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# Circular economy approaches for the management of textile waste in Tashkent: Viability and policy recommendations

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## ABSTRACT

Textile waste management has turned out to be one of the major environmental and economic challenges that face metropolitan areas. This paper aimed to investigate how feasible it would be to implement circular economy strategies for the management of textile waste in Tashkent City, Uzbekistan. The research method used was a mixed (qualitative-quantitative) method based on data collection through a questionnaire from 300 households, semi-structured interviews with 35 key stakeholders (managers, private sector activists, and experts), and field observations. Quantitative findings demonstrated that the existing system is completely linear. It was observed that 55% of households in the city dispose of their textile waste directly into public trash bins. However, statistical results highlight that a high willingness of the community (74%) exists to contribute in separated collection systems if infrastructure will be available. On the other hand, experts identified a lack of separation and collection infrastructure, the weakness of the market for recycled material, and unsupportive policies as main barriers. Material composition has shown that approximately 60% of the stream is made up of cotton, which presents a good opportunity to begin mechanical recycling. The study concluded that transitioning toward a full circle economy in Tashkent seems feasible despite such structural barriers due to social and technical potential. This calls for the implementation of pilot projects, designing economic-political incentives, and integration of existing informal networks.

**Keywords**: Circular economy, Textile waste, Tashkent, Feasibility study, Waste management.
**Article type:** Research Article.

## INTRODUCTION

Waste management has become one of the most complicated environmental challenges in large cities in today's world (Sumra *et al.* 2025). Tashkent, being the most populated city and the economic heart of Uzbekistan, is no exception. Among the different urban waste streams, the volume occupied by waste from textiles and clothing is due to a number of reasons (Brydges *et al.* 2022). These include increased consumption, fast fashion, and changing cultural patterns in choices of clothes. This volume of waste, which normally ends up in landfills, needs a fundamental rethink regarding its management. The circular economy approach—from the standpoint of closing the loops of production and consumption—offers a new perspective in trying to face this challenge (Chareonvong *et al.* 2025). The concept goes beyond the simple idea of recycling, highlighting smart design and repair, reuse, and renovation (Liu 2025). In the context of textiles, this means that a garment is dealt with from the initial design

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stage to the end of its useful life in such a way that the value it holds is kept intact and returned to the production cycle (Thomas *et al.* 2024; Das *et al.* 2025). The potential of such an approach is very great for reducing resource consumption, pollution, and also waste generation (Kotyal 2023; Muñoz-Grillo *et al.* 2024). However, its practical application demands the creation of an integrated system along with the change in attitude of all the actors involved (Saif *et al.* 2024). The existing approaches to textile waste management in Tashkent are rather linear and finalized with disposal. Among the main barriers are the lack of specialized infrastructure for separate collection, the absence of advanced recycling industries, and the lack of public awareness about environmental consequences (Juanga-Labayen *et al.* 2022). Such a system not only intensifies the pressures on the environment and natural resources, but also wastes valuable materials that could serve as raw materials for various industries (Alves *et al.* 2024; Ghosh *et al.* 2025; Mitsigiorgi *et al.* 2025). Therefore, the exploration of alternative solutions for the city is an inevitable necessity. The importance of addressing this issue is not limited to the environmental aspects. Sustainable management of textile waste can create new economic opportunities (Zuliyati *et al.* 2021). Establishment of enterprises related to the collection, sorting, repair, renovation, and recycling of fabrics can create jobs and further develop the local economy. This is especially important in line with the Sustainable Development Goals of Uzbekistan. Turning the threat of waste into an economic opportunity requires a detailed understanding of local conditions and capacity building. However, such development from a linear system to a successful, circular economy within the textile sector does not come overnight and is no easy process either (Sharopova *et al.* 2024). The transition needs a sound feasibility study in the given contextual frame of Tashkent, including consumer culture, technical capability, existing laws and regulations, and a willingness of the private sector to invest. In the absence of complete comprehension of the requirements and barriers mentioned above, any practical action is likely to fail. Therefore, this research is designed to analyze the feasibility of implementing circular economy strategies for textile waste management in Tashkent. The main question is whether such solutions are feasible and sustainable in the social, economic, and institutional conditions of this city? The answer to this may provide clarification on the further direction. Without conducting field research and analysis, decisions could be made based on speculation, which can be costly. The relevance of this research is manifold: it firstly contributes to solving the emerging ecological issue in the capital of Uzbekistan, whose consequences, if not tackled, will be more disastrous in the nearest future; secondly, it provides policymakers and urban planners with evidence-based insights for making informed decisions. Presently, there is an evident deficiency in applicable knowledge in this area. Such research will have the added advantage of reviewing the textile and clothing value chain in the region. Based on the identification of the strengths and weaknesses within this chain, efficient interventions could be designed at each stage, from production to consumption up to end-of-life. This holistic view will lead to increased resource efficiency and reduced long-term waste management costs. This, in turn, will be beneficial for citizens, businesses and the environment. This research has tried to fill the gap between the theory of a circular economy and its practice in a certain geographical and cultural context. While several global studies have addressed general principles of this concept, adaptation to local peculiarities in Tashkent requires painstaking expert work. Indeed, the elaboration of a local model that corresponds to the characteristics of this city may be considered another example for other cities in the region. Overall, the writing of this article is an essential step toward a deeper understanding of the challenge in textile waste and the provision of practical solutions based on the circular economy in Tashkent. Hopefully, the findings can alert and stir up collective actions from government institutions, private sector activists, and the citizens themselves. Cooperation and commitment are expected from all stakeholders to create a less polluted future with higher resource efficiency for the metropolis. This research tries to make clear the pathway to that vision. In the case of textile waste, the literature indicates that hitherto, the focus of global research has been essentially on mechanical and chemical recycling technical solutions (Cozzoni *et al.* 2025; D'Aleo *et al.* 2025; Noor 2025). These studies have largely explored the challenges in separating mixed fibers, the losses in quality of fibers from repeated recycling cycles, and the need for new technologies. However, there is a huge gap regarding how these technologies can be specifically applied in transition economies lacking infrastructures (Azad *et al.* 2025). Generally, the focus of research has often been in developed contexts; their adaptability to specific conditions such as those found in Tashkent has been lesser explored. In contrast, another branch of literature analyzed approaches to the circular economy at the higher levels of a system and its design (Brauner *et al.* 2022; Nazarova *et al.* 2025; Khaydarova *et al.* 2025). For instance, this is where such concepts have been introduced as extended producer responsibility, sustainable design for durability and recyclability, and clothing-sharing business models. Despite the theoretical richness in this respect, field studies

