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Towards a Low-Carbon Circular Economy: Innovative Solid Waste Management in Garment Industries of Urban and Peri-Urban Dhaka

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Abstract

The garment industry, one of Bangladesh's largest economic sectors, generates a substantial number of solid wastes, particularly fabric scraps known locally as "*jhute*". Improper management and poor disposal of these wastes have resulted in serious environmental challenges. The challenges include the rise of Green House Gas emissions, which contribute to global warming. The present paper evaluates the solid waste management practices in selected garment factories in urban and peri-urban Dhaka, the capital of Bangladesh. The paper aims to focus on the environmental impacts and carbon footprint of the garment factories. Adopting the Organizational Carbon Footprint (OCF) approach using a gate-to-grave system boundary that falls under Scope 3, Category 5 Waste Generated in Operations - GHG Protocol, the study evaluates the emission factor-based estimation for three common disposal methods: recycling, incineration and landfilling. The estimated carbon emissions show that recycling produces the lowest emissions of 252.3 kg CO_2e, whereas landfilling and incineration generate emissions with an approximation of 790.2 kg CO_2e and 886.8 kg CO_2e, respectively, indicating that recycling is the most viable and carbon efficient method of disposing garment waste. The calculated values reflect indirect emissions from the overall waste-disposal process, based solely on the mass of waste generated and disposed. The findings suggest improvement of domestic recycling capacity, formalization of the *jhute* sector and incentives for low-carbon waste policies. With proper validation of the findings, strengthening the waste management infrastructure and promoting greener industry practices would assist the garment sector move towards a more circular, low-carbon and environmentally responsible future.

Keywords

Garment industry, *Jhute*, Solid waste disposal, Carbon footprint, Recycling.

1. Introduction

The world population is increasing at an unprecedented rate, putting more pressure on the finite resources. The need for sustainable management of these resources is urgent, given the growing demand, particularly in the garment industry. The trend of fast fashion, coupled with the needs of a growing population, is leading to an increase in the number of garments produced. The solid waste generated in the manufacturing process is primarily driven by the mass production of clothing in these factories. According to Habib et al. (2022), the garment industry generates 4% of the total waste produced globally. As the second largest exporter of ready-made apparel in the world, Bangladesh is an influential player in the global textile manufacturing industry. In particular, Bangladesh's major areas - Dhaka, Gazipur, and Narayanganj - host 1,160, 1,053, and 613 garment factories, respectively (Biswas et al., 2024; Shajahan

et al., 2021). Bangladesh Garment Manufacturers and Exporters Association (BGMEA) estimates that there are over 4,500 active RMG factories in Bangladesh that jointly produce approximately 351,000 tonnes of textile by-products annually (Bhuiya, 2017). Primarily, the waste is produced during the cutting processes, which accounts for 60 to 70% of the total waste, with the remainder contributed by sample waste, production line scraps, and defective materials. In Bangladesh, the solid textile scraps are locally known as *jhute*.

Children's clothes and pillow covers are produced using large pieces of fabric, whereas the leftover scrap is recycled into items such as mattresses and cushions. Cutting waste is converted into towel and quilt yarn by local industries, and high-quality scraps are exported to India, China, and Turkey. Textile waste, particularly cutting waste, is a major by-product of garment manufacturing, generated at various stages of production, including cutting, sewing, and inspections. A big proportion of the waste is non-biodegradable, and in most cases, the wastes are disposed of without much thought for the environmental repercussions. According to Chowdhury et al. (2023), the industry continues to suffer from a lack of awareness regarding environmental management, financial and technical capacity, along with a poor perception of effective waste mitigation measures. This compromises both long-term sustainability and increases the rate of environmental degradation in already vulnerable urban areas – this indicates a research gap requiring attention.

