside Khulna expands the range of plastic waste that can be recycled. Additionally, sourcing from other RSs within the city is evidence to resource optimization. It involves recycling materials previously considered non-recyclable. This approach not only minimizes waste but also increases the overall efficiency and usefulness of the recycling process. The diversity in sourcing practices, encompassing external and internal city sources, is a vital advantage for RS owners. It ensures a steady, year-round entry of plastic waste materials, reducing the risks associated with supply variability.

3.2 Challenges

3.2.1 Impurities in Plastic Waste

It is investigated into both that the frequency of impurities faced by RS owners in their input materials and the correlation of these impurities with their sources. This investigation shows the challenges faced in the recycling process within Khulna City. Firstly, it is revealed that a significant number of RS owners frequently deal with impurities. Specifically, 48.48% (n = 16) encounter impurities 'Sometimes,' and 39.39% (n = 13) face them 'Very often.' Only 12.12% (n = 4) reported 'Never' encountering impurities. This data, illustrated in Figure 3, highlights the widespread nature of impurity challenges in the recycling process.

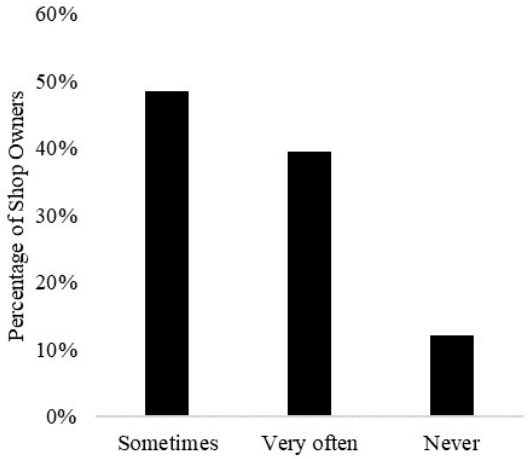

Figure 3 Frequency of facing impurities in plastic wastes

The presence of impurities requires additional processing stages like sorting and cleaning, which are resource-intensive and increase operational costs. This challenge is further highlighted by the significant impact on the quality of recycled products. Materials contaminated with non-recyclable components lead to products that are weaker, less durable, or aesthetically defective, thereby affecting market demand and value.

The cross-tabulation analysis, depicted in Figure 4, shows the relationship between impurity frequency and material sources, which is mentioned in the Figure 2. A notable finding is the higher frequency of 'Very often' encountering impurities in materials sourced from local RWT/WC (39.39%) and ‘outside of Khulna City’ (27.27%). In contrast, a smaller percentage reported 'Never' encountering impurities across all sources, with the lowest frequency in sourcing from other RSs within Khulna City (7.58%).