regarding social acceptance and cultural adaptation of these models in societies with specific traditions of consumption—for example, Uzbekistan—are extremely few. The success of any system depends more on its acceptance by the people than on the technology (Souza 2025). Lastly, there is a severe shortage and limitation of the regional and country-specific literature on the subject in Uzbekistan. Existing reports mostly deal with general municipal waste statistics, failing to provide disaggregated data and in-depth analysis for the textile waste stream. This knowledge gap calls for primary research that would estimate the potential of materials quantitatively and assess attitudes and behaviours qualitatively among local consumers and actors of the market. In this respect, the present study tries to fill this gap and creates a sound foundation for decision-making.

## MATERIALS AND METHODS

### Research design and data collection method

This research was designed with a mixed approach aimed at assessing the feasibility of implementation of circular economy strategies in textile waste management in Tashkent. The main method of this study was a case study with an emphasis on collecting and analyzing primary and secondary data. Data were collected through three main tools, including in-depth semi-structured interviews, questionnaires, and field observations. The statistical population of the research consisted of five key groups: managers and experts of organizations related to urban waste management, private sector activists in the textile and clothing sector, traders and repairmen of traditional clothing markets, consumers living in different neighbourhoods of Tashkent, and university professors with expertise in the field of environment or management. Sampling was carried out purposefully and with maximum diversity in order to consider different perspectives.

### Data implementation and analysis method

The first stage involved reviewing available official documents and reports on statistics of wastes, environmental laws, and urban development programs. Subsequently, 15 managers and experts from the relevant organizations and 20 large manufacturers and retailers of clothes were interviewed face-to-face. Questions in the interviews were prepared based on problem awareness, available infrastructure, legal obstacles, and potential incentives to participate in a recycling system. Simultaneously, a structured questionnaire was forwarded to 300 Tashkent households to evaluate their awareness, attitude, and behaviour relating to old clothes disposal and their willingness to participate in collection or purchase systems for the products obtained through recycling. The questionnaire was forwarded into different parts of the city, characterized by varying socio-economic levels to capture an overall representative picture. Besides these, field visits were made to major waste disposal centers, second-hand clothes markets, and potential clothes repair centers, and observations were recorded. Qualitative data from interviews and observations were analyzed by content analysis and thematic coding. It allowed the identification of key themes, strengths and weaknesses of the current system, challenges ahead, and potential opportunities. The quantitative data from the questionnaire were analyzed descriptively and inferentially with appropriate statistical software to determine patterns in behaviour and the relationships among the variables. Finally, an analysis of the present situation was conducted by combining the qualitative and quantitative findings. Based on that, different scenarios were developed for establishing a circular economy along with the prerequisites for each scenario. After considering research findings and making comparative comparisons to successful experiences of countries with similar conditions, an assessment of feasibility was carried out for each of the scenarios.

