

# Identifying Gaps In Existing Recycling Mobile Application: Positioning Ambrosa For Improved Adoption

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## ABSTRACT

Urban sustainability in rapidly expanding cities like Dubai depends significantly on efficient waste management and increased recycling participation. Household recycling rates are low, despite the availability of recycling facilities, due to logistical inconvenience and lack of time. This study examines a novel solution through the development of Ambrosa, a smartphone application that uses electric vehicles to provide affordable, low-emission pickup and delivery services for domestic recyclables. Based on quantitative analysis, 40 households revealed that 77.5% viewed the lack of collection services as a barrier, 80% were willing to pay for the service, and 93% would recycle more if such a service were offered. The study supports the idea that incentives and convenience—such as DEWA electricity bill credits—are essential for increasing participation. Ambrosa not only addresses logistical challenges but also combines clean energy transportation, digital engagement, and reward-based behavior change in alignment with the Dubai Clean Energy Strategy 2050. It concludes with strategic recommendations for stakeholders, highlighting the potential of digital, incentive-supported recycling platforms to transform urban sustainability efforts.

## INTRODUCTION

With the continued growth and urbanization of Dubai, waste management and waste reduction strategies such as recycling are becoming increasingly important for the city's sustainable development. Unfortunately, although so many facilities for recycling are available, very few residents are able to make use of them on a regular basis because of their hectic daily routines or lack of available options. Addressing this problem, our team has developed a prototype of a mobile application that connects residents with drivers of electric vehicles that are able to deliver their recyclable waste to the recycling centers within the area. This project seeks to incorporate all positive aspects that would make recycling easy and friendly to the environment including offering DEWA points, a reward that will reduce electricity consumption costs. Our project addresses some of the long-term objectives regarding waste disposal practices with a view of improving the environment in Dubai.

**Keywords:** Waste Management, Recycling, DEWA Points, Electric Vehicles, Mobile App, Dubai, Sustainability

## REVIEW OF LITERATURE

### Introduction to Sustainable Waste Management

At its core, sustainable waste management is just figuring out how to deal with our rubbish without messing up the planet even more. It sounds simple when you put it like that, but it is really a mix of big policies and tiny everyday habits. Cities everywhere are trying to cut back on what goes into landfills, recycle more, and make sure the whole waste process does as little damage as possible to the air, water, and soil. Dubai has its own version of this push with the “Dubai Clean Energy Strategy 2050,” aiming for 75% clean energy by 2050. That is a big, bold number, and it is not going to happen unless a lot of different systems, including waste management, get better. The thing is, even with recycling centres dotted around the city, a lot of people just do not use them. And honestly, it is not always about being careless. Life is busy here. People are working long hours, juggling family life, and the idea of driving out of your way to drop off some bottles and cans can easily slip off the list. That gap between having the facilities and actually using them is exactly what is pushing people to think up smarter, easier ways to get recycling done.

In rapidly growing cities such as Dubai, waste management has increasingly been influenced by technology. Under the Smart Dubai initiative, digital solutions have been introduced to make daily life more efficient while supporting environmental sustainability. The use of mobile applications has been identified as one of the most effective ways to connect residents with recycling facilities. According to Almansoori and El-Baz (2021)<sup>1</sup>, nearby recycling centres can be located by users, and guidance on proper waste separation is provided through these applications. Convenience has been reported as a significant factor in participation because residents often have busy schedules.

It has been observed by Tan et al. (2022)<sup>2</sup> that recycling behaviour is increased when reminders and location-based alerts are provided within mobile platforms. Incentive programs have been shown to further support engagement with recycling practices. For instance, points or rewards are offered for disposing of recyclable materials through applications such as RECAPP by Veolia (Veolia Middle East, 2023)<sup>3</sup>. A sense of accomplishment is reported by users when progress is tracked and rewards are earned, and long-term engagement is encouraged. Gamification elements have also been incorporated, and motivation to participate in sustainable practices has been enhanced (Jin et al., 2021; Hassan & Abbas, 2023)<sup>45</sup>.

