



THE IMPENDING EVOLUTION OF THE WASTE MANAGEMENT INDUSTRY

Global waste volumes are on the rise. We see images of garbage floating hundreds of miles into the Oceans, as well as plastic bottles and wrappers piling up on the highest mountain peaks. While human beings build more, consume more, and explore more, we will continue to leave behind traces of our presence. And it is this that is pushing global policy changes.

Nearer home, bins are filling up faster, and with inadequate segregation, waste is becoming increasingly hard to recycle. This increasing quantity of waste is posing significant operational challenges for waste management companies.

Adapting to changing patterns of consumption and newer kinds of waste generation requires environmental services providers to evolve their approaches, processes, and tools.

The path towards intelligent and efficient waste management comprises of three broad steps:

- I. Understanding the challenges of a changing world
- II. Identifying the pillars of evolution
- III. Evolving into a Live Enterprise that is always prepared for change

The end goal: To be a resilient enterprise that is constantly sensing the pulse of its environment, responding with agility, and continually learning.

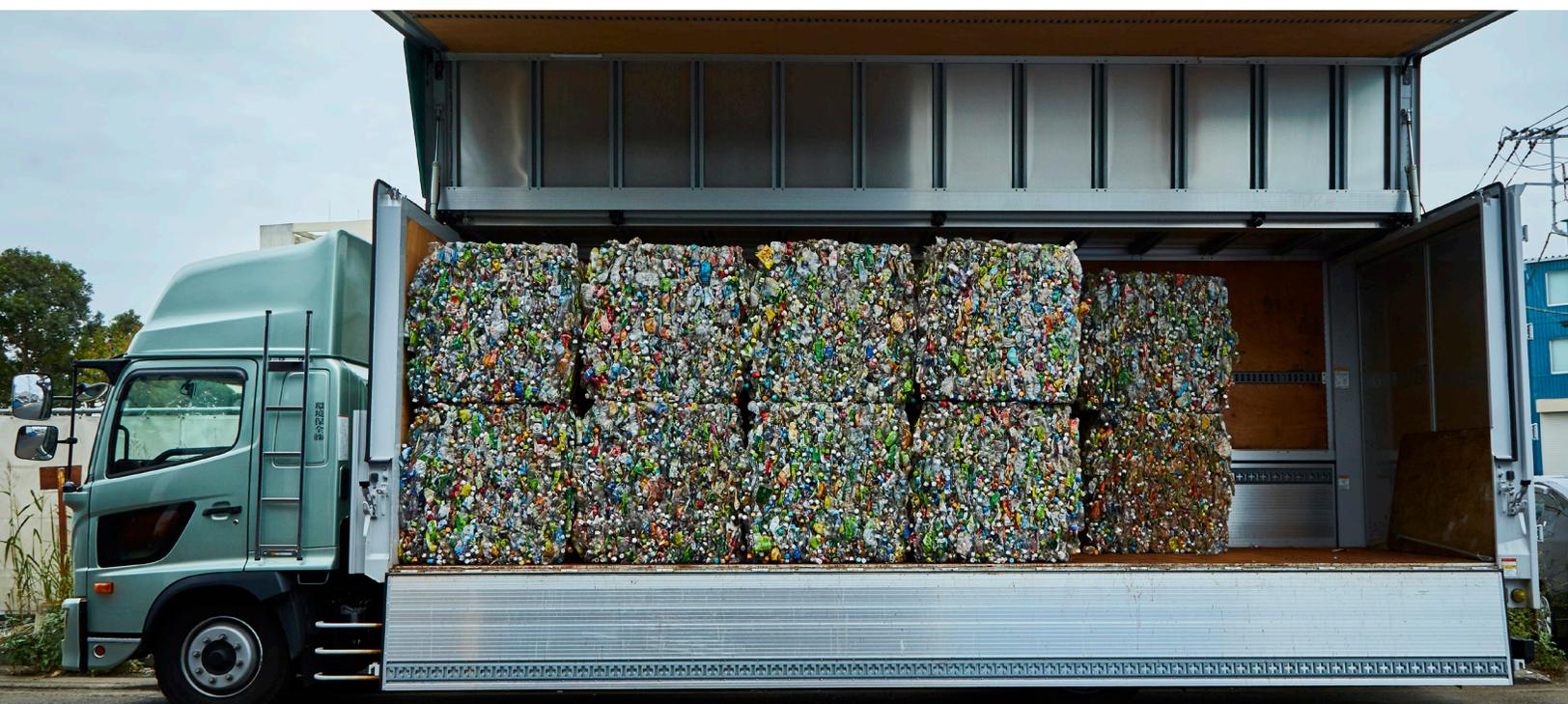
The Challenges of a Changing World

To truly understand the scale of the impending transformation awaiting the Waste Management industry, we need to look at the changing tides engulfing the industry at every point in the value chain. From collection and transportation, to recycling and landfills, every part of the waste management ecosystem can be disrupted if it cannot constantly adapt and consistently deliver.

Waste volumes are growing

A World Bank report found that 2.01 billion tons of waste is generated globally, every year. And forecasts suggest that this figure could grow to 3.04 billion tons by 2050. This signals that collection services will come under enormous pressure to collect and transport massive amounts of waste on time. Recycling services will see their sorting and segregation facilities