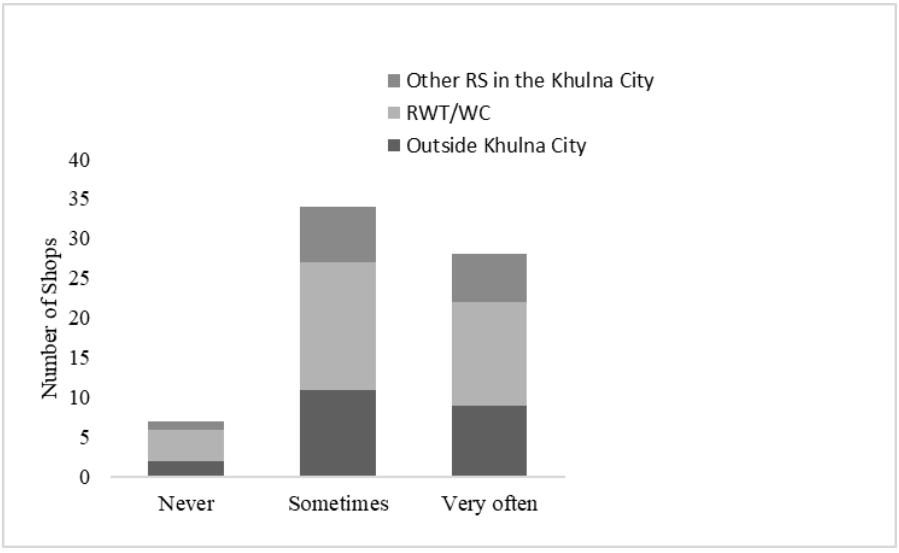

Figure 4 Frequency of facing impurities vs sources of input materials

The high frequency of impurities (39.39%) in materials sourced from local WCs highlights the challenges inherent in this primary source. The nature of collection and lack of initial sorting at this level might contribute to the higher impurity levels. The observation that 27.27% of shops sourcing from outside of Khulna City encounter impurities 'Very often' suggests that even externally sourced materials are not free from contamination challenges. The lower impurity rate in materials from other

RSs within the city suggests a quality advantage in sourcing locally processed recyclables, likely due to preliminary sorting or processing. These diverse patterns in impurity frequency based on the source highlight the necessity for tailored quality control measures. Shops relying on local collectors may need more advance sorting and cleaning processes than those sourcing from other RSs. Understanding this relationship between impurity levels and material sources is crucial for strategic decision-making. A diversified sourcing strategy could balance the impurity risks, enhancing the overall quality of recycled products. Identifying sources with high impurity rates presents opportunities for targeted interventions, such as improving waste sorting standards or capacity building for RWT/WC. KCC may formulate policy, standard regulation for waste collection and strategy. For this purpose, they should make collaboration with the local RWT/WC by integrating them to regular MSWM system of the city.

3.2.2 Administrative Challenges

The data indicating that 30.30% of survey respondents face challenges with municipal bodies (such as KDA and KCC) highlights an area for policy improvement. These challenges encompass bureaucratic complexities, the absence of supportive policies, and a gap in collaborative efforts between RS owners and municipal authorities. This situation presents a key opportunity for policymakers to refine and advance policies supporting the recycling sector. Potential actions could include restructuring regulatory frameworks, announcing incentives to strengthen recycling efforts, or fostering better communication channels between municipal bodies and the recycling sector.

Among the participants, 39.39% RS owners face infrastructural related challenges. The RSs operate their operations within the Khulna City corporation area. But they are not allowed to continue their operation in the city area. Other hand, they have no specific zone where they can operate recycling practices without hurdles. For these two-way problems they face lot of barriers during their operation. They can't expand their infrastructure, which hamper their regular activities.

The challenges associated with municipal bodies and infrastructure may impact the current efficiency of recycling operations. Enhanced policies and infrastructure could lead to more effective recycling processes, higher quality of recycled products, and, the expansion of the recycling sector. There lies a substantial opportunity for strengthened public-private partnerships, where cooperative activities between municipal authorities and private RSs could yield advantageous results. The concerns raised by a significant portion of RS owners regarding municipal and infrastructural aspects signal an imperative need for focused policy interventions and infrastructural enhancements. This approach is vital to overcome existing barriers and to cover the way for a more strong and efficient recycling sector.

3.2.3 Lack of Technically Qualified Staffs

Among 33 RS owners 27 shop owners (81.82%) mention that they face technically qualified staff. When the new staffs join, it is need to train them for a specific time. After a certain time, when the staffs become qualified, some of them leave the work. Among them, some change the occupation, some migrant to other places and some join other RSs. 6 RS owners don't face these types of barriers.

The participants mention that it makes a hamper to the recycling activities, when workers leave the work suddenly. In this mean time, it is hard for them to manage qualified workers. To address this situation, the RS owners who don't face these types of problems can share their experience and strategy with the RS owners who encounter this challenge.