According to Ahmeda et al. (2022), approximately 50% of garment companies sell their waste to buyers, whereas others use landfill (18%), recycling (14%), incineration (10%), and less traditional waste disposal such as stockpiling (4%), and other solutions (4%), most of which are not eco-friendly (Figure 1). Poor disposal practices have serious environmental impacts due to their high Global Warming Potential (GWP). Additionally, these practices are a major contributor to carbon emissions, which are responsible for worsening the global climate crisis. As such, the garment industry is a significant contributor to environmental degradation (Sandin & Peters, 2018). To safeguard our environment, it is crucial to mitigate carbon emissions in existing practices. The carbon footprint analysis of the most common waste disposal systems allows for identifying the most environmentally harmful processes and assists in choosing the most sustainable option, taking into account the economic feasibility.

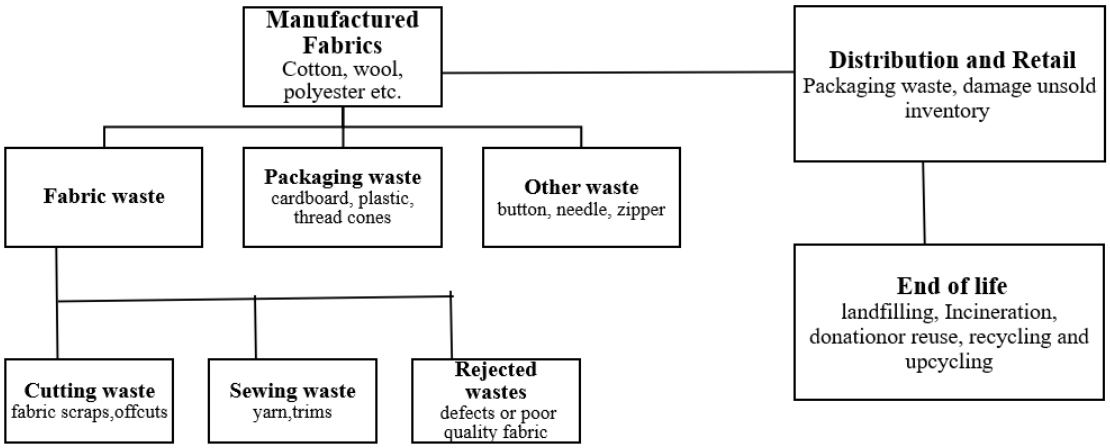

Figure 1. Garments Solid Waste Flow

1.1Objectives

This study aims to assess the solid waste management practices in the garment industry of urban and per-urban Dhaka. Specifically, the study analyses the ecological impacts associated with poor waste disposal practices and identifies areas of improvement. Additionally, the study evaluates the environmental impacts of common waste management techniques, such as landfill, incineration, and recycling, with a focus on their carbon footprint. The study focuses on the carbon footprint of solid waste produced by the garment industry, which is carried out based on a gate-to-grave

approach. Estimation based on emission factors is adopted to assess the results of various waste treatment and disposal processes and for the comparison of CO_2e quantities emitted.

2. Literature Review

In recent years, numerous studies have focused on the importance of effective waste management to mitigate the detrimental environmental consequences associated with the garment industry. According to Ahmeda et al. (2022), with an increase in production rate, the generation of solid waste in the garment factories increases concurrently and proper waste management is dependent on reducing pollution and getting the most out of resources. Some of the primary waste management strategies include textile reuse and recycling. Sandin and Peters (2018) report that reuse and recycling are more advantageous for the environment compared to incineration and landfilling. These practices may be influenced by factors such as the cleanliness of production processes. Additionally, the large amount of waste generated from these sources highlights the adverse impact on the environment and depletion of natural resources. The extent of landfill application is concerning owing to the chemical pollution resulting from the disposal of synthetic and dyed textiles (Bhuiya, 2017). Although certain factories have implemented in-house recycling or downcycling, these measures are insufficient to achieve full sustainability. The findings indicate that the preferable option is upcycling, which can enable the use of waste in a creative way to ensure new product production. Nyika and Dinka (2022) highlight the environmental damage caused by landfilling and incineration of clothing waste. These researchers suggest that promoting more sustainable alternatives, such as reuse, recycling, and biodegradation helps reduce greenhouse gas emissions (GHG) and reliance on raw resources.