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<sup>1</sup> Almansoori, H., & El-Baz, S. (2021). *Mobile applications for sustainable waste management in urban UAE. Journal of Environmental Innovation.*

<sup>2</sup> Tan, C., Wong, J., & Lim, R. (2022). *Technology-driven recycling behaviour: The role of convenience and reminders. Environmental Technology and Society.*

<sup>3</sup> Veolia Middle East. (2023). *RECAPP annual sustainability report.*

<sup>4</sup> Jin, Y., Park, S., & Lee, M. (2021). *Gamification for environmental engagement in smart cities. Journal of Sustainable Systems.*

<sup>5</sup> Hassan, F., & Abbas, R. (2023). *Gamified environmental apps and youth engagement: A cross-sectional study. Sustainability Reports, 15(4).*

The importance of visible feedback has been highlighted by Kumar and Singh (2022)<sup>6</sup>, who reported that when users are shown the impact of their actions, such as the amount of waste recycled or carbon emissions reduced, continued participation is more likely. Chen et al. (2020)<sup>7</sup> also observed that measurable results strengthen commitment to recycling habits. Nevertheless, challenges remain. Engagement with sustainability apps often declines over time when rewards become repetitive or interfaces are perceived as complex (Al-Ghamdi, 2022)<sup>8</sup>. Privacy concerns have been noted by Zhao et al. (2021)<sup>9</sup>, as some users are hesitant to share location data despite the environmental benefits. A sense of shared responsibility within the community has been suggested as necessary for true behavioural change (Ogunseitan, 2023)<sup>10</sup>.

Overall, it has been very clearly demonstrated how combining technology and customer feedback can help support a sustainable recycling app. The inculcation or integration of apps like RECAP along with awareness programs can help make recycling a routine and quotidian part of a resident's life. Alongside all this, the contribution of technology to sustainability has been further reinforced by El-Gamal and Youssef (2023)<sup>11</sup>, who emphasized the need for practical, accessible solutions to achieve the Clean Energy Strategy 2050 goals.

## STATEMENT OF THE PROBLEM

There is accelerated urbanization in Dubai that has heightened the problem of waste management at the household level sustainably. Although the city has invested in recycling facilities and aligned its long term plan with the Dubai Clean Energy Strategy 2050, the rate of participation of households in recycling has been persistently low. Literature presents the fact that this is not so much a matter of raising public awareness, but a problem embedded in convenience and accessibility. For most residents, busy lifestyles and the lack of flexible collection services deter regular recycling, even where facilities are offered.

Research indicates further that technology led systems, specifically mobile apps, can contribute to filling this gap by increasing the convenience and visibility of recycling for households.<sup>12</sup> Research also indicates that green transport modes, like electricity-powered vehicles, lower the carbon impact of collection services, consistent with overall sustainability objectives.<sup>13</sup> Yet solutions to date tend not to be integrated with these logistical components and behavioural incentives, making them short-lived. The incentive mechanism, by

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<sup>6</sup> Kumar, P., & Singh, V. (2022). *Digital feedback systems and recycling motivation in urban communities*. *Waste Management Review*.

<sup>7</sup> Chen, L., et al. (2020). *Long-term behavioural change through eco-apps*. *Environmental Psychology Review*.

<sup>8</sup> Al-Ghamdi, S. (2022). *Adoption barriers of sustainability apps in the GCC*. *Smart Environment Journal*.

<sup>9</sup> Zhao, Y., et al. (2021). *Privacy concerns in environmental mobile applications*. *Journal of Information Ethics*.

<sup>10</sup> Ogunseitan, O. (2023). *The psychology of sustainable technology use*. *Global Sustainability Review*.

<sup>11</sup> El-Gamal, N., & Youssef, A. (2023). *Smart city strategies and sustainable development in the UAE*. *Journal of Urban Policy Studies*.

<sup>12</sup> De Wildt, Kelly K., and Marijn H. C. Meijers. "Time Spent on Separating Waste Is Never Wasted: Fostering People's Recycling Behavior Through the Use of a Mobile Application." *Computers in Human Behavior*, vol. 139, Oct. 2022, p. 107541, doi:10.1016/j.chb.2022.107541.