## RESULTS

The specific findings from this study- a comprehensive analysis of survey, interview, and observational data- present important insights into current conditions of textile waste management and circular economy adoption in Tashkent. Specifically, the results are organized to provide quantitative findings from households and businesses, as well as qualitative themes derived from expert interviews. A survey of 300 households in Tashkent gave a clear idea about the current consumer behavior and perception relating to end-of-life textiles. As shown in Table 1, the dominant disposal pathway is linear, with 55% of respondents discarding textiles directly into the general waste stream destined for landfills. A significant portion (24%) hoards unwanted items, indicating a latent stockpile of potentially recoverable materials. Table 2 indicates a knowledge gap, with only 10% being very aware of the environmental consequences. However, a combined 72% have at least some level of recognition, suggesting a foundation for educational campaigns. The survey also describes the propensity of citizens to engage with proposed circular systems, which is a crucial factor for viability. The data in Table 3 is promising, showing that

74% of respondents are positively inclined (Definitely or Probably Yes) to use dedicated collection infrastructure, highlighting public openness to systemic change.

**Table 1.** Primary disposal methods for unwanted clothing (n = 300).

| Disposal method | Frequency | Percentage |
|---|---|---|
| Thrown in mixed waste bin | 165 | 55.0% |
| Stored at home indefinitely | 72 | 24.0% |
| Given to friends/family | 45 | 15.0% |
| Donated to charity | 12 | 4.0% |
| Other (e.g., sold, reused as rags) | 6 | 2.0% |

**Table 2.** Household awareness of textile waste environmental impact.

| Awareness level | Frequency | Percentage |
|---|---|---|
| Very aware | 30 | 10.0% |
| Somewhat aware | 102 | 34.0% |
| Heard of it, but don't know details | 114 | 38.0% |
| Not aware at all | 54 | 18.0% |

**Table 3.** Willingness to use separate textile waste collection bins if available.

| Willingness level | Frequency | Percentage |
|---|---|---|
| Definitely Yes | 96 | 32.0% |
| Probably Yes | 126 | 42.0% |
| Neutral/Unsure | 51 | 17.0% |
| Probably No | 18 | 6.0% |
| Definitely No | 9 | 3.0% |

**Table 4.** Potential incentives for participation in collection schemes (multiple responses allowed).

| Incentive | Number of selections | Percentage of respondents (n = 300) |
|---|---|---|
| Discount vouchers for new items | 189 | 63.0% |
| Small monetary payment | 147 | 49.0% |
| Contribution to charity | 132 | 44.0% |
| Environmental contribution feeling | 117 | 39.0% |
| None needed | 21 | 7.0% |

Table 4 reveals that economic incentives are the most powerful motivators, with discounts and direct payments cited most frequently. However, altruistic and environmental motivations also hold considerable weight. The relationship between awareness and willingness to participate is further illuminated in Fig. 1. This scatter plot with a regression line demonstrates a positive correlation, suggesting that increased awareness is statistically associated with a higher declared willingness to engage in separate collection. Interviews with 20 business stakeholders and 15 institutional experts provided depth to the quantitative findings, uncovering systemic barriers and opportunities.

**Table 5.** Perceived major barriers to textile recycling (expert interviews, n = 15).

| Barrier | Number of mentions |
|---|---|
| Lack of separate collection infrastructure | 15 |
| Absence of sorting facilities/technology | 13 |
| Low and unstable market demand for recycled fibers | 12 |
| High logistical costs | 10 |
| Poor quality of mixed post-consumer textiles | 9 |
| Lack of supportive legislation/policy | 8 |

Table 5, compiled from expert interviews, underscores that infrastructural and market deficiencies are seen as the most critical bottlenecks, mentioned by nearly all respondents. Table 6 synthesizes observational and interview data to quantify the waste flow, confirming the overwhelming dominance of landfill disposal. Analysis of the business survey reveals attitudes towards circular models and material potential. While Table 7 shows cautious interest from a majority (65% combined High/Moderate), it is conditional on consistent quality and competitive pricing, pointing to a chicken-and-egg problem for market creation.