overwhelmed. While storage services might have to direct even more waste to landfills. Apart from finding ways to reduce waste generation, another feasible solution is to leverage the circular economy, extract more value from waste and reduce the waste that is sent to a landfill.



Operational costs are rising

The volume problem is compounded by increasing global labor costs -- especially in developed nations like the USA. While it is hard to ignore the mounting costs of collecting, sorting, and processing recyclables or those of running and maintaining a fleet of collection vehicles, waste management companies are also grappling with various hidden costs. Landfill operation costs that include cleaning up surface and groundwater, monitoring landfills, and long-term maintenance are classic examples. With barriers to raising the rate of waste collection at the municipal level, increasing revenues to meet increasing costs is not an option. The only solution: look inwards to improve efficiencies.

Global sustainability goals are set

Even if environmental services companies could increase rates, rising climate concerns have brought a whole new level of scrutiny into how they operate. As governments sprint to meet emission reduction targets set by the Paris Agreement, every industry, including the waste management industry is becoming mindful of its carbon footprint and environmental impact. That means monitoring, managing, and reducing emissions from the fleet to landfills, and everything in between.

The rulebook is only expanding

Ever-changing government rules and regulations pose strictures to how waste management companies operate. With many levels of environmental and financial regulations, operational compliance, and specific policies for handling different types of waste, complying with regulations and responding to changes with agility can be a competitive advantage. One that ensures smooth operations and keeps in check the costs of staying compliant.

The COVID-19 pandemic drove a significant increase in waste generation as people worked and often fell ill at home. Improper handling and treatment of this waste can put countless lives at risk -- from waste management workers, to the community at large.