<sup>13</sup> Peña, David, et al. "Sustainable Waste Collection Optimization Using Electric Vehicles." *Sustainable Cities and Society*, vol. 105, Mar. 2024, p. 105343. <https://doi.org/10.1016/j.scs.2024.105343>.

way of discounts or credits on utility bills, has been found to promote regular recycling habits by connecting individual actions to palpable gains.

The root issue thus remains between the supply of infrastructure and household uptake. There are recycling plants in Dubai, but the absence of convenient logistics and incentive mechanisms discourages households from visiting them on a regular basis. This disconnection means significant levels of recyclable material are ending up in general waste, defeating the city's sustainability targets. A model that combines accessible, low-emission transport with digital platforms and incentive schemes is needed to correct this issue and make recycling both convenient and rewarding for busy city-dwellers.

## HYPOTHESIS

- **Null Hypothesis (H<sub>0</sub>):** Providing a mobile application with a pickup/delivery recycling service and incentivised rewards does not significantly affect households' recycling participation rates in Dubai.
- **Alternative Hypothesis (H<sub>1</sub>):** Providing a mobile application with a pickup/delivery recycling service and incentivised rewards significantly increases households' recycling participation rates in Dubai.

## RESEARCH METHODOLOGY

This research was conducted to investigate the barriers preventing families from engaging in recycling and reusing activities, with a particular focus on the absence of delivery and pickup services. The study also aimed to assess the willingness of households to pay for such a service and their likelihood of increasing recycling efforts if it were provided. A quantitative research design was adopted, using a questionnaire survey as the primary data collection tool. This approach enabled the collection of measurable data from a diverse group of respondents, ensuring reliability in identifying common trends and preferences.

The study was carried out across multiple residential communities in the UAE, targeting families from varying socio-economic, cultural, and professional backgrounds. A total of 40 families participated, selected through random sampling to ensure representation from different community types and household structures. A structured questionnaire containing three key questions was prepared to identify whether the lack of a delivery/pickup service hinders recycling and reuse, measure willingness to pay a small amount (7–10 AED) for such a service, and understand if such a service would encourage increased recycling and reuse. The questionnaire was distributed digitally via Google Forms and also conducted in person at common community areas such as parks, cafes, and residential meeting spaces.

The collected responses were tabulated and converted into percentages for interpretation. Results showed that 77.5% of respondents reported the absence of delivery/pickup services as a barrier to recycling, 80% expressed readiness to pay 7–10 AED for the service, and 93% stated they would recycle more if such a service were available. These findings indicate that transportation and convenience are significant barriers to recycling, a high proportion of households are willing to pay for a solution, and there is strong potential to increase recycling rates if an accessible, low-cost service is introduced.

Based on these findings, the proposed solution is a mobile application offering sustainable pickup and delivery of recyclable and reusable items using pre-owned electric scooters, electric bikes, and bicycles. This service would be convenient for busy families, promote environmental sustainability, reduce household clutter through regular clearance of recyclables, and provide an affordable option priced between 7–10 AED

per use. By addressing transportation challenges and time constraints, the service directly targets the root cause of low recycling rates while offering an environmentally responsible and economically viable solution.

## RESULTS AND DISCUSSIONS

Data was collected from 40 families living in various residential communities across the UAE, which clearly supported general patterns in household recycling and reuse behaviours, barriers and enabling behaviours. The largest barrier was around delivery and pickup services, which was reported by 77.5% of respondents, identifying it as the primary reason as to why they do not recycle or reuse household items. This response was consistent across most socio-economic groups and locations, highlighting the systemic nature of this transport-related issue, as well as providing insights into time and convenience positioned as barrier rather than an issue of commitment, engagement, or awareness.

When respondents were asked if they would be willing to pay for a pickup service, 80% said yes at an acceptable fee level (between 7-10 AED), if a service existed. While obviously impacted by cost, these data support the above findings that many are willing to pay for a more sustainable and convenient solution which helps them clear out their recyclables without having to spend their own time to drop them off at the center. Additionally, this fee seems to be reasonable as compared to our competitors like Green Truck, who charge 120 AED for one time service and Recapp, which charges 39 AED per month.