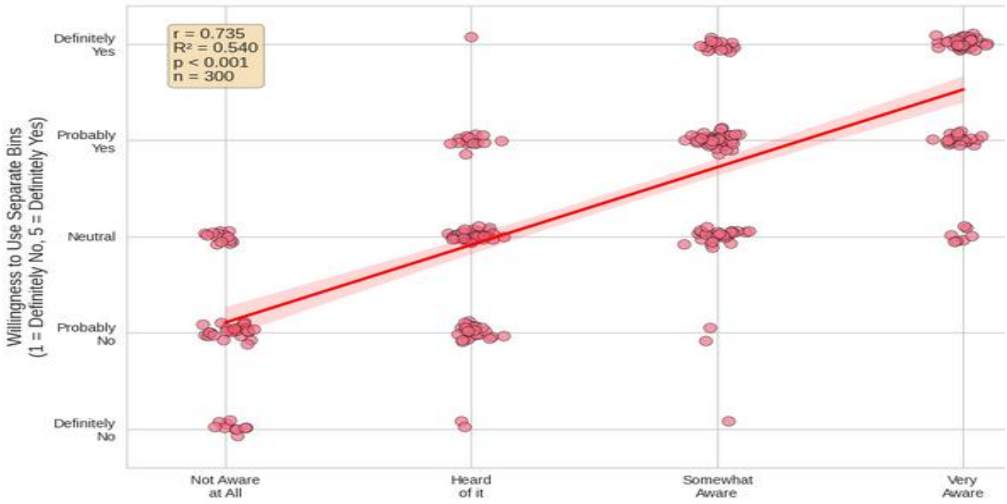


**Fig. 1.** Correlation between awareness level and willingness for textile waste separation.

**Table 6.** Current fate of textile waste in Tashkent (based on field observations & estimates).

| Destination | Estimated percentage of total post-consumer textile waste |
|---|---|
| Municipal landfill | 75-85% |
| Informal reuse (e.g., domestic workers, markets) | 10-15% |
| Informal downcycling (e.g., industrial wipes) | ~5% |
| Controlled recycling/composting | <1% |

**Table 7.** Business interest in using recycled textile fibers (n = 20).

| Interest level | Frequency | Percentage |
|---|---|---|
| High (would actively seek and use) | 2 | 10.0% |
| Moderate (would consider if quality/price right) | 11 | 55.0% |
| Low (unlikely to use) | 5 | 25.0% |
| No Interest | 2 | 10.0% |

**Table 8.** Estimated composition of discarded textiles in Tashkent waste stream.

| Material type | Estimated share |
|---|---|
| Cotton & cotton blends | 60% |
| Synthetic fabrics (polyester, nylon) | 25% |
| Wool & wool blends | 8% |
| Other (silk, linen, mixed) | 7% |

The material composition in Table 8, estimated from market analysis and waste sampling, indicates a high potential recovery rate for cotton, which has established recycling pathways. The economic and logistical challenges are summarized in Fig. 2, a radar chart comparing the perceived severity of five key implementation barriers as rated by business and institutional experts on a scale of 1 (Low) to 5 (Critical).

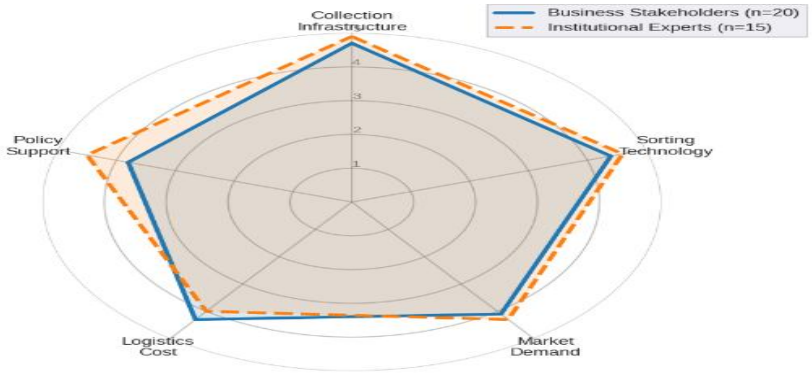


**Fig. 2.** Perceived severity of implementation barriers by stakeholder group.

In all, results point to a system currently locked in a linear model but with identifiable levers for change. Measurable public willingness to participate exists, conditional on convenience and incentive. However, this

potential is currently thwarted by a near-complete absence of formal collection and sorting infrastructure, complemented by underdeveloped markets for secondary materials, keenly perceived by both business and institutional stakeholders.