Worldwide, garment industries are major contributors to GHG due to heavy energy consumption coupled with improper waste management methods. A textile company based in Turkey reports that a single company has emitted up to 68,746.86 tonnes of CO_2e annually, hence contributing substantially to the carbon footprint. Anaerobic digestion, when integrated with recycling strategies, has proven to be an effective waste management approach for minimizing these environmental impacts. Evaluating various waste management scenarios in Malaysia, Malakahmad et al. (2017) report that anaerobic digestion combined with recycling produced the lowest carbon footprint, resulting in net decreased emissions owing to the benefits of energy recovery and material reuse. In contrast, incineration generated the highest emissions. The clothing industry alone contributes approximately 10% of global carbon emissions. According to Ramachandra and Ranadewa (2023), the raw material extraction phase is the primary contributor to the industry's carbon footprint, followed by energy-intensive manufacturing processes. Additionally, these researchers bring attention to a lack of research on energy management within the sector. Moreover, the large volume of textile waste, more than 66%, ends up in landfills, which exacerbates the industry's environmental impact. With only 15% of textile products being recycled, the low recycling rate highlights significant inefficiencies in the industry's waste management practices.

Numerous recent publications examine sustainable solid waste management strategies and disposal worldwide within the textile industry in depth. Certain studies examine the environmental consequences of waste disposal methods such as landfilling, upcycling, recycling, and reuse, while also incorporating a comparative analysis and offering recommendations derived from the assessment. Some articles emphasize the carbon footprint analysis of the management processes within the entire sector while assisting in explaining the real effects of these factories are on the global climate. A research gap exists due to the insufficient number of studies focusing on the carbon footprint analysis of Bangladesh's garment industry, particularly in Dhaka and Peri-urban Dhaka. This report aims to assess existing waste management procedures and examine the carbon footprint associated with the disposal of solid waste generated by factories. This will offer a better understanding and facilitate a comparison of each waste disposal method, focusing on their carbon emissions.

3. Methods

3.1 Study Area

The study area is situated in Dhaka and its peri-urban areas. Dhaka city, the largest and most densely populated city in Bangladesh, is located in between 23.8041° North longitude and 90.4152° East Latitude. Gazipur and Narayanganj are peri-urban areas of the city located at 23.9905° N, 90.3877° E and 23.6429° N, 90.4883° E, respectively. Figure 2 illustrates the map of the study areas focusing on the apparel industries assessed in this research.

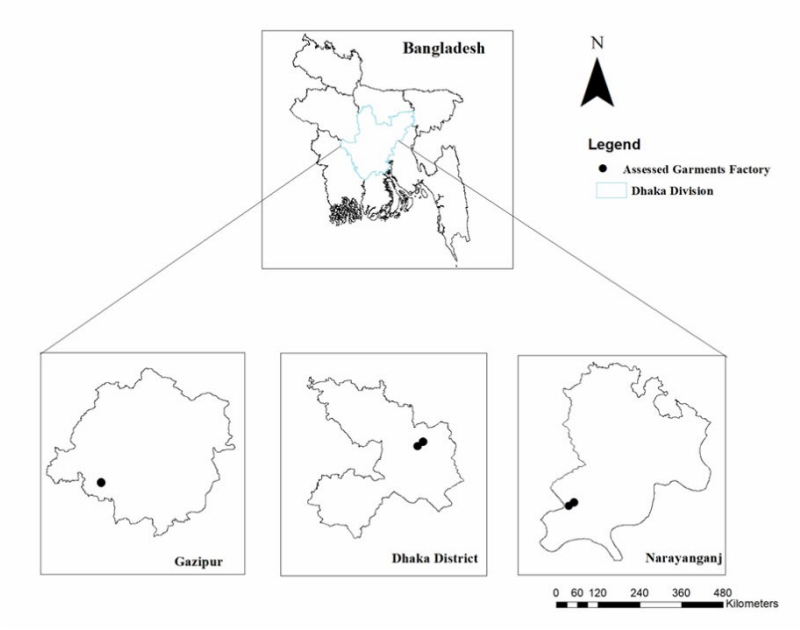

Figure 2. Study Area map of Dhaka, Bangladesh.