Furthermore, 93% of respondents confirmed they would recycle and reuse a lot more if there were an accessible, reliable pickup and delivery service. Overall, these data reflect a good latent demand for practical service-based options that overcome physical and logistical barriers to recycling.

To provide evidence of possible real-world use of such a service we carried out a pilot, where households from one area all participated and collected over 30 kilograms of recyclables. The contribution from each household so clearly illustrated the volume of recyclable material that is out there but currently not being used (recycled), and it also demonstrated that the system and the HRE (human recycling engagement) for recycling in higher abstraction levels already existed, they were only being under-used due to lack of access and transport options.

The findings of our study also corresponded to international studies regarding recycling app uptake. Studies have demonstrated that recycling mobile app uptake is very often hampered by poorly integrated logistics in the real-world, personalization and lack of user incentives<sup>14</sup>. Also majority of existing apps has led to

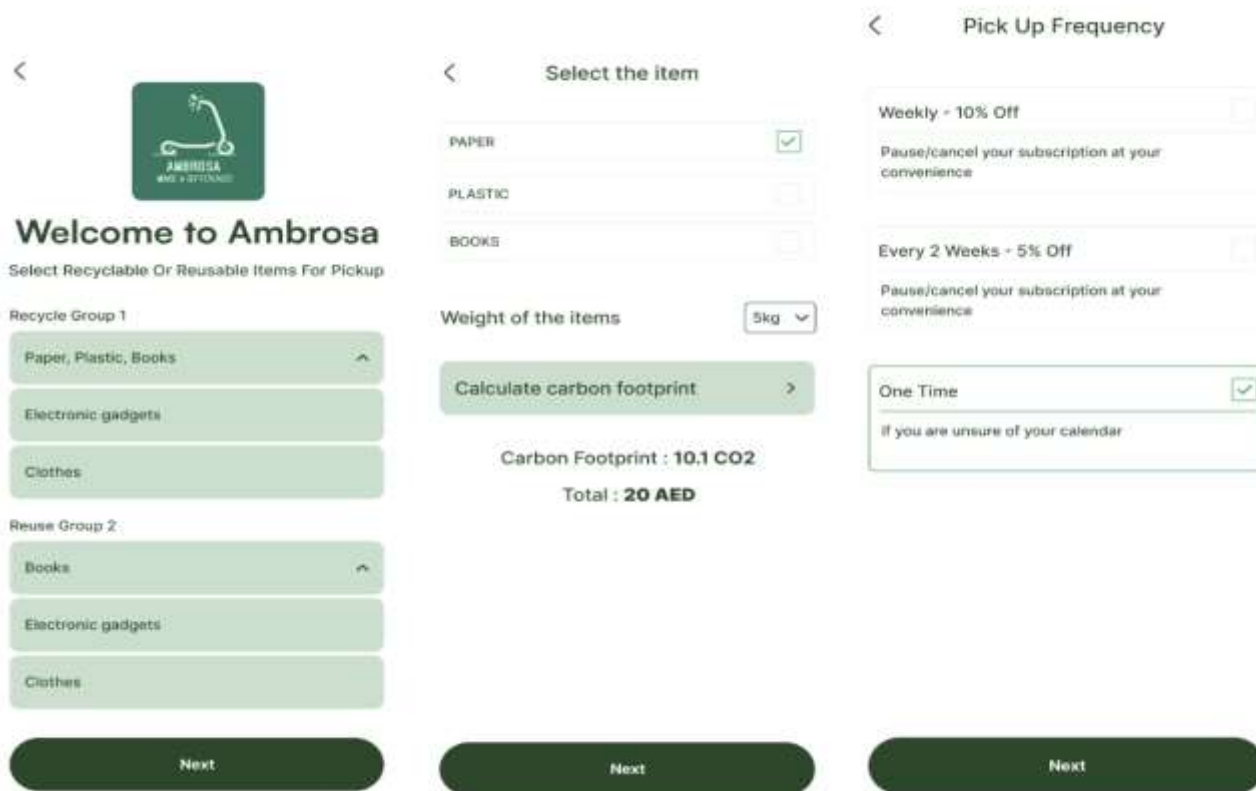
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<sup>14</sup> Sozoniuk, M., Park, J., & Lumby, N. (2022). Investigating Residents' Acceptance of Mobile Apps for Household Recycling: A Case Study of New Jersey. *Sustainability*, 14(17), 10874. <https://doi.org/10.3390/su141710874>

