TOWARDS ZERO:

RETHINKING RECYCLING IN SAUDI ARABIA AND THE UAE

Written by: The Economist INTELLIGENCE UNIT

DURACELL®

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About this research

Towards zero: Rethinking recycling in Saudi Arabia and the UAE, a report written by The Economist Intelligence Unit, examines the state of waste management in Saudi Arabia and the UAE and identifies priorities for accelerating recycling. There are several recycling projects underway in the region, but more focused efforts on priority streams—food waste, construction and demolition waste and e-waste—can improve landfill diversion rates. Public engagement to encourage source separation can have a positive impact on recycling efficiency, making recycling a more commercially viable endeavour for potential investors.

This report combines extensive desk research and insights from expert interviews. We conducted in-depth interviews with executives at municipalities and waste management companies as well as international waste management experts. The interviews were conducted in July 2020.

Our sincerest thanks go to the following participants (listed alphabetically) for their time and insights:

- **Khaled Al Huraimel,** group CEO, Bee'ah
- **Spiros Fafoutis,** director operations and compliance, National Environmental Recycling Co, Riyadh
- **Arne Ragossnig,** transition board member, International Solid Waste Association
- **Malek Sukkar,** CEO, Averda
- **Abdul Al Katheeri,** acting director of projects and facilities department, Centre of Waste Management Abu Dhabi—Tadweer

Foreword by Duracell

"Reduce, reuse, recycle" is a familiar phrase to many around the world promoting environmental sustainability in our lives and our community. Now more than ever we need to take it to heart, especially here in the Middle East. At Duracell, we aim to be more than a company producing batteries. In 2016, as a new Berkshire Hathaway company, we made sustainability an integral part of our DNA. Our products are powering an ever-increasing portion of modern life and the economy in powering many electrical devices from remote controls to drones.

Reducing waste by choosing efficient technologies is a fundamental message delivered through our sustainability programmes. We believe that environmental sustainability starts first and foremost with product design, that is, with batteries that perform well and last long. The formula is simple: Highly efficient technologies create far less waste. That's why we've chosen to use alkaline batteries over zinc-carbon cell ones, as research shows that these batteries can last three to five times longer in devices with a low- to mid-power demand.

However, we know that even the longest-lasting batteries cannot last forever and will have to be replaced. An "empty" battery still is "full" of valuable raw materials which should not go to waste. That's why we believe that our responsibility as a battery producer extends beyond just producing cells but also finding the right solutions to collect and recycle them.

This is why we support company and consumer education through Duracell sustainability initiatives. We are proud to be leading in the Middle East in the promotion of battery collection programmes and working to install a collection infrastructure to make recycling easy and economically viable. In the UAE we have partnered with Bee'ah to raise awareness of battery recycling in schools and retail outlets. We have partnered with the Dubai Multi Commodities Centre Free Zone (DMCC), where Duracell is headquartered in the Middle East, to install battery collection drops to make recycling simple and easy for all who live and work there.

Through partnerships with governments, retailers, schools and consumers we hope to influence and educate people to encourage collaboration and to hold each other accountable to achieve sustainability. Our ambition is to enable a circular battery economy that takes your recycled batteries and turns them into new ones. Until technology advances and becomes economically viable, our goal is to recycle and reuse the battery components in other industries or even our gardens as fertilizer! Yes, some of the components of our alkaline batteries can be turned into micronutrient fertilizer. We also support eye-opening research such as the vital briefing you are about to read because we need our governments and consumer partners to join us in our effort to promote environmental sustainability in our region. Our role is to take responsibility for our products both by developing technologically advanced batteries that last longer and are more efficient and by making it easy and obvious for consumers to recycle empty batteries.

The latter requires the contribution from all partners: companies, consumers and governments. Review the research and join us in making our region a more recycle-friendly and sustainable place.