3.2 Detailed Methods

The present study employs both quantitative and qualitative analyses. Five apparel industries; Dekko Fashion Ltd., Dekko Readywears Ltd., RN Knit Tex Ltd., United Costume Ltd., and Mascom Composite Ltd. (Garments Division), located in Dhaka and peri-urban Dhaka, were visited. Qualitative data were collected from the selected factories.

The data were collected through field visits and literature review regarding the collection, storage, handling, disposal or recycling of waste in garment factories. Carbon footprint analysis of garment industry solid waste was performed employing a gate-to-grave approach under Scope 3, Category 5 of the GHG Protocol framework. Carbon dioxide emissions from various waste treatment and disposal methods were estimated using an emission factor-based approach. For secondary data collection, Emission Factor (EF) values were obtained from a literature review, which ensured a more accurate carbon footprint assessment, as emission determinants can vary depending on factors such as energy consumption, technological configuration, geographical location, and waste composition.

4. Data Collection

The data used for calculation were collected from Mascom Composite Ltd. (Garments Division), a garment manufacturing factory situated in Gazipur. A site visit and detailed observation of the processes identified the main sources of solid waste. As the factory did not provide access to raw waste records, a partial unit-based estimation had to be applied, assuming 1000 kg of total waste and calculating by percentage distribution. Fabric waste estimates were obtained through discussions with factory representatives regarding losses during cutting, checking, sewing, and finishing. The analysis focused exclusively on cotton fabric waste, which constituted the predominant factor of the waste generated. In the case of heterogenous textile waste, variation in material composition would necessitate different emission factors, thereby altering the overall carbon footprint. In addition, packaging waste, including paper, cardboard, and needles, was estimated based on qualitative inputs from factory staff. Table 1 presents the compiled and estimated data.

Table 1. Category Wise Fabric and Packaging Waste in Percentage

Types of Waste	Category Wise	Wastage Amount (Kg)	Wastage%	Total Wastage (Kg)
Fabric Waste (Cotton)	Cutting	150	15	265
	Inspection	60	6	
	Sewing	40	4	
	Finishing	15	1.5	
Packaging Waste	Paper	70	7	80
	Cardboard			
	Plastic	10	1	
	Miscellaneous	1.5	0.15	1.5

* All estimated values are in kg calculated for every 1000 kg of garments

5. Results and Discussion

5.1 Numerical Results

The employed EFs (the ratio of kg CO_2e/kg waste treated) were determined from previously published sources [e.g. IPCC (2006), EEA (2020), WRAP (2011,2012), DEFRA (2023), and Textile Exchange (2021)]. The factors represent approximate values derived from literature-based ranges to reflect the average performance of waste treatment methods employed in Bangladesh's garment industry. The approach ensures methodological consistency while accounting for technology, energy consumption, and material composition variations across various facilities.

Table 2. Emission Factors

Treatment Method	Waste Type	Estimated EF (kg CO_2e/kg)	Key References
Recycling	Fabric (Cotton)	0.8	WRAP (2011, 2012); Textile Exchange (2021); IPCC (2006); DEFRA (2023); EEA (2020); Plastics Europe (2020); DEFRA (2023); EPA WARM Tool; Eurofer (2022); World Steel Association (2022)
Landfilling	Fabric (Cotton)	2.4	
Incineration	Fabric (Cotton)	2.7	
Recycling	Packaging (Paper/Plastic)	0.5 / 0.45	
Incineration	Packaging (Paper/Plastic)	2.0 / 3.1	
Landfilling	Packaging (Paper/Plastic)	1.8 / 2.8	
Other Wastes	Mixed	0.5 / 0.1 / 0.2	

Table 2 presents the resulting EF used on each type of waste at three treatment scenarios (i.e., recycling, incineration and landfilling) are displayed in Table 2. Compared to landfilling and incineration (up to 3.1 kg CO_2e/kg), recycling has lower emission intensity (0.45 - 0.8 kg CO_2e/kg) because of the increased energy and emission load.