increased carbon footprint of logistics (using trucks), that adds environmental cost and limits scalability.<sup>15</sup> Ambrosa, however, aims to fill these gaps in the future service by creating its own features that integrate personalization in scheduling collection, tracking carbon footprint and low-cost transportation providers using electric scooters and bikes, which each produce 202g Co2 per km compared to the 201kg Co2 per trip using traditional trucks.

As described, there are several features in the design of Ambrosa that have subscription pricing, carbon tracking features, and both paid and volunteer based driver options which are ways to cut overall costs and support local employment/volunteering . The competitive analysis demonstrates that Ambrosa offers more flexibility, lower environmental impact, and lower cost per transaction than the alternatives, like Recapp and Green Truck.

Overall, the evidence confirms a significant opportunity in the market for an accessible, low-cost, app-based recycling pick up service in the UAE. The research shows that the absence of logistics support is a major barrier, and that a large majority of households would both use and pay for a service to remove that barrier. Overall, the results strongly validate the potential adoption and impact of Ambrosa in the UAE, in particular for busy urban families who currently contribute to the low recycling rate in the country.



**Fig: Prototype of Ambrosa**

<sup>15</sup>Wati, H. R., & Puspita, A. S. (2024). *Waste transportation environmental impact using life cycle assessment*. *Polish Journal of Environmental Studies*. Retrieved from <https://www.pjoes.com/pdf-186580-116101?filename=Waste+Transportation.pdf>



**Fig: Results of market survey done with 40 families in a neighbourhood**

## RECOMMENDATIONS

The study’s findings highlight the need for accessible, affordable, and user-friendly recyclable solutions to overcome transportation barriers. To maximize recycling’s potential, stakeholders should adopt and promote mobile-based recycling platforms like Ambrosa.

Government stakeholders should implement federal sustainability initiatives and establish app-based recycling services as part of community-based waste collection networks. This strategy rewards households for recycling, eases centralized activities, and supports local governments in meeting environmental policy goals. App data can also help governments track urban waste planning and resource use.

Educational organizations, including schools and universities, can use app-based recycling initiatives in school curricula or sustainability committees. Students can participate in community-based recycling projects using Ambrosa, fostering environmentally responsible behavior and lifelong commitment. They can also participate in awareness campaigns or volunteerism around the app’s objectives, developing civic engagement and problem-solving skills.

Community organizations and social units, especially culturally diverse ones, can use Ambrosa to facilitate recycling drives, group pickups, and awareness initiatives in their neighborhoods. This inclusive approach encourages shared responsibility and collective action, leading to cleaner and more environmentally-conscious communities. Companies and business managers can enhance sustainable practices by integrating Ambrosa into their CSR initiatives. This can include sponsoring recycling pickups for employees or providing an app discount as an employer-based benefit. Sponsorship stimulates environmental awareness and activism for ESG, distinguishing companies favorably in the public eye and appealing to socially responsible investors and consumers. Finally, mobile app developers and environment-related startups should prioritize convenience, adaptability, and social impact. Ambrosa’s success model, utilizing cost-effective electric transport, a multilingual user interface, and a volunteer base for material deliveries, provides valuable insights for app design. Incorporating similar features to primary recycling app functions will make apps more desirable, user-friendly, and contribute to the objectives of the circular economy and sustainable development.

<sup>1</sup> Recommendations are based on the study’s findings.

<sup>2</sup> They are intended for practical application and improvement.

