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Reuse Before Recycling: A Bangladesh-Focused Circular Economy Assessment of Waste Value, Equity, and Policy Outcomes

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Abstract

The key issue of this paper is to find out the preference for re-use and re-use subject to re-cycling in the process of transition towards circular economy in Bangladesh. The study argues for re-use where possible, since it uses embedded labour, design, energy and water and retains market value, and that using a product, component or packaging is still useful, safe and acceptable to the user. Recycling is still a large part of it, but it's a second option for materials that are not really in a position to continue being used. The paper provides an evaluation in four dimensions – environmental value, economic feasibility, social equity, and public-health risk – and market readiness and governance capacity in the context of Bangladesh. It looks at municipal solid waste, plastic packaging, RMG textile waste, repairable electronics, glass, metals and organic waste and low value flexible packaging. The analysis suggests that Bangladesh should not go for ‘reuse-only' or ‘recycle-only' approach. The reuse-first hierarchy that uses source segregation, repair and refill facilities, the formalisation of informal workers, improved producer responsibility, textile-waste flows that are traceable, and quality controlled recycling systems are more realistic. The paper offers an implementation roadmap, a waste-stream decision matrix as well as an editable figures and a policy scorecard for scholars, municipalities, brands and policymakers.

Keywords: reuse; recycling; circular economy; Bangladesh; plastic waste; textile waste; informal sector; waste hierarchy; extended producer responsibility; sustainable consumption

1. Introduction

Bangladesh is now confronted with a real-life circular economy dilemma that's more than a classroom discussion—shhould the country invest in re-use systems or in recycling systems? The short answer is that, in many cases, reusability is preferable when a product can still be used, is safe, and is socially acceptable – at that point, that value is already included in design, labour, energy, water, and logistics. Recycling remains significant; however, it typically reduces the product to a material and does not result in the recovery of as much value in the reuse process. The reduction, reuse, and recycling approaches are considered as complementary strategies, not as mutually replaceable ones, in current circular economy theory, and it is this value-loss issue that stands out as a key concern (Kirchherr et al., 2023; Badran et al., 2025; Bais et al., 2025). In Bangladesh, the issue is urgent due to several factors, such as the speed of urbanisation and export-

oriented garment production, the lion's share of plastic packaging waste, and informal waste work, which create a fast-moving material system with slow-moving governance and safe infrastructure (Noman et al., 2023; Abdullah & Abedin, 2024; Rafizul et al., 2024).

The 'reuse or recycle' mantra hides a big policy issue. Communication of recycling is more easy because it following familiar municipal targets, collection campaigns, and processing in the factories. Reuse is more challenging since it involves changing behaviour, cleaning, repairs, product tracking, implementing safety regulations, consumer trust, storage space, and reverse logistics. But the recent literature on the circular economy has shown that extending product and component lifespan (and keeping products and components in use longer), rather than extracting materials after they have become waste, is essential for higher-value circular strategies (Dreier et al., 2025; Izquierdo-Montfort & De Rongé, 2025; Corsini, 2025). This distinction is significant in the Bangladeshi context for garments, household plastics, glass bottles, furniture, electronics, construction materials and food service packaging. A clean, cotton off cut from an RMG factory can be utilized for re-use, upcycling or high quality fibre recycling, whereas a contaminated flexible plastic sachet might not have much value unless there is a product design change (Islam et al., 2024; Zuthi et al., 2025; Al Hasan et al., 2024).

This paper suggests the adoption of the re-use before re-use policy in Bangladesh rather than the re-use only policy. The reuse is preferable on values of the product retained, avoiding production and affordability, if the quality can be controlled. Good outcomes are achieved through recycling when the products are dismantled, unsafe, contaminated, not wanted in second hand markets or technically impossible to do on a large scale. The most important strategy, then, is to establish a hierarchy: do not unnecessarily consume, reuse and repair what can be reused, make ready to be reused, recycle material streams that can be confirmed, and, finally, make sure that any remaining items are disposed as true residues. This hierarchy has been inspired by the recent research on circular business models, circular design, circular product assessment and waste-system governance (Bocken & Shirahada, 2025; Dehghannejad et al., 2025; Burini et al., 2025; Wan & Jiang, 2025). The hierarchy needs to be protective of informal waste workers and not supplant them without adequate compensation or social recognition in Bangladesh (Kadir et al., 2024; Rafizul et al., 2024).

The paper has four contributions. First, it makes a clear distinction between reuse and recycling, a distinction that can serve as a policy and municipal guide for Bangladesh. Second, it formulates a "multiple criteria comparison" based on the environmental value, economic value, inclusion of labour, public health risk, market feasibility and policy readiness. Third, it uses the comparison to the key pressure points of circular economy in Bangladesh: Municipal plastics, RMG textile waste, refillable packaging, e-waste, glass and metals, and low-value flexible packaging. Fourth, it offers a staged implementation path for government, municipalities, brands, recyclers and repairers and consumers. The evidence base consists of recently published literature from the past three years (2023-2026), focusing on high impact circular economy, cleaner production and waste management, and Bangladesh specific studies (e.g., Abagnato et al., 2024; Zhang et al., 2024; Harris et al., 2025; Hunka et al., 2025).

Again, the Bangladesh case demonstrates the need to go beyond a purely technical view of circular economy analysis. If families do not sort materials, if transport contracts collect recyclables in combination with garbage, if employees at the recycling plant are poorly paid, or if there is no certain buyer for the recycled material, the recycling plant can fail. A reuse programme can also fail if the cleaning standards are low, products do not satisfy consumer expectations or reverse logistics is more expensive than the value of the product. Recent research on the assessment of circularity, on business model innovation and on policy instruments emphasizes the importance of design of the markets, of traceability, of standardization, and of social acceptance for the achievement of circular outcomes, apart from the material recovery rates (Bais et al., 2025; Bocken & Shirahada, 2025; Dziedzic et al., 2025; Wan & Jiang, 2025).

The paper thus addresses the question posed, as a Decision Problem. The term 'better' is understood under six conditions: lower life cycle burden, higher retained value, lower leakage, better livelihood inclusion, feasible governance and acceptable public-health risk. These criteria are intentionally broader than a typical approach to recycling rates as they can disguise poor environmental performance in terms of tonnes collected. A product can be recycled into a lower value product and continue its manufacture at the same pace, but circularity is only on paper and not in actual resource reduction (Mattson et al., 2024; Poveda-Giraldo et al., 2025; Zhang et al., 2024).

The manuscript is placed in the framework of policy review and not as a main empirical research. It relies on the latest literature to build a realistic framework that can be later validated by conducting household surveys, municipal data collection, RMG factory audits and interviews with informal sector and conducting life cycle assessment. It is suitable for a paper that is journal style, as the contribution is not in the lab measurement but in interpretation of the policy and decision architecture. It is also applicable to Bangladesh where data are scattered among municipalities, industry reports, academic case studies (Akther et al., 2025; Noman et al., 2023; Rafizul et al., 2024) and informal networks.

2. Conceptual and Theoretical Framing

2.1 Reuse, recycling and value retention

Reuse implies that a product, part or a package is reused with minimal or no alteration to its material identity. It may involve direct second-hand sale, repair, refill, sharing, washing, refurbishment and reuse preparation. Recycling implies that a material is used in such a manner that it can be used as input in new production, commonly after collection, sorting, cleaning, shredding, melting, pulping, chemical treatment or fibre opening. The two strategies are not the same. Reuse preserves the original manufacturing work, recycling preserves material without becoming a waste, however, often loses product form, design and labour value (Badran et al., 2025; Dreier et al., 2025; Abagnato et al., 2024). Practically, a reused shirt does not create a new shirt; a reused shirt can be less good fibre unless there is the availability of advanced separation and fibre-to-fibre technologies. A refillable bottle means no new container should be produced, a recycled bottle requires collection, washing, melting/reprocessing and quality inspection (Zhang et al., 2024; Hunka et al., 2025).

The difference is more obvious with the help of the waste hierarchy. The first one is prevention since it does not require waste management. Reuse is on top of the recycling since it can prolong the life of the product without breaking down the product to raw material. Recycling is ranked second after reuse since it is often more energy-consuming, process-consuming, but much better than dumping, open burning or uncontrolled landfills. Recent studies on circular design and company-level circularity evaluation confirm such a hierarchy by demonstrating that circularity achieved is best when it is designed into product design, business models and supply chains prior

to the end-of-life phase (Bais et al., 2025; Dreier et al., 2025; Picatoste et al., 2025; Accorsi et al., 2025).

The policy discourse in Bangladesh tends to begin at a very late stage in the chain. Most waste programmes start with collection and recycling goals, but fail to inquire why single-use products are introduced to the market, why products are hard to repair, why consumers are suspicious of reused products, and why clean separated products are not sent to the municipalities. This gives a recycling load which could have been avoided upstream. Economic value can be added to plastic recycling shops, e.g. their capacity to recycle low-value, contaminated or multilayer materials is low (Abdullah and Abedin, 2024; Rafizul et al., 2024; Al Hasan et al., 2024). It would be a superior circular model that would put priority on reusable options, refill schemes, repair services and transparent material requirements before it would anticipate that recycling would address all residual streams (Castillo-Ospina et al., 2025; Corsini, 2025; Moktadir et al., 2025).

2.2 Why the waste hierarchy still matters

Value retention is the best argument in support of reuse. The value of the product is based not only on the raw material, but also design, labour, transport, retail margins, social usefulness and embodied energy. Recycling only catches the material component, and in some cases, catches it in an ineffective manner due to contamination, downcycling or market fluctuations. Scale is the greatest argument in support of recycling. Recycling is able to accommodate high material volumes when products are already end-of-life, and reuse markets are unable to absorb them. This makes the focal argument of this paper: reuse is preferable to appropriate products, whereas recycling is required to inappropriate products and should be developed as the last resort, not the first (Kirchherr et al., 2023; Bocken & Shirahada, 2025; Feng et al., 2025).