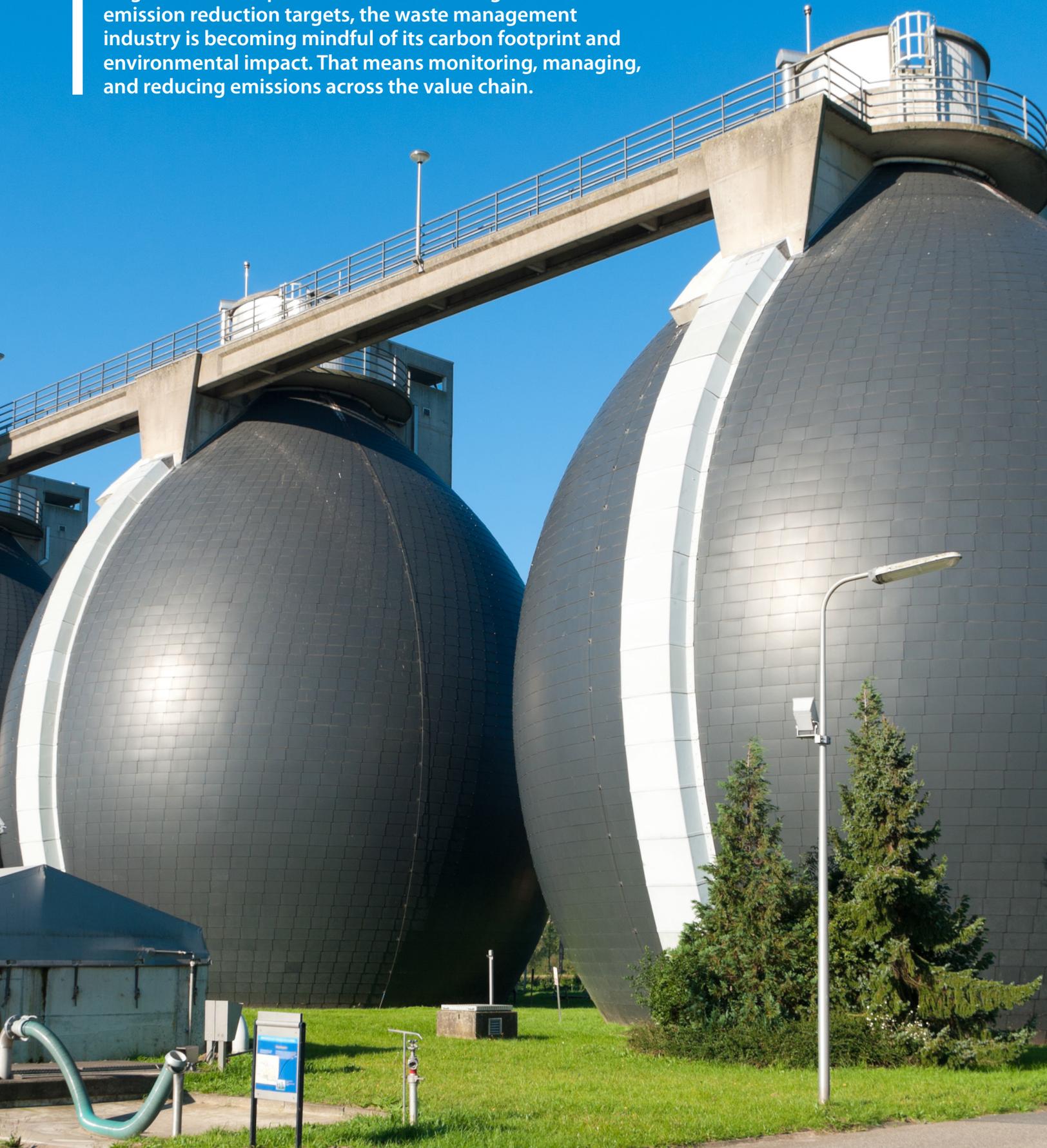
The pandemic is a new dimension

The COVID-19 pandemic drove up waste generation as people worked and often recuperated from illness right in their home. Waste management being an essential service needed to continue unhindered. Improper handling and treatment of this waste by collection workers can put countless lives at risk. While the US EPA quickly released a temporary policy regarding proper labelling for safe disposal. Establishing robust processes and mechanisms to ensure that safety precautions are followed can reduce the spread of disease in general and not just the COVID-19 virus, while also ensuring proper disposal of all waste.

Developing countries are stopping the import of trash

For decades, half the world shipped its waste for segregation and recycling to developing countries. Many of them have either stopped the import of trash or are implementing legislation curbing these imports. This has upped the pressure on governments and waste management companies to figure out how they can manage, recycle, and dispose of the waste within their national borders. This is especially challenging in the US and Europe, where handling waste locally can be expensive and operationally challenging. The result: more waste than ever is getting tossed into landfills. The most viable solution is to optimize operations and make processes efficient, thus bringing down overall costs.

As governments sprint to meet the Paris Agreement's emission reduction targets, the waste management industry is becoming mindful of its carbon footprint and environmental impact. That means monitoring, managing, and reducing emissions across the value chain.





Managing waste is now the last step in a series of measures that waste management companies need to take to be more sustainable and responsible. The first step is to reduce the amount of waste that ends up in landfills.

Identifying the Pillars of Evolution

Given the sheer breadth of challenges facing the waste management industry, transformation -- both horizontal and vertical -- is critical.