Amer Afifi
General Manager, Middle East & India,
Duracell

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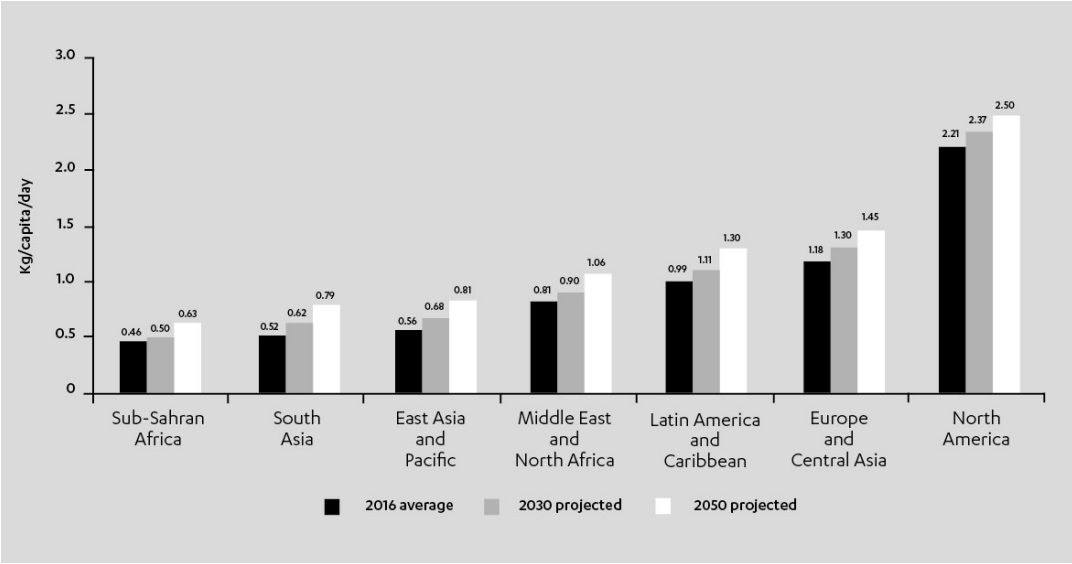
Chapter 01

State of waste

Municipal solid waste (MSW)[1] generated globally is expected to increase from 2bn tonnes in 2016 to 3.4bn tonnes in 2050, fuelled by urbanisation and population growth.[2] In the largest Middle Eastern economies, Saudi Arabia and the United Arab Emirates (UAE), waste generation per person was estimated at 1.4kg and 1.6kg per person per day, respectively, in 2016. This is significantly higher than the average for Middle East and North Africa (0.8kg) but lower than that of North America (2.2kg).

Figure 1: Projected waste generation by region, 2030 and 2050



Source: What A Waste 2.0, World Bank

Figure 2: Key statistics: UAE and Saudi Arabia

Country population:		Saudi Arabia **35m**	UAE **9.5m**
Waste generated annually:		Saudi Arabia **16m tonnes**	UAE **5.4m tonnes**
Waste generated per person per day:		Saudi Arabia **1.4kg**	UAE **1.6kg**
Recycling rates:		Saudi Arabia **10-15%**	UAE **20-30%**
Estimated waste sent to landfills annually:		Saudi Arabia **14m tonnes**	UAE **4m tonnes**

Source: The Economist Intelligence Unit; World Bank

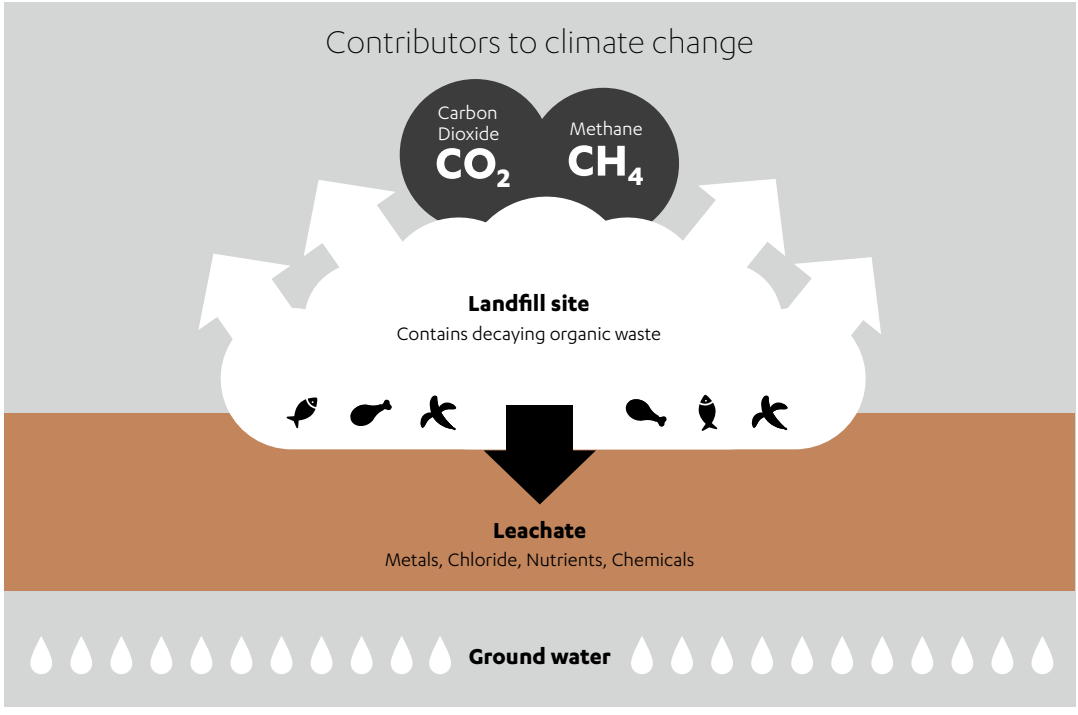
[1] Municipal solid waste is defined as residential, commercial, and institutional waste.
[2] S Kaza, L Yao, P Bhada-Tata et al., "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050", World Bank Group, September 20th 2018. https://openknowledge.worldbank.org/handle/10986/30317