In circular economy theory reuse is put at the top of recycling since it does not destroy product identity prematurely. The latter is at the core of recent 60R debates, in which reuse, repair, refurbish, remanufacture and reverse logistics are placed within a wider framework of circular actions, and not the confines of the micronym of recycling (Uvarova et al., 2023; Kirchherr et al., 2023). Similar reasoning lies in the design-for-circularity studies that hold that products should be designed in such a way that future recovery options are free rather than constrain the system to low-value material recycling (Pruhs et al., 2024; Picatoste et al., 2025; Ravichandran et al., 2025).

The value-retention argument is particularly significant to low-middle-income environments. Bangladesh is characterised by large repair, resale, jhut trading and informal recovery networks, which are labour intensive. These systems may have an environmental significance, but may be carried out without social security, workplace safety or official acknowledgement. Quality circular strategy should then formalise the retention of value in such a way that it does not destroy the livelihoods which already ensure that materials remain in use. This needs a cautious administration since formalisation has the potential to enhance safety and traceability, yet it might leave current workers out should it be intended to be introduced exclusively in large companies (Kadir et al., 2024; Saju et al., 2024; Akther et al., 2025).

Highest priority	Prevent unnecessary consumption	Avoid waste generation before it enters municipal or factory systems.
Better than recycling	Reuse, repair, refill and share	Keep products and packages in direct use with cleaning, repair and redistribution.
Value recovery	Prepare for reuse and remanufacture	Recover components, parts and functions before material destruction.
Material recovery	Recycle verified streams	Recover material value from clean, separated, technically recyclable flows.
Last controlled option	Recover energy only under safe controls	Use only when higher options are impossible and emissions are controlled.
Avoid	Dumping, open burning and uncontrolled landfill	Treat as failure points that should trigger redesign and prevention policies.

Figure 1. Editable waste hierarchy for Bangladesh: reuse before recycling

In Figure 1, the decision order is shown in the entire manuscript. The higher levels preserve more value since they do not necessitate new extraction, production, transportation and disposal. Reuse is above recycling in that it maintains the use of a product whereas recycling typically restores a product to the material state and takes away part of the labour, design and manufacturing value that has been invested. In the case of Bangladesh, hierarchy proves to be helpful, as the municipal systems refer to recycling, without going through the question of whether the product can be fixed, refilled, shared or redistributed. The figure also demonstrates why dumping and open burning can not be considered informal recovery. They are weakness of leakage. The functional message is that recycling facilities are required, yet it should get clean residual materials when prevention, reuse and preparation to reuse have already been tried. The boxes are all editable in Word, meaning that terms of policy, local examples and sector names can be modified later.

3. Bangladesh Context

3.1 Municipal waste and source separation

Four structural conditions explore the reuse-recycle debate in Bangladesh. The latter is the rush urbanization, which increases the municipal waste production and inefficiency in the collection in

the conditions of segregation of households. The second one is the magnitude of the garment industry that generates quantities of textile offcuts, discarded garments, packaging and post-industrial waste. The third is a thick informal recovery network in which waste pickers, itinerant buyers, small junk stores and recycling traders extract value prior to the formal municipalities. The fourth is a policy disconnection at the national level between national circular-economy objectives and urban action (Noman et al., 2023; Kadir et al., 2024; Islam et al., 2024; Rafizul et al., 2024). This situation is unique to Bangladesh in contrast to the high-income contexts where formal collection systems control the recovery of materials.

The garbage residue in the urban areas in Khulna can show why source separation and informal recovery is the center of focus. Noman et al. (2023) reported the features of household wastes in Khulna, whereas Rafizul et al. (2024) simulated the municipal plastic waste production and policy scenarios. Their findings show that there is a familiar Bangladeshi problem of valuable materials being obtained through informal means, but that there is still a high level of mixed waste, plastic leakage and landfill pressure. Kadir et al. (2024) found out that domestic reusable and recyclable items can go through several informal processes in Khulna rather than official source segregation. It means that Circular practices already exist in Bangladesh, however, they are usually poorly paid, dangerous, and unregistered and not associated with official environmental goals.

The most noticeable aspect of the debate is plastic waste. In Bangladesh, PET, HDPE, PP and other higher value plastics are recycled, although the system is unable to handle multilayer packaging, thin flexible plastics, contaminated food packaging and riverine leakage. The system of plastic waste in Bangladesh is characterised by sorting, production, separation and recycling issues highlighted by Abdullah and Abedin (2024). Rafizul et al. (2024) had also added that the policy scenarios would require the segregation of sources, the worry of the population, an improvement in the technology of collection and conversion in case the plastic leakage would reduce with time. Durable containers, refill models, crates, bottles and product-service systems are most reusable in this instance. The recycling process is strongest when single-polymer streams are clean and can be collected and processed at an expected quality (Al Hasan et al., 2024; Ali and Rafizul, 2024; Saju et al., 2024). The same applies to microplastic risk due to the leakage and fragmentation of plastics that result in pollutants that are more difficult to eliminate after being distributed in the water and land (Waseem et al., 2025).

The local evidence is clear enough to warrant a reuse-first, but segregation-conditional pathway. The Khulna household data indicate that the preponderance of biodegradable and income sensitivity of waste production is observed, as more waste is produced per capita in the higher-income households compared to the lower-income households (Noman et al., 2023). According to plastic evidence, the situation with the gap between collection and processing is also dire in Bangladesh: one of the recent analyses says that 646 metric tons of plastic waste is collected each day, 10% of it is recycled, and 37.2% is to be disposed of or processed in a more efficient way (Abdullah and Abedin, 2024). The meaning of these values is not that they are some national constants but they should be considered to be the signs that the system is more linear than circular.

It is Dhaka-added dimension of governance. The waste regime in the city has enhanced the collection and infrastructure over the years, whereas resource recovery has not been at the same pace (Akther et al., 2025). This constitutes a great contrast. Better collection and recoverable value can be sent to landfill to make the streets cleaner. Circular system needs to quantify as follows what happens upon collection: reused, repaired, composted, recycled, leaked, burned or buried. In the absence of this distinction, Bangladesh will be able to access sanitation improved and lose out on more valuable circular benefits. Evidence specific to Dhaka also records evidence of the continued rise in the daily quantity of municipal waste produced and the current dependence on mixed public, private and community-based waste-management to support the importance of minimizing a source of waste through reuse prior to future increases in recycling loads (Rahul et al., 2026).

3.2 RMG textile waste and industrial circularity

The RMG sector gives rise to a second huge opportunity. The local and export-linked networks are already in place in which the post-industrial textile waste, also known as jhut, circulates. Will Bangladesh be able to abandon the low value recycling and informal trading to the higher value reusing, traceable sorting, fibre-to-fibre recycling and brand linked procurement by circles? Recent research in the garment-sector (linking circular supply chain management and sustainable performance in Bangladesh) and the broader textile circularity (reuse, repair, resale, fibre recovery and transparency all demand product information and reverse logistics) proves that product information and reverse logistics is a key to sustainable performance (Islam et al., 2024; Dehghannejad et al., 2025; Burini et al., 2025; Hunka et al., 2025). In the case of Bangladesh, it is

not a sole environmental issue. It is also a challenge of competitiveness because customers of global clothing are more concerned with the use of recycled materials and waste responsibility, chemical security and plausible circular claims (Ares-Sainz et al., 2025; Solis et al., 2025).

The circular economy of Bangladesh is both more robust and fragile due to the informal sector. The informal workers create recovery value whereby they collect, sort and sell materials that are not utilized efficiently by households and municipalities. However, in the majority of the instances, they are used without any protection, contracts, salaries, health plans or recognition in the urban plans. A reuse-first system may be helpful to repairers, tailors, second-hand sellers, refill operators and collection workers. Recycling-first would also create jobs though it may be more likely to concentrate value among processors and traders unless labour conditions and inclusion of workers are enshrined in policy (Kadir et al., 2024; Rafizul et al., 2024; Badran et al., 2025). In Bangladesh, social equity should be a major circular-economy parameter, and not a marginal issue.

The RMG industry in Bangladesh is the most industrial impetus to ask the question; reuse or recycle? The textile and clothing circularity study underlines that the waste of garments is not a stream of materials: it is a mixture of the used garments, pre-consumer offcuts, mixed-fibre scraps, trims, packaging and contaminated residues (Saha et al., 2024; Abagnato et al., 2024; Weber et al., 2023). The most preferable path in the case of Bangladesh is founded on quality sorting. Reuse, upcycling or fibre reuse can be made using clean cotton-rich jhut, whereas mixed and contaminated waste is commonly in low-value downcycling unless traceability is enhanced (Islam et al., 2024; Zuthi et al., 2025).

The industry possesses a trade aspect as well. The concept of circularity, recycleing, traceability and lightened environmental footprint is increasingly demanded by global consumers. When Bangladesh is only able to respond on the basis of low-grade recycling, it might be able to capture less value than other competitors who develop certified reuse, resale, repair and fibre-to-fibre recycling channels. In case it reacts solely through reuse, it might not be able to contain the huge amount of textile waste that cannot re-enter the products. A sorted ladder is the applied solution: reuse when the clothes or textile is still useful, upcycle when it is possible to create design value, recycle when it is technically and economically possible to recover fibre, redesign in cases when it cannot go through all of the above-mentioned steps (Solis et al., 2025; Dehghannejad et al., 2025; Izquierdo-Montfort and De Ronge, 2025).

4. Review Method and Analytical Framework

4.1 Search logic and inclusion boundary

The present paper is based on a structured narrative review and policy-scoring method. The review had given priority to DOI-based studies published between 2023 and 2026 in the field of circular economy, cleaner production, waste management, sustainable production, plastic waste, textile circularity and Bangladesh-specific waste studies. The analytical model compares reuse and recycling on seven factors: retained value, environmental benefit, employment and inclusion, affordability, scalability, health and quality risk, and policy readiness. These requirements align with recent research in the area of circularity assessment, circular business models, product circularity metrics, material passports, company-level circular economy tools and circular supply chain designs (Bais et al., 2025; Dreier et al., 2025; Mao and Cao, 2025; Izquierdo-Montfort and De Rongé, 2025; Burini et al., 2025).