## CONCLUSION

This study highlights the likely transformational role a mobile (app) digital waste collection tool can play together with an electric vehicle-based waste collection system in the active recycling process and a system to promote sustainability in emerging contexts, specifically urban contexts like Dubai. As urban confines become more populated and the number of waste materials increase, new challenges are posed to conventional waste management systems' viability to function effectively and with minimal environmental harm. The proposed solution directly enables clean energy transportation, digital tracking, community engagement and behavior-reliance (adhering to the Dubai Plan for a smart sustainable circular economy) whilst effectively tackling many of those challenges.

Moreover, there are a host of few benefits as anticipated below: a sustainable protocol that will reduce carbon emissions through electric vehicles, enhance citizen engagement in recycling actively through digital tracking and incentivisation, improved operational efficiencies through enhanced performance with data driven collection routes, and finally: create more environmental awareness within daily urban living through adopting the technology to reflect behaviour change. It is possible, with incentives and behavioural amendments to the way people think and embody sustainability personally that a shift could take place at the city level. Such change behaviour is essential if we are to approach the environmental sustainability agenda as personal and not merely policy driven.

Even so, the research highlights the need for strong multi-stakeholder collaboration (including government authorities, private innovators, and the public) for effective adoption. Supporting policies must invest in the necessary infrastructure, create significant and permanent economic incentives, and promote conditions conducive to innovation. Continuous engagement with the community, targeted awareness campaigns, and ongoing transparent dialogue and education about potential environmental benefits will also be needed to support long-term, continued community involvement.

Some residual considerations remain, including initial capital investments, the robustness of technology, and achieving a shift in inefficient waste disposal practices. However, the potential long-lasting benefits with respect to a cleaner environment, improved operational efficiencies, and public health heavily outweigh these perceived barriers. With reasonable and adapted planning; scalable and applied integration; and ongoing improvement – the authors conclude that this model is not only usable in Dubai, but in other cities worldwide who wish to transition to a more sustainable, urban lifestyle.

Ultimately this research represents a new chapter in the body of evidence that viable, tech-driven solutions for achieving urban sustainability are possible. Integrating green and urban innovation into smart urbanism would enhance Dubai's global profile as a leader, and provide a direct model for sustainable material resource recovery (waste management) to contribute sustainably to a healthy metropolis for its residents.

<sup>3</sup> The conclusion highlights the study's key outcomes.

<sup>4</sup> It reflects the broader significance of the research.

## LIMITATIONS

Although this study demonstrates some early potential for a mobile application decommissioned with electric vehicles to help rate of recycle and drive proper waste management practices, it should be recognized that there are several limitations:

1. Limitations in data scope - The research was based on secondary data and hypothetical modelling. Therefore, there may be limitations in making judgment about what is entails to bad the proposed solution in Dubai, as complex realities that would be tested in a real-world example may present themselves. Field tests can reveal some unknown logistical, technical, or social issues.
2. Geographical limitations - This findings are particular to Dubai, which has a sophisticated infrastructure, high technology adoption, and government enacted sustainability. Thus, its potential relevance to other cities with less socioeconomic and infrastructural context of Dubai, is limited.
3. Assumptions About Behavior - The model makes the assumption that with incentives, residents will participate in the recycling programs at a high level. People tend to want to do the right thing, but their participation rates might be decreased by often very different cultural beliefs, perceived expectations, convenience options, and the varying levels of intrinsic motivation.
4. Technological and Operational Risks - This proposed recycling system relies heavily on an online platform and an electric vehicle fleet. A loss of data from the platform, interference by programmers, depreciation and operational / maintenance of the electric vehicle fleet, data security, etc. could severely compromise efficiency and trust.
5. Economic Limitations - It is likely that significant upfront investment like government funding will be needed to offer viable options for electric cars, application development, and public engagement for full size implementation and potentially even for to possibility of ongoing administration with electric cars and a mobile app.

These limitations would require additional empirical research, piloting projects, and cost-benefit analysis in order to test the model before eventual overall implementation.

<sup>5</sup> The study had certain constraints that may affect interpretation.

<sup>6</sup> These should be acknowledged when considering results.