3.3 Needs to Improve Recycling Practices

3.3.1 Recognition from KCC

The survey data reveals an agreed sentiment among RS owners in Khulna City, with every respondent (100%, n = 33) expressing a desire for recognition of their work from the KCC. This consensus

emphasizes a crucial need among shop owners for increased acknowledgement and support from local authorities. The fact that all respondents uniformly expressed a desire for more appreciation underscores a strong collective sentiment in the recycling community. This combined call for recognition reflects their understanding of the significant role they play in enhancing the city's environmental sustainability through their contributions to solid waste management. Their unanimous response highlights the integral role which these shop owners play in Khulna City's waste management system and emphasizes their contribution to the city's environmental sustainability.
Though, RS owners and their recycling activities significantly reduce the working and operation load in solid waste management of KCC. But, KCC don't want to allow the recognition and support the RS. These type of uncooperative attitude from municipal body create dissatisfaction among the RS owners in the plastic recycling sector of the city. Due to the lacking of recognition, the RS owners face various administrative challenges such as charging fine from administrative body due lack of papers and legislation, bureaucratic barriers and sometimes harassment from fraud journalist. This situation points to a vital need for policy enhancements and increased support from local governmental bodies. The provision of recognition and support from the KCC can be in various forms, including policy initiatives, financial incentives, or public acknowledgement of the role these shops play in the city's environmental health. There is a corresponding need to raise public awareness about the contributions of these RSs. Increased public appreciation could improve collaboration between the community and the recycling sector.

3.3.2 Certificate from DoE

The survey data illustrates a unanimous need among RS owners in Khulna City regarding the necessity of obtaining environmental clearance certificates from the Department of Environment (DoE). All participants (100%, n = 33) acknowledged this requirement, signifying a collective aspiration for formal recognition and validation of their environmental practices. Such certification is considered as a means to confirm their compliance with environmental standards and strengthen their overall reliability. Furthermore, the high percentage of shop owners recognizing their roles in various environmental aspects, which is showed in figure 1 underlines their understanding of the broad benefits derived from their recycling activities.

Despite these acknowledged contributions to environmental sustainability, according to the existing policy the DoE don't issue the environmental clearance certificates to RSs within the KCC area, poses a significant regulatory barrier. Due to the lack of formal recognition, RS owners face administrative harassment. The consistent demand for environmental clearance, which is related with their acknowledged positive roles, indicates an argent need to remake current policies. Bridging the gap between the regulatory framework and the recycling operations is important. Providing environmental clearance certificates could appear them as alternative formal recycling sector.

3.3.3 Industrial Zone

In response to the query on the necessity for specific industrial zone and waste management facilities, the survey data revealed a unanimous sentiment among the RS owners in Khulna City. All respondents (100%, n = 33) stated the need for such facilities. This finding indicates a widespread recognition among the shop owners of the importance of specific industrial zone to support their recycling operations.

The shop owners' request for a designated space from the KCC for their recycling activities highlights a specific infrastructural need. Obtaining a dedicated space for recycling will provide a structured environment for operations and will signify formal recognition and support from DoE. By providing dedicated areas for recycling, KCC can play a crucial role in organizing the recycling sector and also in promoting environmentally sustainable practices

4. CONCLUSIONS

This study was conducted to analyse the perceptions, roles, challenges and needs encountered by RS owners during performing the recycling activities in Khulna City of Bangladesh. It is recommended to reform policies and frameworks and also to build collaboration between the RS owners and municipal, government bodies for the effective plastic recycling practices of Khulna City. Future studies should explore strategies for an effective collaboration between the RS owners and municipal, government bodies. Findings from this research can be implemented to develop the recycling practices in a same context of other cities of development countries. The major outcomes of the study are enlisted bellow:

- All participating RS owners think that they contribute positive roles to the solid waste management. In the research, their claim is appeared as truth specially to reduce plastic waste from MSW.
- All RS owners source their plastic waste materials from local RWT/WC. A smaller fraction of RS owners (15.15%) collect plastic waste from 'Other' sources, lot of them source from outside of Khulna City (66.67%), as well as from other RSs of the city areas (42.42%).
- Maximum RS owners face impurities in their input material. Other challenges including lack of technically qualified staffs, policies and frameworks related barriers from municipal and government bodies and, lack of specific industrial zones
- All RS owners demand some necessities such as support and recognition from KCC, issuing Environmental Clearance Certificate from DoE and allocating specific places for effective recycling practices.

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