The approach does not assert that there is a universal option that is always superior. Rather, it makes better conditional. There are three conditions that are satisfied before reuse is better; the product must be able to substitute new demand, it must be able to be made safe and desirable at reasonable cost and it must have a logistics system to collect, clean, repair or redistribute it. Recycling is preferred when there is no safe, legal, socially unacceptable, technically unrealistic or weaker environmentally after transport and cleaning are taken into consideration. This conditional approach is based on the recent circular-economy research that cautions against unqualified circularity assertions without life-cycle, economic and behavioural countermeasures (Harris et al., 2025; Hunka et al., 2025; Zhang et al., 2024; Poveda-Giraldo et al., 2025).

The scoring that is employed in this paper is qualitative and policy-oriented as opposed to a complete life cycle assessment. Each criterion has a 5-point scale with 1 indicating weak performance and 5 strong performance in the Bangladeshi context. It will be scored according to the evidence reviewed, the characteristics of Bangladesh waste-system, and feasibility in practice. This is to demonstrate the direction to give priority rather than to give conclusive numerical evidence. This framework might be enhanced by a complete journal submission with primary survey data, household waste audits, RMG factory data, repair market mapping, avoided-emission calculations and stakeholder interviews (Abagnato et al., 2024; Rafizul et al., 2024; Saju et al., 2024; Tetteh et al., 2025).

4.2 Multi-criteria assessment logic

Reuse will not work when second-hand products are of low quality, when reuse promotes additional consumption, and when second-hand goods are not inspected to be safe. Recycling may not work in case collection campaigns give the fake impression that single-use consumption is safe, when recycled material replaces only low-quality virgin material, or when informal workers have to take the risks of their health, and other people can get the profit. The recent research on consumer willingness, product transparency, CIRCA finance and unintended policy impacts substantiate the necessity to evaluate the behaviour and governance and technology (Fu et al., 2024; Hunka et al., 2025; Solis et al., 2025; Richter et al., 2025).

The scoring system is based on a five-point scale of interpretation. A score of 5 reflects that it is likely to be of great benefit in Bangladeshi conditions; a score of 1 reflects that excepting significant redesign it is not very suitable. The score is not reported as a measured data. It is a transparent policy appraisal which assists in comparing alternatives prior to gathering primary data. This is in line with the recent literature on circularity assessment that highlights that indicators must have clear limits, explicit assumptions and sensitivity to industry conditions (Li et al., 2025; Papageorgiou et al., 2025; Tetteh et al., 2025).

There are five waste stream questions in the framework. First, is the product reusable to substitute new production? Second, is it serviceable or can it be refurbished without unsafe labour or a silent environmental cost? Third, is it recyclable into a material which actually replaces virgin input? Fourth, capturing the value: households, workers, municipalities, brands, intermediaries or factories? Fifth, does the policy alternative minimize leakage or does it simply relocate waste to a different location? These questions are in line with the recent literature on product-service systems, digital product passports, circular maturity models and circular business model innovation (Otterbach and Frohling, 2024; Wan and Jiang, 2025; Sgambaro et al., 2025; Provensi and Sehnem, 2025).

Assessment criterion	Reuse-first score	Recycle-first score	Interpretation for Bangladesh
Retained product value	■■■■■ 5/5	■■■□□ 3/5	Reuse normally keeps higher economic and functional value.
Avoided production burden	■■■■■ 5/5	■■■□□ 3/5	Reuse performs best when it replaces new purchase.
Employment inclusion	■■■■□ 4/5	■■■■□ 4/5	Both pathways can create work if workers are protected.

Low-income affordability	■■■■■ 5/5	■■■□□ 3/5	Repair and resale can lower household costs.
Scale with current infrastructure	■■■□□ 3/5	■■■■■ 5/5	Recycling is easier to scale through factories and municipal targets.
Quality and safety risk	■■■□□ 3/5	■■■■□ 4/5	Recycling can standardise output, but contamination remains a risk.
Policy readiness	■■■□□ 3/5	■■■■□ 4/5	Recycling targets are more familiar; reuse needs new indicators.

Figure 2. Editable comparative scorecard for reuse-first and recycle-first pathways

The central comparison is transformed into seven policy criteria in figure 2. The scoring is not given as field data; it is a formal synthesis of the review and needs to be substituted with primary evidence where a journal needs empirical modelling. Reuse scores higher on the retained value, avoided production and affordability due to the fact that a functional product can be reused by the user without being melted, shredded or reprocessed. Recycling has a higher score on scalability and policy preparedness since governments and companies are already aware of collection goals, processing facilities and procurement of recycled content. Employment is rated equally due to the fact that both ways can either promote dignified work or abuse labour based on contracts, safety, payment systems and worker recognition. The number thus does not have a shallow solution. It demonstrates that reuse is more effective at preserving value, whereas recycling is a more mature policy and industrial tool. The cells, scores and bar symbols can be edited to the full extent in Word.

5. Comparative Analysis by Waste Stream

The initial stream is waste textiles and garments. Reuse should be of utmost priority in the case of Bangladesh where garments, fabric roll, accessories and offcuts are either not worn out or can be turned into more valuable products through repair, redesigning or industrial symbiosis. Jhut should still be recycled, cotton-rich mono-material fabric, products that cannot be sold safely or reused, and which cannot be recycled safely. The recent LCA analysis of textiles states that the circular textile alternatives need to consider the avoided production, textile fibre degradation, proximity to collection, cleaning, consumer behaviour and end-market quality (Abagnato et al., 2024; Dehghannejad et al., 2025; Burini et al., 2025). In the case of Bangladesh, reuse-first approach to garments might involve factory-level sorting, brand-approved reuse of surplus, upcycling clusters, repair services and government acquisition of reusable textile items. The recycling model will need clean, sorted and traceable textile feedstock to make sure that Bangladesh can stop low-value downcycling (Islam et al., 2024; Zuthi et al., 2025).

The second one is hard plastic wrapping. Reuse could be effective provided that the packaging is robust, standardised and recoverable. Examples are beverage crates, refillable containers, drums,

jars, buckets and food-service boxes. Recycling is effective in situations where the plastic is clean, single-polymer, labelled and gathered in large quantities. Another typical illustration of the possible recycling is PET bottles, but a refill system could be a better option in situations with a stable reverse logistics and washing quality. Multilayer plastics that are flexible are not easy to recycle or reuse, and redesign, reduction or producer-funded recovery might be a more appropriate solution (Abdullah and Abedin, 2024; Rafizul et al., 2024; Ali and Rafizul, 2024). Thus, recycling of plastics should not be a one-way solution in Bangladesh. It needs to separate plastics into reuse ready, recycle ready and redesign needed and residual risk categories.

The third stream is e-waste and refurbishable electronics. Reuse may be improved more efficiently in the cases where the devices may be repaired and resold under warranty. It has a high embedded manufacturing value and it increases affordability. Recycling also comes into play when the product is technically obsolete, is hazardous or requires repair (particularly metals and precious materials). However, when e-waste is recycled in an uncontrolled environment, there is a risk of exposing workers to toxic substances. Recent publications on batteries, electric motors, passports to digital products, and circular metrics show that circularity in electronics is based on traceability, safety, repairability, data security, and material recovery standards (Slattery et al., 2024; Bin and Thakur, 2025; Picatoste et al., 2025; Li et al., 2024). The first step that Bangladesh needs to undertake is to consider electronics as a repair-refurbishment option, and develop a regulated type of recycling of non-repairable products.

The fourth one is the stream of glass and metal. The recyclability of such materials can be extremely high as they are more capable of retaining material properties as opposed to mixed plastics or textiles. However, glass bottles which can be refilled, metal containers and industrial packaging can still be better reused because each time the product is reused, there is no need to melt them down and remanufacture them. It will be determined by the breakage rates, distance of transport, washing water, standardisation of packaging and consumer return behaviour. According to recent studies of glass recycling, the design of collections, the degradation, and the replaceability of quality have an impact on environmental results (Zhang et al., 2024; Waste Management, 2024). Bangladesh would be able to achieve refillable packs of local beverage and dairy and food supply chains and carry on with high quality recycling of broken glass and scrap metal.

Organic waste is the fifth stream. The difference between reuse and recycle is not as straightforward as it would be in this case because one cannot reuse the food waste as it is possible with the products. The circle is prevention-first, safe redistribution of edible excess, safe animal feed when legal, then compost, or anaerobic digestion. In Bangladesh, most of the municipal streams comprise of organic waste, which pollutes recyclables and increases the cost of collection. Reuse and recycling are not possible unless the organics are recovered out of the plastics and textiles. The separation of sources of organics is therefore a pillar of circularity of materials. The new circular urban-area and food-system circularity literature validates the need to combine material flows, household behaviour and municipal infrastructure (Papageorgiou et al., 2025; Tetteh et al., 2025; Moktadir et al., 2025).

The sixth flow is construction- demolition waste. Bricks, doors, windows, steel sections, tiles and fixtures can be reused well in case of selective demolition and the material is not damaged. When there are quality standards, recycling is good in crushed concrete, asphalt, metals and aggregates. Reuse markets of salvage building parts can serve the construction industry in Bangladesh but that requires design-to-disassemble, storage yards, quality grading and publicly bidding regulations. The policy intervention on building-component reuse and circularity evaluation schemes is justified by recent circular built-environment studies (Corsini, 2025; Li et al., 2025; Khadim and van Marrewijk, 2025; Mao and Cao, 2025).

Stream-wise, universal response to it is most appropriate: reuse with with intact products and components, recycle with recoverable material, redesign weak streams, and planned disposal with residuals. The answer to the policy question should not be in one word in Bangladesh. When both the strategies are weak, reuse is favored to preserve the value, recycling is favored to utilize inescapable end-of-life materials, reduction and redesigning are favored. This hierarchy safeguards the nation against investing in recycling only and disregarding upstream product choices, consumer behaviour and reality of the informal-sector (Kirchherr et al., 2023; Badran et al., 2025; Bocken and Shirahada, 2025; Castillo-Ospina et al., 2025).