Carbon Footprint Calculation:

Equation (1) was used to calculate the total carbon footprint (CF) of each type of waste and its corresponding treatment method:

$$CF\ (kg\ CO_2e) = Waste\ Amount\ (kg) \times EF\ (kg\ CO_2e/kg) \quad \ldots\ldots\ldots(1)$$

The weight of wastes generated in the garment facility were multiplied by their respective emission parameters to determine the total emissions for the three treatment options. The summary of the results is presented in Table 3

Table 3. Summary of Carbon Footprint Calculations

Waste Type	Waste (kg)	Recycling (kg CO_2e)	Landfilling (kg CO_2e)	Incineration (kg CO_2e)
Fabric (Cotton)	265	212	636	715.5
Packaging (Paper)	70	35	126	140
Packaging (Plastic)	10	4.5	28	31
Other Wastes	1.5	0.75	0.15	0.3
Total Emissions	—	**252.3**	**790.2**	**886.8**

Table 4 presents the estimated carbon footprint of the waste per treatment scenario and category according to Equation (1) (Boyle, 2024). Recycling generated minimum carbon emissions (252.3 kg CO_2e), incineration generated maximum carbon emissions (886.8 kg CO_2e) whereas landfilling generated moderate carbon emissions (790.2 kg CO_2e). The findings provide numerical evidence of the differences in GHG emissions among the various treatment methods and serve as the base for the comparative analysis in the following section.

5.2 Graphical Results

Table 4. Percentage Contribution and Total Carbon Footprint of Solid Waste Disposal Methods in Garment Production

Disposal Method	Total CF (kg CO_2e)	% of Total
Recycling	252.3	13.1%
Landfilling	790.2	40.9%
Incineration	886.8	46.0%

The **Total emissions (all methods)** = 252.3 + 790.2 + 886.8 = 1,929.3 kg CO_2e

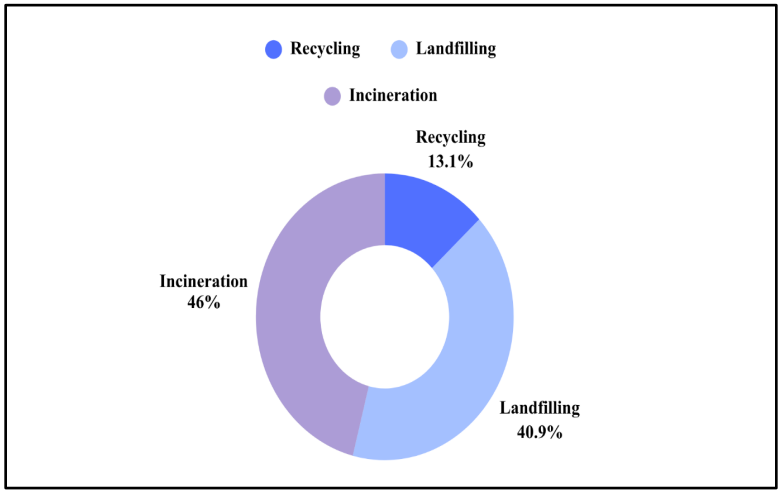

Figure 3. Carbon Footprint Contribution of Solid Waste Disposal Methods in Garment Waste Management.