Although globally about one-third of waste generated is mismanaged through open dumping and burning, almost all the waste from homes and offices in the UAE and Saudi Arabia is collected. But of this, only a small share is recycled (about 20-30% in the UAE and 10-15% in Saudi Arabia[3] compared with 61% in Singapore and 35% in the US), with the rest making its way to landfills. The expansion of landfills over the years has led to growing concern about their adverse environmental impact.

There are several problems associated with landfills. If improperly designed they allow many toxic substances to seep into the soil and groundwater which impacts the ecosystem for years.[4] Leachate is formed when water passes through waste, becoming toxic and causing further contamination. "If the waste received in the landfill is high in its organic content, the leachate production will increase accordingly," explains Abdul Al Katheeri, acting director of the projects and facilities department at the Centre of Waste Management Abu Dhabi—Tadweer, the UAE capital's municipality. Landfills also generate large amounts of methane, a greenhouse gas that traps 21 times more heat than carbon dioxide and one that is highly combustible.[5]

"In Saudi Arabia and UAE, methane formation is not much of an issue because of the very warm and especially dry climate," says Arne Ragossnig, transition board member and former managing director at International Solid Waste Association (ISWA) which represents waste management and recycling bodies in 102 countries. "Leaching is an issue if landfills are not designed properly." [6,7]

Figure 3: Adverse environmental impact of landfills



Source: Toronto Environmental Alliance

[3] Salman Zafar, "Solid Waste Management in Saudi Arabia", EcoMENA, February 27th 2020. https://www.ecomena.org/solid-waste-management-in-saudi-arabia/
[4] "The problem with landfill", Environment Victoria, June16th 2013. https://environmentvictoria.org.au/resource/problem-landfill/
[5] Management of Landfill Gas", ISWA, 2007. https://www.iswa.org/index.php?eID=tx_iswaknowledgebase_download&documentUid=128 8
[6] MI Al-Wabel, WS Al Yeha, AS Al-Farraj et al., "Characteristics of landfill leachates and bio-solids of municipal solid waste (MSW) in Riyadh City, Saudi Arabia" Journal of the Saudi Society of Agricultural Sciences, Vol. 10, No. 2, June 2011. https://www.sciencedirect.com/science/article/pii/S1658077X11000312
[7] "Environmental Impact of Landfill on Groundwater, South East of Riyadh, Saudi Arabia", Journal of Natural Sciences Research, Vol. 3, No. 15, 2013. https://www.iiste.org/Journals/index.php/JNSR/article/download/9724/9937. Yen Nee Lee,"The world is scrambling now that China is refusing to be a trash dumping ground", CNBC, April 16th 2018. https://www.cnbc.com/2018/04/16/climate-change-china-bans-import-of-foreign-waste-to-stop-pollution.html

Amid global conversations about building sustainable and "circular" economies, there is mounting pressure on government leaders to address issues around waste management. This is compounded by fewer opportunities to export waste as countries such as China closed its doors to waste imports.[8] In Saudi Arabia and the UAE, that means efforts to recycle waste and create a circular economy must be accelerated.