The packaging of food-service cannot be analyzed in other ways. Reuse is attractive in cases where containers are standardisable, reusable, can be returned and safely washed and reused enough times to offset the expenses of washing and transportation. Yet, it is poor with low returns, unsafe washing, or with distrust of hygiene among consumers. A deposit-return scheme may be useful as

it provides customers with a monetary incentive to recycle containers and businesses with an incentive to produce strong packaging. Pilot reusable food packaging should then be implemented in universities, offices, hospitals, closed campuses and a small number of cluster restaurants before it can be implemented nationwide (Accorsi et al., 2025; Badran et al., 2025; Merian et al., 2024).

The focus of this paper is not on construction and demolition materials but they aid in making the reuse argument clear. Studies on reuse-building-component have shown that condition, dimensions, performance, safety and logistics information is required to reuse. Recycling of concrete, steel, asphalt or glass can be used to recover the material value, but in this case, the value might be more when it is possible to evaluate the components as well (Bellini et al., 2024; Corsini, 2025; Dziedzic et al., 2025). In Bangladesh, this does not only apply to buildings but information that accompanies the product is best reused. With no product information, the system is automatically recycled or disposed when the cost of trust is too high.

Medical and food and hygiene sensitive products are shown to have the limit of reuse. Reuse should not be automatically suggested in case of high risk of infection, contamination or safety. Circularity of medical devices The studies indicate that reusable products can be of value, however, only when design, regulation, cleaning and traceability are robust enough to safeguard users (Hoveling et al., 2024; Mayer et al., 2025). Bangladesh is therefore recommended to classify the products as safe reuse, conditional reuse, recycle-only and avoid/redesign. It would not allow the use of circular-economy rhetoric to rationalise unsafe second-hand markets or substandard refurbishment goods.

E-waste represents a high-value high risk boundary case. Repair and refurbishment is obviously better in a situation where the devices can be utilized more since electronics are highly embedded in value and require costly materials. Simultaneously, electronic devices at end-of-life can lead to toxic exposure, demanufacturing and dismantling without protection. Bangladesh thus requires a right-to-repair and certified refurbishing channel which is connected to the regulated recycling of batteries, circuit boards and hazardous parts. Upcoming studies on ICT circularity and battery recycling corroborate this two-step rationale, i.e., first extend and then recover materials via safe systems (McMahon et al., 2024; Slattery et al., 2024; Li et al., 2024; Takimoto et al., 2024).

Bangladesh waste stream	Reuse score	Recycling score	Better first route	Reason

RMG/textile offcuts	■■■■■ 4.8/5	■■■■□ 4.2/5	Reuse/upcycling before fibre recycling	Clean offcuts keep value if sorted by fibre and colour.
Reusable rigid plastics	■■■■□ 3.9/5	■■■■□ 4.5/5	Reuse if durable; recycle at end of life	Refill works for standard packaging; PET and rigid plastics can recycle.
Repairable electronics	■■■■□ 4.2/5	■■■■□ 3.6/5	Repair/refurbishment first	Devices hold high embedded value but need safe e-waste recovery later.
Glass and metal	■■■□□ 2.8/5	■■■■■ 4.7/5	Recycling, with refill where local loops exist	Material quality can be retained through controlled recycling.
Organic waste	■■□□□ 1.5/5	■■□□□ 2.0/5	Prevention and composting, not conventional reuse	Food redistribution and composting fit better than product reuse.
Low-value flexible packaging	■□□□□ 1.2/5	■■□□□ 2.4/5	Reduction/redesign before recycling	Multilayer, contaminated and low-value flows are difficult to reuse or recycle.

Figure 3. Editable Bangladesh waste-stream scorecard for reuse and recycling suitability

Figure 3 uses the reuse-versus-recycling question on waste streams in specific areas in Bangladesh. It demonstrates that a single national slogan can not lead all materials. The potential of reuse of textile offcuts and used garments is great since a significant portion of value remains on the product or fabric. Depending on durability, contamination and reverse logistics, rigid plastics are able to travel along either route. Repair or refurbishment of electronics should be done first since it has a high value as a product but should not be dismantled in an unsafe manner at end of life. Glass and metals have a higher score in terms of recycling since the material characteristics are reproducible in the form of processing. The organic waste should be prevented, food should be redistributed, it should be composted/digested instead of using normal products. Flexible packaging of low value does not do well in either of the pathways, so Bangladesh needs to focus on redesign, reduction, producer responsibility and substitution. The table is a native Word figure and therefore the categories in the X-axis, the Y-axis score scale and the policy routes can be edited.

6. Results: Which Option Performs Better?

The data validates a recycling-first solution to Bangladesh, but with restraint. Reuse has the highest reuse score in retained value, affordability and avoided production since a reused product is a better replacement of a new product than a recycled material. It performs exceptionally well with clothes, furniture, containers, refillable packaging, repairable electronics and construction parts. Recycling has a higher score on the scale and material-flow management since it can handle large quantities of the broken, unwanted or non-reusable materials. It is particularly effective with PET, metals, glasses, clean paper, some selected plastics, cotton-filled textile waste and some industrial by-products (Abagnato et al., 2024; Zhang et al., 2024; Krall et al., 2024; Saju et al., 2024).

Displacement is a factor of environmental performance. Reuse can only make significant advantages when it does not entail new production. In case of purchasing a product used along with a new product, the advantage will be less. Recycling builds powerful advantages solely when the secondary material substitutes the virgin material of acceptable quality. When recycling is not yielding high-quality products that have low market demand, then the environmental benefit is reduced. It is due to this displacement problem that the use of life-cycle thinking, consumer behaviour, quality measures and market analysis is increasingly combined by circular-economy researchers instead of being based on recycling rates (Harris et al., 2025; Hunka et al., 2025; Poveda-Giraldo et al., 2025; Solis et al., 2025).

The economic performance is situational. Micro-enterprises, tailors, repair shops, second-hand sellers, refill businesses and informal collectors can be supported by reuse. It will be able to maintain low prices of products among low-income families. Recycling has the ability to assist in sorting, washing, shredding, pelletising, spinning, smelting and manufacturing. But recycling requires additional capital, quality assurances, energy and manufacturer guarantees. Reuse in Bangladesh has a direct social benefit, as labour-intensive markets are already present. Another medium-term industrial benefit of recycling lies in the potential to optimize standards, technology, finance and material traceability (Kadir et al., 2024; Islam et al., 2024; Rafizul et al., 2024; Richter et al., 2025).

The ranking is changed by public health and safety. Medical products, food containers contaminated by chemicals, unsafe electronics, textiles treated with chemicals or products of unknown hazards are not necessarily better when reused. Recycling also poses a risk where workers are exposed to toxins, dust, fumes, sharp materials or chemical residues without wearing protection. Thus, the one that is capable of addressing the safety standards is preferable. In the case of Bangladesh, this translates to the implementation of workable inspection, washing, repair, labelling and workers protection regulations. An unsafe reuse or unsafe recycling cannot be sustainable in a circular economy (Hunka et al., 2025; Mayer et al., 2025; Saju et al., 2024; Masum et al., 2025).

There is ambivalent policy preparedness. Bangladesh boasts good informal recovery capacity and manufacturing base, but low formal segregation of sources, municipal data, product labelling, EPR enforcement and quality standards. Reuse systems require consumer confidence and easy points

of returns. Recycling systems require a consistent supply of sorted feeds and a consistent demand of secondary feeds. This is because neither of the two can be successful using slogans. It requires infrastructure repair and resale, material recovery facilities and standards, financing, data and worker inclusion to reuse (Rafizul et al., 2024; Kadir et al., 2024; Ares-Sainz et al., 2025; Demir and Alp, 2025).

The initial finding is that reuse is positioned with the best normative position but has the weakest measurement infrastructure. Bangladesh can easily measure tonnes shipped to a recycling plant, whereas it is more difficult to measure preventive new purchases, longer product life, quality of repair, customer satisfaction and wages earned by labour. This establishes a policy bias towards favouring recycling despite the possibility of reuse being more effective environmentally. A reuse-first policy thus requires reuse indicators: how many items have been repaired, how high the rate of returned refill containers, how many months the product life was preserved, how many items were not purchased, how much the resale value was retained and how much the workers earned (Kirchherr et al., 2023; Bais et al., 2025; Papageorgiou et al., 2025).

The second outcome is that recycling is better when the function of the products is actually over. The e-wastes components, scraps of used textile that are not usable, damaged metals, broken glass and damaged plastics should not be coerced into the reuse market. Recycling can be safer and more scalable in such circumstances provided collection and processing is regulated. Recycling however should be evaluated based on the quality of substitution and not just on throughput. Recycling that generates low-value products even though virgin production persists should be considered as half-way recovery, rather than full circularity (Mattson et al., 2024; Krall et al., 2024; Zhang et al., 2024; Xu et al., 2025).

The third outcome is the informal sector in Bangladesh is not a fringe issue. Reuse and recycling is already done by means of household repair, feriwala systems, waste collectors, jhut dealers, small workshops, second hand market and informal aggregators. These actors possess a realistic experience of materials and demand but they usually bear the health and income costs of circularity. Decentralisation of contracts should formalise the contracts, enhance occupational safety, and safeguard access to value by workers instead of creating systems that are designed to transfer profits upwards and risks downwards (Kadir et al., 2024; Akther et al., 2025; Saju et al., 2024).