Figure 3 illustrates the percentage contribution of each solid waste disposal method to the total carbon footprint of garment waste management: incineration has 46.0%, landfilling has 40.9%, and recycling has only 13.1%. The values indicate that non-recycling methods are the largest contributors to GHG emissions, collectively accounting for approximately 87% of total emissions. The findings suggest that recycling is the most carbon-efficient option, substantially reducing emissions compared to landfilling and incineration. This highlights the significance of implementing recycling-focused waste management systems to minimize the CF of the garment industry.

5.3 Proposed Improvements

The findings of this study clearly indicate that recycling is the most eco-friendly sustainable method for managing garment waste, as it substantially curbs GHG emissions by lowering waste volumes and demand for virgin materials. Landfilling is less carbon-efficient, whereas incineration generates significantly higher emissions and may be used only as a last resort. Note that by 2026, garment industries are expected to adopt the 'Net Zero - EMS' project, replacing traditionally used equipment with renewable energy, consistent with global evidence that recycling lowers GHG emissions compared to landfilling or incineration (EPA, 2020). In the context of Bangladesh's garment industry, these findings are highly relevant and consistent with current sustainability challenges and emerging policy directions. The industry generates huge quantities of cutting, fabric, and mixed textile waste, much of which is continues to be handled through informal sorting, open disposal, or low-value reuse. Recycling, particularly fiber-to-fiber and material recovery processes, offers the most environmentally efficient solution as it directly reduces the need for imported virgin fibres, lowers production energy demand, and significantly cuts GHG emissions.

Currently, a significant portion of the generated waste is directed to informal second-hand markets, manually sorted mainly by economically disadvantaged women, and exported for recycling abroad. Although this trade is economic significant, the trade lacks formal regulation in Bangladesh. The findings highlight the need for recycling-focused, regulated waste management practices to reduce the industry's carbon footprint.

5.3.1 Enhancing In-Country Recycling

Behavioural changes can be obtained by launching sustainability awareness campaigns and training programs. Training the various stakeholders about the environmental impacts of incineration and landfilling, compared to the benefits of recycling is expected to support the long-term adoption of greener practices. The findings of the study reveal that large quantities of garment waste are exported to neighbouring countries for recycling. As such establishing advanced recycling facilities locally would reduce transportation-related emissions while retaining the economic value within the country. Moreover, this approach is unlikely to displace workers in the *jhute* segregation sector; instead, it will generate additional employment opportunities and strengthen the economy.

5.3.2 Formalization of the *Jhute* Sector

The findings indicate that although *jhute* trade plays a critical role in waste distribution and management, it remains largely informal and unregulated. It is noteworthy that many underprivileged women employed in this sector work without labour protections or occupational safety standards. Legalizing and formalizing this industry could ensure fair wages, safe working conditions, and environmentally responsible operations. As such integrating this sector into official policy would improve both social and ecological outcomes (United Nations BD, 2023).

5.3.3 Policy Incentives for Low-Carbon Practices

Tax breaks on recycling efforts and upcycling initiatives by businesses or carbon credits to factories using fewer toxic technologies can encourage improved waste management. Note that encouraging upcycling, not just conventional recycling, promotes the transformation of waste materials into higher-value products, thereby reducing raw material demand and lowering lifecycle emissions. In addition to the treatment of wastes, focus should be placed on an integrated strategy on carbon reduction to attain sustainability in the industry. This goal would serve the global climate agenda while having positive effects on the economic and social grounds.

5.4 Validation

This study adopts Organizational Carbon Footprint (OCF) to measure the carbon footprint of the estimated amount of solid waste from the garment industries. Using a boundary of the gate-to-grave system, the analysis focuses on dealing with emissions arising from the waste produced by organizations under the garment industry aligning with the desired agenda of GHG emissions (Gao, et al., 2014). OCF is commonly assessed using the GHG Protocol Corporate Standard, developed by World Resources Institute and the World Business Council for Sustainable Development. The calculation of this study falls under Scope 3, which covers indirect GHG emissions occurring across the organizational value chain, including extraction, production, transportation, and waste disposal (Boyle, 2024). Additionally, these are defined within the three scopes of the Corporate Accounting and Reporting Standard (Pandey et al., 2011), which provides tools and methodologies for the quantification and reduction of GHG emissions.