The region does not lack intent. "At a public sector level, there is a huge recognition of the problem and the need to change it," explains Khaled Al Huraimel, group chief executive officer at Bee'ah, a waste management company formed as a public-private partnership with the government of Sharjah, an emirate of the UAE. The UAE aims to divert 75% of its MSW from landfills by 2021, although Sharjah is aiming for 100% diversion in the next few years.[9] In Saudi's capital, Riyadh, the municipality aims to recycle over 80% of its MSW.[10]

But recycling is an expensive and complex affair. "In the end, recycling costs money," says Malek Sukkar, CEO of Averda, a global waste management company working with municipalities in Dubai, Abu Dhabi, Riyadh, Jeddah and, most recently, The Red Sea Development Project. "And at the moment there is very little regulation that requires waste to be dealt with except in the most economical way, which is just to collect and put it in a landfill." Regulation can be bought "off the shelf", he says, but there are deeper issues around the commercial viability and implementation of recycling that need to be resolved.

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[8] "Yen Nee Lee,"The world is scrambling now that China is refusing to be a trash dumping ground", CNBC, April 16th 2018. https://www.cnbc.com/2018/04/16/climate-change-china-bans-import-of-foreign-waste-to-stop-pollution.html

[9] "UAE's ambitious waste diversion goals", Gulf Today, July 11th 2019. https://www.gulftoday.ae/business/2019/07/11/uaes-ambitious-waste-diversion-goals

[10] "https://global-recycling.info/archives/3215"

02

Chapter 02

Towards a circular economy

In response to ambitious targets, municipalities and waste management companies have launched numerous initiatives across the waste management spectrum. They are implementing bins equipped with sensors and tracking vehicles carrying different types of waste to optimise routes and collection. Waste management facilities are being retrofit with advanced technologies to enable more effective sorting. Importantly, many of these facilities are progressing the development of a circular economy as waste from one industry can now serve as raw material for another.

Bee'ah's material recovery facility sorts household waste into bales of plastic, cardboard and aluminium, among others, for further processing. Plastic bottles, for instance, are processed into pellets, a raw material for t-shirts and shoes. Through anaerobic digestion, food waste is converted into fertiliser for urban farms and landscaping. Their tyre recycling facility produces rubber crumbs used to manufacture rubber tiles for jogging tracks, playgrounds and gyms. Their car recycling facility produces scrap metal which is exported or used in the construction sector. All such recycled products are certified by the Emirates Authority for Standardisation and Metrology to ensure they are of desired quality.

In Abu Dhabi, Tadweer leads similar projects: a crusher to recycle construction and demolition waste into aggregate for the construction sector; a facility to recycle organic waste and animal manure into compost; and a tyre recycling facility to produce floor tiling for playgrounds.

These examples show that the recycling processes for traditional waste streams—including metals, paper and glass—are well-understood and developed. Meanwhile, plastic recycling is still at a nascent stage as waste management experts are still deepening their knowledge of polymers and additives. "Economically, aluminium, steel, certain plastics like polyethylene terephthalate, cardboard and paper are profitable to recycle," explains Mr Sukkar of Averda. "Laminates (used in juice box lining for example) are notoriously difficult to recycle because you have to deconstruct and reconstruct them." This echoes the common criticism that recycled plastic is uncompetitive in terms of price compared with virgin plastic, especially at low oil prices. The approach to recycling in the region therefore needs to be far more nuanced.

> **"With new technologies arising in the market and more awareness of waste as a valuable source for production, the recycling opportunity can be expanded"**
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> Abdul Al Katheeri, acting director of projects and facilities department, Centre of Waste Management Abu Dhabi—Tadweer

Dedicated recycling facilities are emerging. In 2019, an e-waste recycling facility, The Recycling Hub, opened in Dubai Industrial Park to process electronic equipment, IT assets and other specialised waste.[11] The first initiative under the Integrated Waste Management and Recycling Plan for Riyadh—led by the National Waste Management Centre, the Riyadh Municipality and the Saudi Investment Recycling Company—will be the recycling of construction and demolition waste. "With new technologies arising in the market and more awareness of waste as a valuable source for production, the recycling opportunity can be expanded," says Tadweer's Mr Al Katheeri.

Despite these efforts, recycling in the region is still at an early stage. The high capital investment combined with concerns over efficiency and profitability and an undefined market for recycled materials have deterred investors so far. A key issue is the wide gap between the cost of recycled and virgin materials. Recycled materials are often impure, making them unsuitable for reuse without affecting the safety and performance of the end-product. To address these concerns, a holistic strategy for waste management and recycling is required. This starts at the source.