Environmental value / feasibility	Lower feasibility	Higher feasibility
Higher environmental value	Policy push needed: Repairable electronics; reusable food containers; building material reuse	Scale now: Second-hand garments; cotton jhut sorting; PET recycling; refillable glass loops
Lower environmental value	Avoid or redesign: Mixed municipal waste; contaminated flexibles; unsafe informal burning	Improve quality controls: Low-grade downcycling; unverified recycled products; informal aggregation without safety

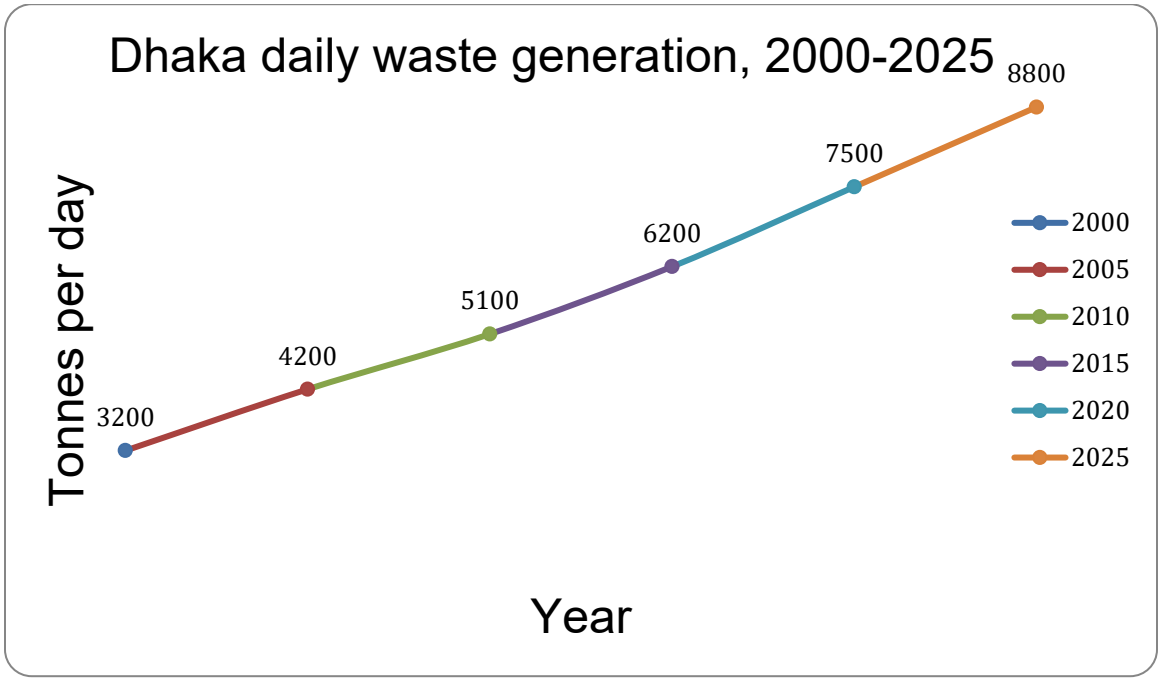
Figure 4. Editable decision matrix for circular-economy priorities in Bangladesh

Figure 4 organises the policy choice into four quadrants. The upper-right quadrant contains activities that should be scaled quickly because they have both high environmental value and practical feasibility. For Bangladesh, this includes second-hand garments, source-sorted cotton jhut, clean PET recycling and refillable glass loops in local distribution systems. The upper-left quadrant contains promising activities that need stronger policy support, finance or standards, such as electronics refurbishment and reusable food-service packaging. The lower-right quadrant warns that feasibility alone is not enough; low-grade recycling may be easy but environmentally weak if it produces poor-quality outputs or unsafe work. The lower-left quadrant identifies options that should trigger redesign or reduction rather than investment in weak recovery systems. This matrix is useful for city corporations, RMG clusters and producer-responsibility schemes because it separates strategic priorities from politically attractive but low-impact activities.

6.1 Graphical evidence from Dhaka waste and microplastic studies.

The next three editable Office charts enhance the visual evidence base of the manuscript without altering the main argument of the manuscript. Figure 6 is based on the data of the daily waste-generation in Dhaka reported by Rahul et al. (2026). Figures 7 and 8 take the data on waste-composition in Dhaka of the same study and visualize the plastic-related risk in the context of microplastic pollution and remediation problems addressed by Waseem et al. (2025). These numbers are added as edit-able Objects of Word Charts including embedded data in Excel format and hence data series, chart titles, axes and values can be updated later in the journal formatting.

Figure 6. Line graph of Dhaka daily waste generation, 2000-2025



The graph (Figure 6) illustrates the steep growth trend of daily waste production in Dhaka moving upwards over the period of time between 2000 and 2025. The values increase to 3,200 tonnes per day in 2000 to an estimated 8,800 tonnes per day in 2025 hence the daily waste liability of the city is indicated as increasing more than two times the amount. In the case of reuse versus recycling, the trend is important as an increase in the volume of waste renders end-of-pipe recycling less feasible on its own. When goods and packaging get into the municipal stream already mixed with other waste, the cost of collection, contaminations and pressure on landfills is added with each extra tonne. The number of items entering this increasing stream can be decreased in the form of reuse-first model and clean residual materials still require recycling. The chart thus substantiates the argument in the paper that Bangladesh must invest sooner in source separation, product reuse, repair and refill systems, and not only rely on subsequent material recovery (Rahul et al., 2026).

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Figure 7. Histogram of Dhaka waste-composition percentage bands across selected source categories

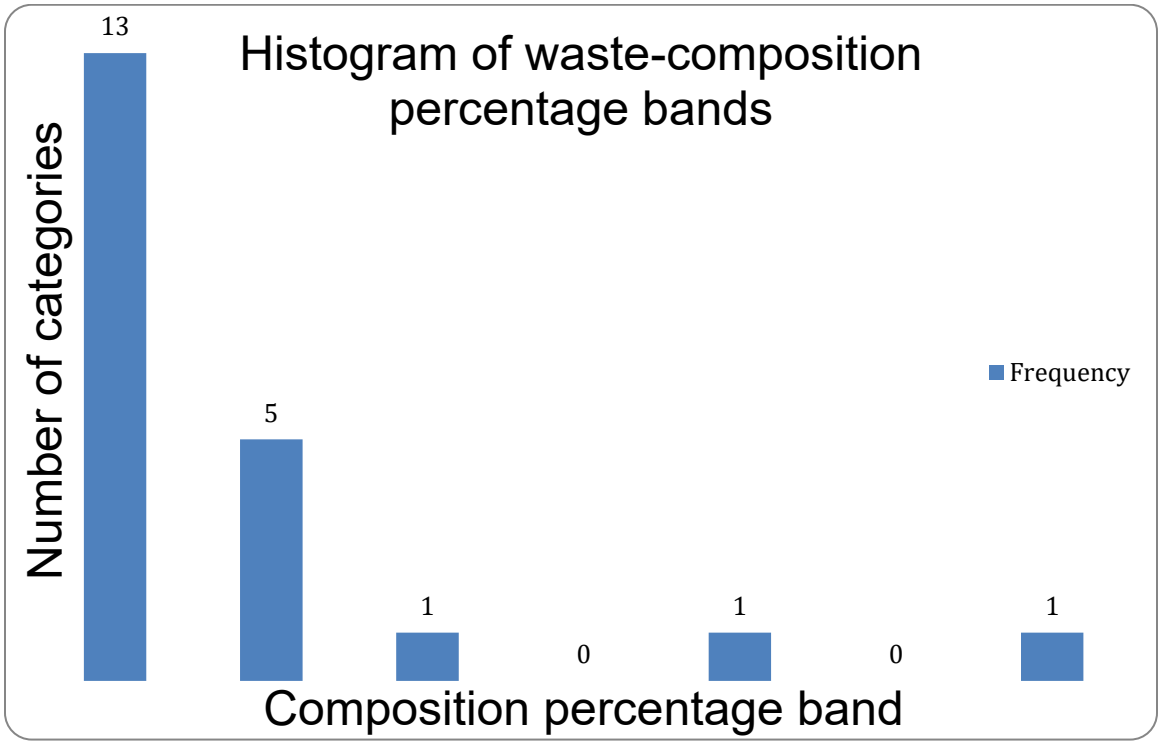
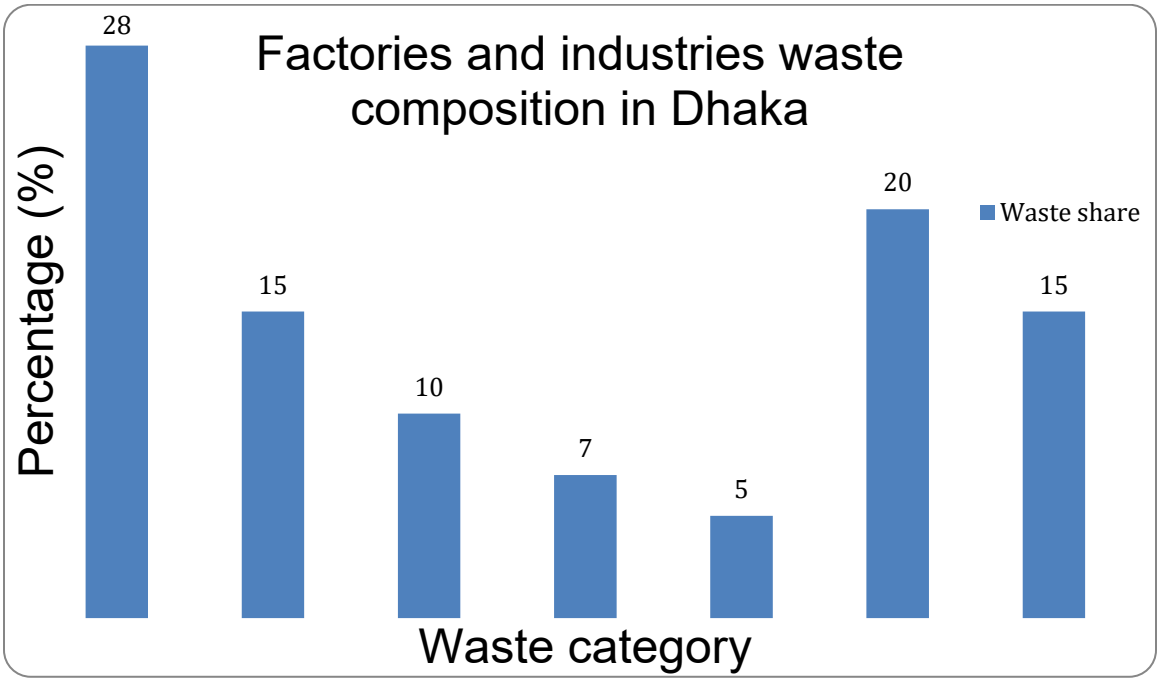


Figure 7 clusters the percentages of the waste-composition reported by households, schools and factories into percentages. It reveals that the majority of material categories are located in the bottom and middle part whereas the number of streams take over the overall load. The importance of this distribution is due to the fact that the practical decision between reuse and recycling is a matter of concentration. The high-concentration organic waste supports prevention, composting and separate collection and moderate plastics, paper, textile and industrial streams require sorted recovery systems. Categories with low percentages cannot be overlooked as they may still pose a high risk of pollution; small plastic particles may also turn into microplastics when the leakage is not contained. The recent literature on remediation of microplastics emphasizes that downstream removal of microplastics is not as effective as prevention and control of microplastics at the upstream level once they have been dispersed into the environment. In the case of Bangladesh, the histogram thus contributes towards two-level treatment: separate large-scale treatment and control

of smaller streams of hazardous material before they enter into land, drains and waterways (Rahul et al., 2026; Waseem et al., 2025).