The calculation of carbon emissions solely from the disposal of solid waste, which is mostly *jhute*, falls under Scope 3, Category 5 as outlined by the GHG Protocol Corporate Value Chain Standard. The standard allows the use of activity data (e.g. mass of waste) and emission factors to estimate GHG emissions. This approach ensures transparency

and reliability in computing the carbon footprints without the upstream or transportation data. Therefore, it is compatible with the accepted global practices in carbon accounting (Eggleston, et al., 2006). Notwithstanding that Category 5 is classified as an upstream activity in the GHG Protocol framework, this study focuses on waste generated post disposal. This classification reflects waste treatment after disposal, and upstream or downstream - determined by value chain position rather than process sequence, which allows the ensuing sections of the report to go on with calculations (Eggleston, et al., 2006).

6.Conclusion

This paper reviews solid waste management in Bangladesh's garment industry, focusing on carbon emissions. The findings of the study indicate that there is limited research on the carbon footprint and environmental impacts of garment solid waste specifically in Dhaka and its peri-urban areas, particularly including informal *jhute* handling and under-researched waste streams. Additionally, existing studies rarely integrate socioeconomic factors, local recycling and upcycling potential, and scenario-based analyses for sustainable waste management in the Bangladesh context. Moreover, the findings suggest that recycling pathways are the most sustainable methods, whereas landfilling and incineration produce high emissions and remain common. The garment sector relies heavily on informal solid waste management, particularly *jhute* markets that lack regulation, safety, or formal oversight. Strengthening and formalizing these recycling channels could improve environmental outcomes while supporting livelihoods, especially for women engaged in this particular field of work.

Based on the findings, the key sustainable waste management strategies for the garments sector include expanding domestic recycling, regulating informal handlers, and promoting cleaner waste treatment, aligned with goals such as Net Zero. With proper infrastructure, policies, and industry commitment, the garment industry can reduce its carbon footprint and build a more sustainable circular economy.

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Biographies

Muhammad Abid Hassan Khan is a final year undergraduate student enrolled at the Department of Civil and Environmental Engineering at North South University, Bangladesh. His research and scholarly interests include environmental sustainability, solid waste management, climate change, and water resources. He has carried out research regarding waste management and the environment in relation to water in the local scene. He dreams of furthering his education in Environmental Engineering in order to add his part in the creation of sustainable and resilient environmental solutions.

Fadi Arhab Sajed is an undergraduate student at North South University, pursuing a Bachelor's degree in Civil and Environmental Engineering. His academic interests focus on the concept of sustainable development to develop practical and innovative solutions in environmental and green engineering. Fadi has attended different seminars and workshops like the Sustainable Water Management Expo 2025 where he was representing his university and has collaborated on his work with his respective faculties. Alongside to his academic pursuits, he is also co-founder of Shustho Bangladesh - a youth-based organization that aims at promoting hygiene and environmental awareness. This contributed to him developing his strengths and abilities to work actively in a group and come up with leadership qualities and pro-active thinking. He is also enthusiastic about finding a chance to cooperate and work on

sustainability-oriented projects. The desire to learn and explore is what made the academic path as well as his career ambitions, as he aims to advocate sustainable engineering solutions at the national and international level.

Afsana Islam is a fourth-year undergraduate student pursuing her course in the Civil and Environmental Engineering Department of North South University. She is a Teaching Assistant within her department and has been working there for the past three semesters. She holds a strong passion for sustainable development in the engineering field, particularly in environmental engineering. She has been involved in research on solid waste management, sanitation technology, textile effluent management, and pavement design. Besides her educational endeavors, she has been able to experience various co-curricular activities, namely, hosting a festival in her department. She also attends seminars and meetings regularly that are relevant to her area of interest. She is a hard-working person who does not take her work lightly and has a strong work ethic.