[11] "World's largest e-waste recycling facility opens in Dubai", Gulf News, March 24th 2019. https://gulfnews.com/uae/worlds-largest-e-waste-recycling-facility-opens-in-dubai-1.62884040

The carrot, not the stick: Source separation

As sophisticated as sorting facilities may be today, they cannot replace source separation. "It's not an exact science, but in general the more you segregate at source [so that items are not contaminated] the more efficient the whole recovery process becomes," says Mr Al Huraimel of Bee'ah. Mr Sukkar concurs: "If you can just separate food waste from everything else, 90% of recycling issues go away."

Separation at source is almost non-existent in the UAE and Saudi Arabia. One reason is the lack of infrastructure—efforts to separate waste at home go in vain when these are dumped together in waste bins or during collection. In the absence of recycling collection from home, trips to remote recycling centres to deliver cardboard boxes and plastic bottles are inconvenient.

Beyond this, there is a deeper issue around culture in the region. Close to 85% of the population in the UAE and about a third in Saudi Arabia are expatriates. Some experts suggest that the transient nature of expatriates in the region translates into limited commitment to the long-term environmental sustainability of the country. "You don't wash a rented car," says one waste management expert.

In the UAE, municipalities in Abu Dhabi, Dubai and Sharjah have launched educational programmes to deepen public engagement and instil a greater sense of responsibility. "The aim is to make environmental education part of the curriculum rather than extracurricular," says Mr Al Huraimel. Ultimately, greater awareness is expected to shift consumer demand towards more environmentally friendly products.

To address issues around infrastructure and convenience, Bee'ah has placed "reverse vending machines" across the UAE. These collect plastic bottles and aluminium cans and are linked to an app so people can earn points and generate rewards over time. But strategies adopted in other countries go further.

In Singapore, waste management firm Sembcorp has launched a mobile app which makes it easier for individuals to have their recyclable waste collected from their homes at no cost. In fact, users get paid for the waste collected. The app is linked to a website with information on recycling and its impact to increase awareness.[12] In South Korea, the government mandates food waste disposal in special biodegradable bags, allowing for effective separation at source. In this pay-as-you-throw scheme, residents' municipality fees are calculated based on the weight of waste disposed in automated bins—encouraging them to reduce total weight by reducing moisture in food waste.[13]

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> CEO, Averda

Some expert interviewees argue for increasing the cost to the consumer—either in terms of a tax on unsustainable products or an increase in municipal fees. This could not only help to alter consumer and industry behaviour but also raise funds for recycling programmes.

Government leaders in the UAE and Saudi Arabia have been more inclined to incentivise positive behaviour than penalise the negative. Research from developed countries shows that using multiple approaches, including recycling incentives and a pay-as-you-throw scheme, yields positive results.[14] Evidence from Finland and Nigeria also supports financial incentives to encourage recycling.[15,16] Regardless of the approach, resident involvement is paramount, says Mr Ragossnig. "If you don't involve them, the system will never evolve."

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[12] Robin Hicks, "Singapore's new waste app provides free door collection service to bypass contaminated recycling bins", Eco-Business, November 10th 2019. https://www.eco-business.com/news/singapores-new-waste-app-provides-free-door-collection-service-to-bypass-contaminated-recycling-bins/

[13] Douglas Broom, "South Korea once recycled 2% of its food waste. Now it recycles 95%", World Economic Forum, April 12th 2019. https://www.weforum.org/agenda/2019/04/south-korea-recycling-food-waste/

[14] M Dri, P Canfora, IS Antonopoulos et al., "Best Environmental Management Practice for the Waste Management Sector", Publications Office of the European Union, May 2018. https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/best-environmental-management-practice-waste-management-sector

[15] Beatrice Abila and Jussi Kantola, "The Perceived Role of Financial Incentives in Promoting Waste Recycling—Empirical Evidence from Finland", Recycling, January 10th 2019. https://www.mdpi.com/2313-4321/4/1/4

[16] Beatrice Abila, "Households' Perception of Financial Incentives in Endorsing Sustainable Waste Recycling in Nigeria", Recycling, June 13th 2018. https://www.mdpi.com/2313-4321/3/2/28

Engaging the entire value chain

Beyond public engagement, there is a role to play for producers, traders and retailers too. "There has to be a grassroots movement," says Mr Sukkar. "There has to be consumer desire, but also regulatory levers such as extended producer requirements." Extended producer responsibility (EPR) is a policy which gives manufacturers of consumer goods significant financial and/or physical responsibility for collecting and recycling their products after use, encouraging separation at source.[17] According to Ocean Conservancy, EPR presents the biggest opportunity to improve funding for waste collection.[18] Brands such as Coca-Cola and Unilever have invested in funds supporting waste management projects in South-east Asia, for instance.[19]

Moreover, EPR forces brands to rethink product design to facilitate reuse and thus reduce the cost of waste collection. France requires manufacturers to design products that are easier to fix, have information on spare parts on labels and allow consumers to avail of free repair or replacement for two years.[20] "The more we discover how difficult it is to recycle the materials we are currently using, the quicker we will move to innovate away from them," says Mr Sukkar. He recommends that every product should have a "dismantling manual" which encourages producers to consider end-of-life issues with their product and post-recycling market needs.