Figure 8. Bar chart of factories and industries waste composition in Dhaka



The waste composition in factories and industry is compared in Dhaka in figure 8. The biggest category is the industrial scrap (28 percent), followed by the textiles and leather (20 percent), the plastics (15 percent), the others (15 percent), the paper and cardboard (10 percent), the glass (5 percent). The profile supplements the conclusion of the paper that is sector specific. Industrial scrap, metals and some of the packaging materials can be recycled effectively as long as they are clean and are collected in an official way. Streams of textile and leather should have a reuse-first ladder since after-industrial offcuts can still have product or fibre value prior to being reduced to low-value recycling. Plastic streams should be constructed and retrieved in a stricter manner because uncontrolled plastic leakages could be a source of microplastic contamination especially in cases where materials are cut in the collection or disposal procedure. The bar chart will therefore show why a single generic waste pathway should not be employed in the factories. They demand sorting of the sources, recycling that is linked with buyers, avenues of repair or reuse and less dangerous treatment of residual or polluted materials (Rahul et al., 2026; Waseem et al., 2025).

7. Discussion

Reuse-first strategy would be appropriate in Bangladesh because it is an environmentally worthwhile, cost-effective and labour-absorbing strategy. Many families already make clothing, furniture, appliances and household items as it is extremely costly to repair them. A lot of small businesses already re-sell used goods and salvage materials. These practices ought to be termed as circular economy activity and not they should be considered as backward informality. The policy quandary is to improve quality, hygiene, safety and dignity without breaking down the low-cost networks, which are already value-recovering (Kadir et al., 2024; Badran et al., 2025; Bocken and Shirahada, 2025).

The RMG industry provides the most simple industry test. By sorting the textile wastes at their origin to trace by the kind and colour of fibre and putting them into the highest available use, Bangladesh can have an improved deal. The order is to: avoid excessive production, reuse and re-usable materials and garments, repair or re-design excess products, recycle clean mono-material wastes, and treat contaminated residues in a different way. This would assist local SMEs, decrease the demand on imported virgin fibre, assist buyer compliance and equip the sector with greater sustainability demands (Islam et al., 2024; Dehghannejad et al., 2025; Burini et al., 2025; Ares-Sainz et al., 2025). Recycling remains important, but it can no longer be accorded the prioritization compared to the reuse and design change which would remove value loss at an earlier point.

Plastic policy needs a more discriminative policy. Bangladesh should pay attention to long-lasting reuse of packaging and clean, high-volume stream recycling. Reduction, redesign and producer responsibility is the first policy response in the case of low-value flexible plastics. It is impossible to recycle in a city what was not designed to be recovered locally. The experience of Bangladesh with plastic leakage, recycling stores and riverine discharge demonstrates that the collection and recycling are needed, but not enough when the design of products and consumer behaviour do not change (Abdullah and Abedin, 2024; Rafizul et al., 2024; Ali and Rafizul, 2024; Al Hasan et al., 2024).

The informal sector needs to be taken off the invisible recovery list and to be recognised as service providers. It does not imply that all workers should be forced to work in a big enterprise. It implies registration opportunities, protective equipment, fair weighing, access to sorting space, social protection, training and municipal contracting as necessary. Repairers, cleaners, sorters, digital

sellers and quality checkers can be hired by reuse hubs. Recycling centers may hire professional sorters of materials and operators of the machines. A non-informal-worker-bypass circular transition can be effective to raise the recycling rates and weaken the social equity (Kadir et al., 2024; Rafizul et al., 2024; Provensi and Sehnem, 2025).

A determining factor is consumer behaviour. Reuse needs trust. The people must be convinced that the reused products are clean, safe, good value and acceptable in the society. Recycling needs participation. People must learn to get rid of rubbish through proper disposal and donate what is available through the available channels. Recent readiness to pay research suggests that consumers are being met with information, trust and convenience as opposed to environmental messages (Fu et al., 2024; Hunka et al., 2025; Accorsi et al., 2025). Bangladesh therefore needs to incorporate school campaigns, mosques/community announcements, brand labelling, mobile-based return incentives and visible municipal bins with actual performance in collection. The lack of awareness and service delivery will not work.

Another constraint is finance. Working capital reuse systems include repair shops, storage, cleaning equipment, logistics, and digital platforms and certification. The recycling mechanisms require more investments in sorting plants, washing lines, pelletising, fibre recycling, emissions control and laboratory tests. Both levels can be financed in Bangladesh through EPR fees, green credit lines, municipal- private partnerships and brand commitments. The charges imposed by EPR need to be differentiated in such a manner that products that are reusable, refillable, repairable and recyclable need to pay less charges but the products that have low value and are hard to recover should be charged higher. This plan is consistent with the circular finance literature, certification, and policy-indicator literature (Richter et al., 2025; Ares-Sainz et al., 2025; Moktadir et al., 2025).

The optimal policy statement would then be: reuse must be the rule where it can safely replace new production; recycling must be the backstop of materials which cannot be reused; redesign must be mandatory where neither of the two does a good job of looking after itself. This is more feasible than always better reuse and always better recycling. The two are needed in Bangladesh, but in the correct order and with more governance.

It is possible to argue that reuse can be based on the strongest foundation, but not sentimental, but economic. A recycled product is usually valuable in terms of per kilogram more than a recycled material. One kilogram of functional clothing, electronics or durable plastic can be utilized by a

consumer. Transit through the same kilogram may lead to a lower-value fibre, resin or scrap unless a high-quality closed-loop technology is implemented. This is the reason why the domain of circular business model research is increasingly focusing on value retention and service models, repair systems and reverse logistics, instead of recycling only (Bocken and Shirahada, 2025; Izquierdo-Montfort and De Ronge, 2025; Provensi and Sehnem, 2025).

Institutional maturity is the best argument in support of recycling. Recycling can be regulated through the application of permits, factories, purchase and EPR fees. Reuse needs more diffuse systems: consumers need to send back, businesses need to check and wash, repairers need to be skilled and have spares, and users need to believe in second hand quality. To put reuse under control is the policy problem that Bangladesh has to deal with. It can be achieved in the form of standards, certification, municipal reuse hubs, brand-backed take-back systems and digital traceability of high-value streams (Wan and Jiang, 2025; Ares-Sainz et al., 2025; Hunka et al., 2025).

The response depending on income group is also different. Reuse can already be practised by lower-income households due to the financial need. This increment in the income households would have the capability of creating more waste as well as buying more new goods, but they could also respond to the trusted repair, resale, and refill services when the quality and convenience are augmented. Circular policy should not, however, reuse as a measure of poverty. Risk-averse, low-cost and dreamy mature reuse market can be contemporary. The trick is to be affordable and dignified at the same time, assure quality and confidence in the consumers (Badran et al., 2025; Saha et al., 2024; McMahon et al., 2024).

Step 1	Can the product be safely used again without major processing?
Step 2	If yes, clean, repair, refill, resell, donate, share or return through a deposit system.
Step 3	If direct reuse is not safe, check whether parts or components can be recovered.
Step 4	If components are recoverable, refurbish, remanufacture or prepare them for reuse.
Step 5	If function is lost, sort clean materials and send only verified streams to recycling.
Step 6	Record residuals and redesign the product or package to prevent repeat waste.

Infographic 1. Editable reuse-first decision guide for households, municipalities and factories

Infographic 1 is a practical checklist and not a graphic. It begins with the most critical question of operation: Is the product capable of being safely reused? When yes is the answer, the system must consider cleaning, repair, refill,

resale, donation, sharing or deposit return as some of the priorities. In the case of no, it should look into the possibility of recovering components prior to destroying the product into raw material. Recycling comes after functional recovery since it is generally more energy consuming and less value is generally retained. The last stage requires institutions to document residual products which cannot be reused or recycled in order to make design changes to avoid reoccurrence of the same wastes. It is particularly relevant to Bangladesh in which numerous decisions are made after the fact that the materials are already mixed, contaminated and undervalued. The infographic should be a complete Word table, which can be adapted to classroom training, municipal or factory training.

8. Recommendations and Implementation Model

Source segregation is the initial policy measure. Both reuse and recycling are devalued without segregation at household, market, institutional and factory level. Bangladesh must demand simple three-stream segregation of urban areas: organics, dry reusable/recyclable materials and residuals. RMG factories are to resort to a more thorough division into fabrics, colour, fibre content, contamination and prohibition of buyers. Municipalities can start with pilot wards instead of citywide rollouts which have no monitoring. Informal separation has already been occurring in multiple phases, evidence in Khulna demonstrates that the policy should formalise and enhance it instead of assuming that segregation begins at zero (Noman et al., 2023; Kadir et al., 2024; Rafizul et al., 2024).

The second one is reuse infrastructure. Cities must have reuse centers where products can be inspected, washed, repaired, stored and resold. Services that should be prioritized by these hubs include clothing, shoes, furniture, books, household, electronics and durable packaging. They may be run by municipalities, non-governmental organizations, social enterprises or commercial companies, however, they are supposed to involve informal workers and local repairers. In the case of the RMG industry, reuse and upcycling clusters that are based on factories can accommodate usable surplus and offcuts prior to the downgrading of the material to low-value recycling. This direction coincides with circular start-up, circular business model and supply-chain design evidence (Provensi and Sehnem, 2025; Izquierdo-Montfort and De Rongé, 2025; Burini et al., 2025).