Adiba Bintay Atik is an undergraduate student at North South University, majoring in civil and environmental engineering. Adiba has been keen on waste reduction, city living change, sustainable development, and environmental engineering. She is determined to find evidence-based solutions and make a difference. Adiba engages in research-oriented activities, seminars, and student-led projects that enhance critical thinking and multi-disciplinary studies in her academic life. Besides her studies, Adiba participates in volunteering activities, leadership training, and student organizations, which encourage partnerships, personal development, as well as civic participation. She aims at building her current abilities, getting to learn more through her colleagues, and placing herself in an academically rich environment.

Israt Fatema Shupti is an undergraduate Civil and Environmental Engineering student at North South University who has become interested in doing research, especially on climate resilience and sustainable development. In her academic journey, she has worked on projects focusing on climate-resilient infrastructure and sustainability practices. In the future, she wants to contribute to innovative waste management systems and promote environmental conservation.

Dr. Shama E. Haque is an environmental scientist and engineer with over twenty years of multidisciplinary research and professional expertise in hydrogeochemistry and environmental engineering. She obtained her B.S. in Civil Engineering from The University of Texas at Austin and her Ph.D. in Environmental Science and Engineering from The University of Texas at Arlington under the mentorship of Dr. Karen H. Johannesson. She completed postdoctoral research at the University of British Columbia, Canada, focusing on the geochemical evolution of groundwater in both pristine and anthropogenically impacted aquifers. Dr. Haque serves as an associate professor in the Department of Civil and Environmental Engineering at North South University, and she also contributes as an associate editor for *Groundwater for Sustainable Development* (Elsevier, Netherlands).Dr. Haque's research portfolio encompasses the biogeochemical dynamics of natural and perturbed surface- and groundwater systems, with particular emphasis on the fate, transport, and speciation of contaminants in sediments, surface water, and aquifers. She has conducted extensive studies on arsenic geochemistry, developing conceptual models of its mobility and transformation along flow paths based on integrated field and laboratory investigations.Her current research addresses sustainable waste management, including construction and demolition debris, household and industrial wastes, and bioremediation strategies. She also investigates climate change mitigation and adaptation, landslide hazard prediction, and urbanization-induced impacts on water quality. Dr. Haque's work bridges environmental engineering, hydrogeochemistry, and urban sustainability, advancing both theoretical understanding and applied solutions to complex environmental challenges**.**

Dr. Nazmun Nahar is a distinguished professor and researcher at North South University (NSU), specializing in Water Resources Engineering. She currently serves as a member of the Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh. Dr. Nahar is the Academic Co-ordinator of the Bangladesh Chapter of International Water Association (IWA). From 2016 to 2024, she was the Director of NSU's Institutional Quality Assurance Cell (IQAC).Prior to joining NSU in 2013, Dr. Nahar gained valuable international experience in both academia and industry from 2005 to 2012. Dr. Nahar holds a PhD and MSc in Civil Engineering, with a specialization in Hydraulics and Hydrology, from Purdue University, USA, and a BSc in Civil Engineering from Bangladesh University of Engineering and Technology (BUET). With over 20 years of experience spanning academia and industry, her areas of expertise include Integrated Stormwater Management Planning (ISMP), floodplain analysis and management, drainage design, advanced hydrologic and hydraulic modeling, evaluation of Best Management Practices (BMPs) for stormwater control, development of low-impact development (LID) strategies, and industrial water management. She has contributed to several peer-reviewed international journals, book chapters, and conference

proceedings.She is a dedicated practitioner of Quality Assurance (QA) in Higher Education, serving as an Academic Auditor, Resource Person, and Facilitator for the Bangladesh Accreditation Council and the British Council. During her tenure as IQAC Director, In 2024, Dr. Nahar was awarded the title of Senior Fellow (SFHEA) by Advance HE, a UK-based global organization committed to improving higher education.