The "unrecyclables": Waste to energy

"You cannot recycle everything," says Mr Ragossnig. "After sorting, there still remains waste which is not [economically or environmentally] feasible to recycle." To avoid diversion to landfills, municipalities in the region are turning to waste-to-energy facilities. Through this process waste is incinerated and its volume reduced by 90%.[21] The heat from incineration is then used to generate electricity.

The region's first waste-to-energy facility, a partnership between Bee'ah and Abu Dhabi-based Masdar (a government-owned renewable energy company), is expected to be completed in 2021. Built to process more than 300,000 tonnes of waste annually, it has a capacity of 30MW—enough to power 28,000 homes.

A critical component of this process is to ensure that it does not release harmful gases into the atmosphere. "A third of the overall cost of our waste-to-energy facility goes into filtering those emissions to purify them and ensure they are not released," explains Mr Al Huraimel. Smarter planning and engineering can minimise the release of harmful gases.

> **"You cannot recycle everything. After sorting, there still remains waste which is not [economically or environmentally] feasible to recycle."**
>
> Arne Ragossnig, transition board member and former managing director, International Solid Waste Association

[17] "Plastics Policy Playbook: Strategies for a Plastic-Free Ocean", Ocean Conservancy, October 17th 2019. https://act.oceanconservancy.org/wp-content/uploads/2019/10/Plastics-Policy-Playbook-10.17.19.pdf
[18] "Plastics Policy Playbook: Strategies for a Plastic-Free Ocean", Ocean Conservancy, October 17th 2019. https://act.oceanconservancy.org/wp-content/uploads/2019/10/Plastics-Policy-Playbook-10.17.19.pdf
[19] https://www.circulatecapital.com/
[20] "Circular Economy in Cities: Evolving the model for a sustainable urban future", World Economic Forum, 2018. http://www3.weforum.org/docs/White_paper_Circular_Economy_in_Cities_report_2018.pdf
[21] "Waste Management Overview", Singapore National Environment Agency, 2020. https://www.nea.gov.sg/our-services/waste-management/overview

Conclusion

Every year the UAE and Saudi Arabia are sending an estimated 4m and 14m tonnes of waste to landfills respectively. The environmental challenges landfills pose—from soil contamination to greenhouse gas emissions—are a growing concern amid global discussions about sustainable economies. Ambitious city-level and national targets are indicative of the intent to act. But waste management experts warn against cutting corners for quick wins; rather, they emphasise developing a long-term, holistic strategy to waste management.

Figure 4: Holistic approach to waste management

To accelerate recycling in the UAE and Saudi Arabia, governments must focus on prioritising waste streams. Priority streams for the region include food waste, construction and demolition waste and e-waste, according to Bee'ah's chief executive officer Mr Al Huraimel. Recycling of traditional waste streams—including paper, glass and aluminium—have well-developed business models that waste management companies can adopt.

Greater integration of advanced technologies across the value chain—including automated bins, AI-driven sorting and blockchain-based certification of recycled products—can enable data-driven waste management and potentially increase efficiency.

But a critical contributor to recycling efficiency, and thus profitability, is source separation. For this, public participation is paramount. Waste management companies recommend separating organic or food waste as a starting point. Countries around the world, from South Korea to the US, have successfully implemented strategies on this front. Offering incentives for separation of recyclable materials and delivery to centres can take this a step further.

More broadly, products must also be designed with recycling in mind. Reducing the use of mixed materials in products or packaging can make extraction and recycling of materials more efficient. However, recycling is only one component of a circular economy. To close the loop, there must be a market for recycled materials. Strengthening quality assessment and certification can increase trust and ultimately the value of these products, making the sector more lucrative for potential investors. In parallel, policies to encourage product redesign for reuse and increased efficiency must be introduced. Combined, these will reduce the long-term burden of waste and propel the region closer to a zero-waste future.