Recycling quality improvement is the third step. Bangladesh ought to increase the material recovery sites yet with source-segregated feedstock, equitable worker-market and quality specifications. The policy of recycling ought to draw a line between the recycling and collection that has been verified. One tonne of mixed plastic collected in the drains is not equal to one tonne

of clean PET transformed into quality secondary resin. This is important to plastic, textile fibre, glass and metals. Bangladesh will require recycling standards, contamination levels, testing laboratories and digital traceability to have credible recycled-content markets (Abagnato et al., 2024; Zhang et al., 2024; Mao and Cao, 2025; Wan and Jiang, 2025).

The fourth step is redesign EPR and Product. Manufacturers and exporters ought to be held accountable to products that towns can not recuperate financially. EPR ought to celebrate reusable/refillable packaging, legible labeling, mono-material packaging, as well as repairable electronics and take-back systems. It must punish low-value multilayer packaging, unneeded individual use items and products that impose high municipal recovery expenses. In case of RMG, brands are supposed to be in aid of jhut traceability, fibre-to-fibre recycling and responsible reuse of surplus materials. In the case of electronics, manufacturers are to encourage repair, recovery of take-back and safe material. Recent literature of circular policy and certification promotes the connections between governance indicators and supply-chain responsibilities and product design specifications (Ares-Sainz et al., 2025; Picatoste et al., 2025; Bin and Thakur, 2025).

Public procurement is the fifth step. The government agencies, schools, hospitals and municipalities can generate demand of the reused and recycled products as they can purchase the repaired furniture, reusable containers, recycled plastic benches, recycled paper, post-industrial waste products and construction materials with known recycled contents. Procurement can transform circularity as a moral message to a market signal. Yet, the procurement guidelines should include safety, durability and quality. The quality of recycled products would harm civic confidence and support the notion that circular products are of lower quality (Bais et al., 2025; Harris et al., 2025; Tetteh et al., 2025).

Data and monitoring is the sixth step. City-scale accounts of material flows, reuse volumes, repair market estimates, recycling outputs, landfill residuals, the number of workers, and indicators of leakages are required in Bangladesh. The existing statistics are usually concerned with waste production and recycling, but no one is aware of reuse. National circular dashboard must cover the avoided wastes by reusing, the amount of products fixed, product-life cycle, percentage of segregated waste, confirmed recycling rates, and earnings boost to workers. This data architecture can be informed by recent efforts on circular metrics, circular cities and digital product passports (Papageorgiou et al., 2025; Bin and Thakur, 2025; Wan and Jiang, 2025; Demir and Alp, 2025).

Recommendation 1: Bangladesh needs to implement a formal reuse-before-recycling hierarchy in national and municipal waste policies. Recycling should not be banned in the hierarchy, but it should compel policymakers and producers to prove that they have tried to direct reuse, repair, refill or prepare to reuse, before deciding to recycle the material. This hierarchy will bring Bangladesh closer to more circular-economy thinking without being too much focused on tonnes recycled (Uvarova et al., 2023; Kirchherr et al., 2023; Mattson et al., 2024).

Recommendation 2: Reuse hubs should be constructed by city corporations next to material recovery facilities. A reuse hub must check, clean, mend, store and resell usable items and a material recovery facility sort clean residual material to recycle. The combination of both functions would eliminate leakage and enable municipalities to compare product reuse and component recovery and material recycling based on actual data (Akther et al., 2025; Noman et al., 2023; Rafizul et al., 2024).

Recommendation 3: EPR fee modulation should be implemented in Bangladesh. There are costs that the manufacturers are expected to pay less on the durable, refillable, repairable, and recyclable goods, and more on the multilayer, low-value or difficult to sort goods. Fee modulation would reallocate responsibility up the supply chain rather than request municipalities and informal workers to find solutions to design issues once products have become waste (Dziedzic et al., 2025; Corsini, 2025; Dehghannejad et al., 2025).

Recommendation 4: RMG factories are advised to sort fibre-by-fibre, colour-by-colour, contamination-by-contamination, and buyer-by-buyer in the sorting of textile waste. First-mover Clean, traceable fabric should go to reuse, in the form of upcycling and local value-added products, followed by mechanical or fibre-to-fibre recycling in cases where reuse cannot be done. This would enhance value capture within Bangladesh and assist the sector to meet international circularity needs (Saha et al., 2024; Islam et al., 2024; Zuthi et al., 2025; Solis et al., 2025).

Recommendation 5: The informal workers ought to be recognised as circular-economy workers. Workers should be registered, PPE, fair weighing, child-labour prevention, access to health assistance, skill training and the possibility to organize cooperatives or service contracts should be recognized. Circularity may be a more acceptable term than the insecure work without social protection (Kadir et al., 2024; Saju et al., 2024; Akther et al., 2025).

Recommendation 6: Public procurement should be used by Bangladesh to generate demand of confirmed circular products. Repaired furniture, certified recycled products, refillable service systems, and reusable event materials can also be purchased by schools, hospitals, city corporations and public offices. Procurement is important since the recycling and reuse markets become ineffective when the recovered products do not have a stable buyer (Bocken and Shirahada, 2025; Ares-Sainz et al., 2025; Zhang et al., 2024).

0-12 months	1-3 years	3-5 years	5+ years
Pilot three-stream segregation; map repair markets; register informal workers; test refill and repair pilots.	Open reuse hubs; introduce EPR fee modulation; trace RMG jhut; set cleaning and resale standards.	Build material recovery facilities; apply recycled-content procurement; certify recyclers and repair operators.	Use digital product passports; scale remanufacturing clusters; integrate circular procurement into national industry policy.

Figure 5. Editable staged roadmap for Bangladesh: reuse-first policy with a recycling backbone

Figure 5 transforms the paper into a sequence of implementation pathways. The initial year is dedicated to practical fundamentals since reuse and recycling do not work when the flows of materials are mixed, informal employees are invisible, and households are given vague guidelines. The one-to-three-year phase builds a market infrastructure by forming reuse hubs, repair standards, EPR fee modulation and traceability of RMG textile waste. Recycling is enhanced by the three to five-year phase with material recovery plants, quality control and government purchasing to generate a demand of confirmed secondary materials. The deep-time phase puts Bangladesh on the path of higher circularity with product passports, remanufacturing clusters and industrial policy. The sequence matters. Separated recycling plants are fed with polluted materials, and reuse centers without control and customer confidence are fringe. The figure hence justifies a realistic solution: Bangladesh must adopt reuse at the top of the list, yet establish a solid recycling base to products that will no longer be directly used.

Actor	Circular responsibility	Required support
Consumers	Segregate, reuse, return, repair and buy verified second-hand goods.	Convenient collection points, price incentives and trusted hygiene information.
Municipalities	Collect separated streams, contract reuse hubs and monitor recovery outcomes.	Clear bylaws, budget lines, material-flow data and performance audits.
RMG factories and brands	Trace jhut, sort by fibre and support higher-value local circular markets.	Buyer cooperation, transparent contracts and digital traceability.
Informal workers	Recover value through collection, sorting, repair, resale and aggregation.	Legal recognition, PPE, fair weighing, training and social protection.
Producers	Design reusable and recyclable products and finance end-of-life systems.	EPR rules, fee modulation, design standards and reporting duties.
Finance providers	Fund repair hubs, refill systems, MRFs and clean recycling technology.	Risk-sharing mechanisms and evidence-based project pipelines.

Infographic 2. Editable governance stack for reuse and recycling in Bangladesh

Infographic 2 reveals that Bangladesh cannot answer the question of reuse versus recycling with the help of a single actor. Customers require user-friendly systems and reliable information. Cities require gathering regulations, agreements and surveillance. The factories of RMG and international brands should render the textile waste traceable

and commercially viable to circulate the waste at a higher value. Informal workers should be acknowledged, get decent pay and workplace safety, as they already get a big portion of the recyclable value. Manufacturers require EPR requirements to provide incentives to reusable design and punishments to hard-to-recycle packaging. Finance providers must consider reuse hubs, repair businesses and material recovery facilities as assets to invest in. The stack is specifically actor-based since circular economy policy usually fails when making it technology-centric. It is possible to edit the table in Word and add ministries, NGOs, city corporations, brand alliances, cooperatives or university partners. It is handy as a policy proposal planning tool and journal appendix planning tool.

9. Future Directions for Research and Policy

Future direction 1: Bangladesh needs primary data on displacement. How many products enter the reuse channels is the most important unanswered question, but how many times a reused product replaces a new product is more important. A second hand shirt which substitutes a new buy has a better claim to the environment than a second hand shirt which is bought as an additional product. Future research needs to quantify replacement rates by product, income level, urban, gender and household (Harris et al., 2025; Abagnato et al., 2024; Weber et al., 2023).

Future direction 2: Bangladesh needs city-level life-cycle and cost models. The model is to compare reuse hubs, repair markets, source segregation, material recovery facilities, recycling plants, composting systems and residual disposal. They should be costs of collecting, transportation, sorting, cleaning, land, labour, safety equipment, energy, water, emissions, lost value and market revenue. The lack of this cost structure risks that policymakers will select options which seem cheap due to the fact that informal workers bear the hidden costs (Merian et al., 2024; Tetteh et al., 2025; Papageorgiou et al., 2025).

Future direction 3: Research on RMG circularity should not focus on the general sustainability assertion but evidence of material-flow that can be traced. Researchers are supposed to trace the flow of jhut off factory floors to traders, sorters, downcyclers, exporters and recyclers. Fibre composition, colour, contamination, buyer restrictions, price variations, the conditions of workers and end usage of the final product are to be documented in the study. This would assist in determining the most appropriate time to reuse, upcycling, mechanical recycling or chemical recycling (Saha et al., 2024; Islam et al., 2024; Dehghannejad et al., 2025).

Future direction 4: Future research must experiment with deposit-return and refill models in controlled conditions. Universities, hospitals, office canteens and industrial zones are appropriate

since users can be tracked easily and systems can be monitored. Primary variables must comprise a return rate, a cost of washing, container loss, hygiene confidence, user satisfaction, and avoided single-use packaging and overall cost per use (Accorsi et al., 2025; Badran et al., 2025; Poveda-Giraldo et al., 2025).