## SCOPE FOR FURTHER RESEARCH

The encouraging outcomes of this study provides several opportunities for future research. First, researchers could implement pilot projects in select districts of Dubai to collect operational and behavioral data in the real world, which would also enable more reliable projections of system performance. Additionally, it would provide pilots to test a variety of incentive models to increase user participation such as financial incentives, gamification, and community recognition.

Second, it would be beneficial for researchers to explore the inclusion of emerging technologies such as Artificial Intelligence (AI) for optimized route development and energy reduction; blockchain for tracking

to improve transparency; and smart bins, which permit a more granular real-time tracking of waste produced through the Internet of Things (IoT). Looking at the application of these technologies would bring greater understanding and help ensure accountability and efficiency in systems.

Third, comparative work on tracking recyclables in varied urban and cultural contexts would provide evidence of the model's transferability and quality of fit for cities with different infrastructure, governance models, and citizen types and attitudes toward recycling within community norms.

Lastly, as part of a whole lifecycle and cost-benefit approach to electric vehicle reliance for waste collection and the overall environmental concern within a long-term comprehension of the model, a further understanding of the sustainability of the model would be needed. Furthermore, pursuing these avenues of future research will further the applicability of the recommended model, enhancing its potential contributions to urban contexts and cities to attain circular economy objectives.

<sup>7</sup> Further research can explore aspects not covered here.

<sup>8</sup> Alternative methods may yield deeper insights.

## REFERENCES

1. Sozoniuk, Joseph, and Seongsoo Park. "Investigating Residents' Acceptance of Mobile Apps for Household Recycling: A Case Study of New Jersey." *Sustainability*, vol. 14, no. 15, 2022, p. 9440. MDPI, <https://doi.org/10.3390/su14159440>
2. Dursun, Pınar, and Şebnem Kabadayı. "Roles of Mobile Applications in Removing Barriers to Individual Recycling: Case of Türkiye." *Environmental Research and Technology*, vol. 7, no. 3, 2024, pp. 239–246. Turkish JournalPark Academic, <https://doi.org/10.35208/ert.1376150>
3. Almansoori, H., & El-Baz, S. (2021). *Mobile applications for sustainable waste management in urban UAE. Journal of Environmental Innovation*.
4. Tan, C., Wong, J., & Lim, R. (2022). *Technology-driven recycling behaviour: The role of convenience and reminders. Environmental Technology and Society*.
5. Veolia Middle East. (2023). *RECAP annual sustainability report*.
6. Jin, Y., Park, S., & Lee, M. (2021). *Gamification for environmental engagement in smart cities. Journal of Sustainable Systems*.
7. Hassan, F., & Abbas, R. (2023). *Gamified environmental apps and youth engagement: A cross-sectional study. Sustainability Reports*, 15(4).
8. Kumar, P., & Singh, V. (2022). *Digital feedback systems and recycling motivation in urban communities. Waste Management Review*.
9. Chen, L., et al. (2020). *Long-term behavioural change through eco-apps. Environmental Psychology Review*.
10. Al-Ghamdi, S. (2022). *Adoption barriers of sustainability apps in the GCC. Smart Environment Journal*.
11. Zhao, Y., et al. (2021). *Privacy concerns in environmental mobile applications. Journal of Information Ethics*.
12. Ogunseitan, O. (2023). *The psychology of sustainable technology use. Global Sustainability Review*.
13. El-Gamal, N., & Youssef, A. (2023). *Smart city strategies and sustainable development in the UAE. Journal of Urban Policy Studies*.

14. De Wildt, Kelly K., and Marijn H. C. Meijers. “Time Spent on Separating Waste Is Never Wasted: Fostering People’s Recycling Behavior Through the Use of a Mobile Application.” *Computers in Human Behavior*, vol. 139, Oct. 2022, p. 107541, doi:10.1016/j.chb.2022.107541.
15. Peña, David, et al. “Sustainable Waste Collection Optimization Using Electric Vehicles.” *Sustainable Cities and Society*, vol. 105, Mar. 2024, p. 105343. <https://doi.org/10.1016/j.scs.2024.105343>.



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