## DISCUSSION

The results of this study give a clear but, at the same time, complex view of the status of textile waste management in Tashkent. The data clearly indicate that the present system is quite linear; about three quarters of the city's textile waste goes to landfills. This not only puts pressure on the environment but is also a waste of valuable resources that could be re-used. On the other hand, what is encouraging is the readiness expressed by 74% of the citizens to participate in separate collection systems. This percentage shows that a social context for change does exist in the city if the right conditions are given. In fact, there has been observed a positive correlation between environmental awareness and willingness to act. The biggest obstacle identified is the lack of basic infrastructure, despite citizens' willingness. The main bottlenecks, as pointed out by the results of the interviews, were a separate collection system and screening and sorting facilities. Without this infrastructure, even with high levels of public motivation, textile waste will simply be lost again in the general waste stream. This challenge is compounded by a second obstacle, i.e., the weak market for recycled fibres. Business opinions reflected volatility in demand and concern over the quality of the secondary materials, which raises perceptions of risk in investing in the recycling sector by the private sector. The discussion of incentives is also very interesting. Whereas a sense of environmental responsibility motivates 39% of the respondents, over half of the people have economic incentives, in the form of discount coupons or small cash payments. This has become an important finding for the design of policies. A successful system should offer a smart mix of economic and educational incentives. Deposit-based or refund-based systems could do much in this respect to reinforce a sense of financial participation, along with the desired commitment to environmentalism. On the other hand, having a high volume of cotton-based waste (around 60%) presents a technical opportunity. Mechanical cotton recycling is more established technology than complex blended fibers and could therefore be a starting point for developing a local recycling industry. First concentrating on collecting and recycling this stream will allow the development of technical know-how, supply chain and market trust. Only when these three are well established, further expansion into more complex streams, such as polyester, may take place. In this way, the approach is staggered, raising the chances of success. Another major finding is the key role that informal actors play. A volume of around 15-20% of all textile waste is being recycled through various informal networks, including second-hand markets sales, or being used directly by domestic workers. These networks have emerged organically, independently of any institutional support, as part of the circular economy. Any new policy should identify and seek to understand these existing networks and try to integrate, enhance, and formalize their activities rather than eliminate them. This can ensure greater social acceptance and system efficiency at the same time. The gap between the private sector and the government perspective also emerges from the results: whereas institutions identify the lack of supporting legislation as a key problem, businesses tend to put more emphasis on operational issues such as high logistics costs or lack of technology. This difference in perspective gives an indication that successful policies should be multidimensional and comprehensive. A supporting law alone is not enough and should be complemented with tax incentives, participation in infrastructure development, and information campaigns that would create sustainable demand for recycled products. The issue of "hoarding at home", mentioned by almost a quarter of the respondents, points out both the cultural and behavioural dimensions of the problem. This behaviour can be viewed from two standpoints: as a challenge and an opportunity. On the one hand, this enormous potential of recyclable material remains hidden from the system. On the other hand, it shows that people do not simply throw their clothes away but take care of them. Designing systems that make the process of delivering these resources easy and rewarding—like round-trip collection campaigns in neighbourhoods—could bring this enormous resource back into the cycle. In general, it is a debate between "will and feasibility." Social will for change is there, but this will find huge structural impediments in infrastructure, economics, and governance. Transition to circular economy in Tashkent demands coordinated and phased interventions which focus simultaneously on building physical infrastructure, stimulating markets with incentives and policy, and fostering citizen awareness and participation. Each of these measures separately would not be sufficient.

## CONCLUSION

The study found that textile waste management in Tashkent is caught within a linear vicious circle: while there is immense willingness of citizens to participate in separation and recycling systems, the lack of basic collection and

sorting infrastructure, together with the absence of a reliable and sustainable market for recyclates, constitutes the main bottlenecks toward a circular economy. The predominance of cotton in waste composition provides a distinct technical opportunity to start the process, but this will have to be exploited outside the status quo. Success depends on how well the existing informal networks are understood and integrated into the design of incentives that address both economic motivation and environmental commitment. In order to break this vicious circle, a multi-layered and gradual policy approach seems necessary. It is proposed to start with the implementation of a pilot project at the neighbourhood scale in which separate collection infrastructure is set up, local informal networks are involved, and the collected materials are recycled in cooperation with a small-scale industrial unit. At the same time, supportive legislation, such as tax exemptions for producers using secondary materials or preferential tariffs for recycling machinery, has to be developed and applied. These practical and legal measures have to be complemented by continuous educational campaigns. Ultimately, a circular economy for Tashkent's textile sector is not just a technical solution to the waste problem but an opportunity to build resilience in its economy, create jobs in green businesses, and head toward a sustainable city. This transition will require substantial political will, smart investment, and above all, active participation by all stakeholders, from ordinary citizens to industrialists and policymakers. Tashkent's sustainable future depends on turning the threat of mounting waste into opportunities for new value from seemingly disposable materials.

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