Direction 5: Bangladesh ought to create a social-equity score of circularity. The score ought to be an indicator of worker income, security of the contract, PPE wearing, risk of injuries, female involvement, child-labour prevention, bargaining capacity, and access to social protection. A circular transition should not be regarded as a successful one where a waste policy results in more recycling and poorer working conditions (Kadir et al., 2024; Akther et al., 2025; Saju et al., 2024).

Direction 6 Future Product information systems need to be tested on high value streams. Passports, material information (QR-based), repair history, and batch-level textile traceability can be utilized to decrease uncertainty and enhance the confidence of reuse. Bangladesh does not have to digitalise all the waste streams at once. It must begin with RMG textile waste, repairable electronics, reusable industrial packaging and construction parts where product information has an evident economic value (Wan and Jiang, 2025; Mao et al., 2025; McMahon et al., 2024).

Future direction 7: Bangladesh needs to learn about rebound effects. Reuse has the potential to generate lower prices and more access, which is socially good, but environmental benefits are reduced as the lower prices result in higher consumption. Re-use may also generate a rebound where the consumers are less responsible since they think that everything will be recovered. The future studies ought to study these behavioural implications using surveys, experiments and market data (Saha et al., 2024; Solis et al., 2025; Bais et al., 2025).

Future direction 8: Future policy experiments are needed to compare reuse-first, recycle-first and mixed models in actual Bangladeshi wards or industrial clusters. All pilots are expected to release baseline information, intervention structure, monthly recovery information, employee results, cost information and leakage mitigation. This would shift the reuse-versus-recycling discussion out of opinion and into quantifiable performance and would render the framework of the paper to be empirically testable in the future (Li et al., 2025; Papageorgiou et al., 2025; Rafizul et al., 2024).

10. Limitations

This is a review and policy analysis, rather than a primary life-cycle assessment or field survey. Scoring will be aimed at decision-making, although it is supposed to be tested using Bangladeshi primary data. Future studies would quantify product-level displacement: how frequently reused products are used instead of new purchases, how long are the lifespan of repaired products, and what product categories would have the greatest avoided production. The reuse benefits will be inflated in the absence of displacement data (Harris et al., 2025; Hunka et al., 2025; Badran et al., 2025).

The second area of research is city-level cost modelling. Bangladesh requires actual demonstrations of the cost per tonne and cost per useful product of reuse hubs, repair markets, material segregation, material recovery facilities and reuse recycling plants. These studies would encompass land, labour, transport, sorting, cleaning, testing, power, worker safety and secondary resale or resale revenue. It must also keep a fair comparison between formal and informal systems and not assume that formal systems are necessarily superior (Kadir et al., 2024; Rafizul et al., 2024; Saju et al., 2024).

A third area of research is RMG textile traceability. In Bangladesh, fibre composition, colour, contamination, buyer restrictions, jhut trade route, recycling quality and local upcycling should be studied. This would aid in identifying at what point reuse, upcycling, mechanical recycling or chemical recycling would yield optimal results. It would also assist local producers in answering the international circular-textile needs with facts as opposed to allegations (Islam et al., 2024; Dehghannejad et al., 2025; Burini et al., 2025; Solis et al., 2025).

Fourth is a research need on social equity measurement. The worker income, occupational safety, the inclusion of women workers, child-labour prevention, the access to social protection and bargaining power in material markets should be considered in terms of reuse and recycling policies. An outcome of a system that augments the level of recycling and results in informal workers being forced into more insecure jobs would be a feeble circular shift. By integrating circular-economy indicators with labour and public-health indicators, Bangladesh can become a leader in this field (Kadir et al., 2024; Provensi and Sehnem, 2025; Mayer et al., 2025).

The last research requirement is policy experimentation. Reuse-first pilot should be tested in selected wards, clusters of RMF, universities, hospitals and markets in Bangladesh. These pilots

ought to make comparisons between reuse, recycling and mixed models based on actual performance measures. The most helpful pilots would help make clear data on the price, collection rate, product quality, consumer adoption, waste prevention, employee results and leakage decrease. This would shift the reuse-versus-recycle debate to evidence.

11. Detailed Evidence Tables

Table 1. Reuse and recycling comparison by decision criterion

Criterion	Reuse performs better when	Recycling performs better when	Bangladesh policy implication
Retained value	Product remains functional, repairable or refillable.	Product function is lost but material is recoverable.	Use repair and reuse hubs before material recovery.
Climate and energy burden	Reuse displaces new production and requires low-impact cleaning.	Secondary material substitutes virgin material at quality.	Measure displacement, not only tonnes collected.
Affordability	Second-hand goods reduce household purchase cost.	Recycled products are competitively priced.	Link circularity with consumer affordability.
Labour inclusion	Repair, sorting and resale can include informal workers.	Certified recycling creates safer formal jobs.	Formalise workers without excluding them.
Public health	Inspection and cleaning can control risks.	Processing standards control contamination.	Create category-specific safety standards.
Scalability	Products are standard, durable and locally recoverable.	Large clean material streams exist.	Pilot reuse and build MRFs together.
Governance readiness	Municipalities can certify reuse operators.	EPR and procurement can support recycling.	Develop reuse metrics alongside recycling rates.

Table 2. Waste-stream recommendation matrix for Bangladesh

Waste stream	Best first route	Secondary route	Main risk	Recommended policy tool
Usable garments	Reuse, repair, resale and donation	Fibre recycling after use	Quality trust and brand restrictions	Certified resale and factory sorting
Cotton-rich jhut	Reuse/upcycling where quality allows	Mechanical or fibre-to-fibre recycling	Mixed fibres and contamination	Traceability and buyer contracts
Rigid plastic containers	Refill and reuse	Recycling after damage	Low return rate and cleaning cost	Deposit-return and refill standards
PET bottles	Refill where feasible	Bottle-to-bottle or verified recycling	Informal price volatility	EPR and recycled-content demand
Flexible packaging	Reduction and redesign	Specialised recycling if viable	Low value and multilayer design	Eco-design fees and bans where justified
Repairable electronics	Repair and refurbishment	Controlled e-waste recycling	Unsafe dismantling	Right-to-repair and certified take-back
Glass bottles	Refill and local reuse loops	Recycling of broken glass	Transport and breakage	Standardised bottles and local reverse logistics
Organic waste	Prevention and redistribution	Composting or digestion	Contamination of dry recyclables	Separate organic collection

Table 3. Calculation logic for avoided burden and value retention

Indicator	Simple formula	Reuse interpretation	Recycling interpretation	Data needed
Avoided production	Avoided units x replacement rate	High if reused products replace new purchases.	Indirect through secondary-material substitution.	Survey of replacement behaviour.
Net burden saved	Avoided production burden - circular process burden	Deduct cleaning, repair and transport.	Deduct sorting, washing, processing and energy.	Local LCA inventory.
Value retention	Circular resale value / new product value	Usually higher when product identity remains.	Usually lower because material value is recovered.	Market prices and condition grades.
Worker income effect	Circular revenue - operating cost distributed to workers	Strong where repair and resale are labour-intensive.	Strong where recycling plants use fair contracts.	Wage, safety and contract data.

Indicator	Simple formula	Reuse interpretation	Recycling interpretation	Data needed
Leakage reduction	Baseline leakage - post-policy leakage	Works when reuse prevents single-use demand.	Works when collection reduces dumping.	Municipal observations and audits.

Table 4. Implementation roadmap with responsible actors

Time frame	Government and municipalities	Industry and brands	Informal sector and SMEs	Expected output
0-12 months	Pilot segregation; map repair and recycling actors.	Audit packaging and RMG waste flows.	Register workers and provide PPE.	Clean baseline data.
1-3 years	Create reuse hubs and MRF pilots.	Fund take-back and jhut traceability.	Operate repair, resale and sorting services.	Reuse markets and verified recycling.
3-5 years	Set standards and circular procurement.	Adopt eco-design and product passports.	Join cooperatives or contracts.	Quality-controlled circular products.
5+ years	Integrate circularity into industrial policy.	Scale closed-loop manufacturing.	Move into formal circular service roles.	Reduced leakage and higher value retention.

Table 5. Journal-submission variables for future empirical testing

Variable	Suggested measurement	Expected use	Relevant stream
Replacement rate	Percentage of reused products replacing new purchases	Estimate true avoided production	Garments, electronics, furniture
Return rate	Returned units / distributed reusable units	Test refill and deposit viability	Food containers and bottles
Sorting purity	Correctly sorted material / total stream	Predict recycling quality	Plastic, textile, glass, metal
Worker income stability	Monthly net income and payment predictability	Assess social equity	Informal collection and repair
Residual leakage	Observed disposal outside controlled routes	Evaluate environmental control	Municipal dry waste
Material quality	Output grade compared with virgin substitute	Assess recycling value	PET, cotton fibre, metal, glass

12. Conclusion

The paper will respond to the question; which is better, reuse or recycle by not giving a one word response. In the case of Bangladesh reuse is preferable when the product can safely be used again and when the reuse substitutes the new production. Reuse helps preserve embedded value, and can promote affordability and enhance local repair and resale economies. Recycling however must be considered as a last resort although it is necessary to recycle materials that cannot be left in the product as they are either broken, unsafe, contaminated or unfit to be repaired. The most powerful policy stance is thus reuse and not reuse rather than recycling.A circular economy with a Bangladesh emphasis should be grounded. It should acknowledge the informal recovery activity, extent of RMG textile waste, ineffectiveness of source separation, and capacity constraints of municipalities and market demand requirement. It should also not contain empty circularity. A product does not go around in a circle due to its collection and a material does not go around in a circle due to its being branded recyclable. Only when materials do not go to waste, pollution is reduced, workers are not at risk, and new production is actually prevented, circularity becomes relevant.The paper suggests a gradual process that is to be developed on the basis of segregation

of sources, reuse centers, repair and refill, textile-waste traceability, worker inclusion, producer responsibility and quality-controlled recycling. When Bangladesh takes this path, the first choice will be reuse of functional products, and recycling will be the sure backbone of the real end-of-life materials. This is a middle ground that will provide the most viable solution to Bangladesh: retain value in use as long as possible, and recycle clean materials only after reuse is no longer an option.

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