Sustainability, efficiency, and technology are the pillars upon which waste management enterprises will build their competitive future. Evolving across these three dimensions entails transforming processes and practices both on and

off the field. The result of holistic and successful modernization for waste management companies is that they don't just survive but thrive.

Here's how waste management companies can navigate this new world.

1 Sustainability: Settle into the circular economy

Managing waste is now the last step in a series of measures that waste management companies need to take to be more sustainable and responsible. The first step is to reduce the amount of waste that ends up in landfills. And that means adopting principles of the circular economy - reduce, reuse, and recycle - as much waste as possible.

Environmental services providers can be innovative with how they reprocess waste materials. With the right technology and

processes, they can enhance segregation right at source. One example is an Australian company that upcycles soft plastics and discarded printer cartridges by extracting certain materials and mixing them with recycled glass and asphalt, to produce high quality road surfaces that last 65% longer. In another example, a Canadian waste management firm has developed technology to extract carbon from non-recyclables and non-compostable trash and use it to make biofuels and chemicals used in everyday products.

The waste that invariably goes to landfills is used by companies to produce biogas and energy. A great example is the Lancaster County Solid Waste Management Authority in Pennsylvania, which has been generating electricity from garbage for three decades! The process also converts waste to ash, which takes up 90% lesser space in landfills. Whether it's Energy-as-a-Service capabilities or innovative processing and upcycling of waste, technology can help companies become more sustainable, while creating new revenue streams and squeezing more value from waste.

2 | Efficiency: Modernize how you operate off the field

Although waste management companies are investing in new-age technologies on the field, they need to equip teams and streamline processes to derive maximum value from these investments. That calls for modernizing systems, tech stacks and infrastructure, and becoming more agile and responsive to build and adapt faster. Moving to cloud is now an imperative for waste management companies looking to leverage next-gen cloud platforms, edge computing, DevOps, and real-time optimization.

Automating processes, gathering data, and establishing strong analytics pipelines all translate to savings and efficiency gains. The result for people is the ability to focus more on decision-making rather than manual, repetitive tasks – like optimizing core business functions by implementing innovative solutions. Another effect of automation is significantly improved compliance reporting as well as faster and cheaper customer service.

But no modernization checklist is complete without core changes to tech stacks and their underlying infrastructure. Today, tech stacks need to be able to integrate with multiple platforms for organizations to truly unlock new levels of efficiency and quickly deliver on changing requirements and demands. Assessing existing systems for digital maturity and taking stock of business goals can help companies adopt the right modernization frameworks, reducing project costs and timelines and de-risking modernization efforts while ensuring business continuity.

3 | Technology: Upgrade the tools you use on the field

To save costs, increase efficiencies and stay ahead in an extremely competitive market, waste management companies are adopting modern equipment and processes on the field. This is especially true for first mile services where inefficiencies can quickly pile up. A stop at an empty bin can seem innocuous within a block but can translate to huge losses at scale.

Sensors, connected devices, and data can save waste management companies millions of dollars by reducing unnecessary collection stops; optimizing routes in real time for maximum fuel and time efficiency; and helping them monitor segregation at hyper-local levels. Automation can also optimize tasks and make field service more efficient. And companies can leverage geo-location and field service management platforms to assign tasks to agents based on skills, proximity, priority and more. The result: increased success rates and productivity.

Further along the value chain, technology can also improve the speed and accuracy of segregation, allowing companies to extract more higher quality recyclables, every hour. With landfills, organizations struggle on multiple fronts -- surveying them can be hazardous for humans and monitoring their emissions is riddled with complexities. However, technologies like drones, satellite imagery and AI-powered image recognition can unlock unprecedented levels of accuracy and efficiency.





The Rise of The Live Enterprise

Sentient, cognitive, responsive – that is what any enterprise in a constantly shifting environment that demands rapid adaptability, needs to become. For waste management enterprises, this evolution is what enables them to stay compliant with government regulations and relevant to the times.

Waste management is no more just an industry created by human society. It is a responsibility that enterprises can expect

to carry out on the path to a greener, more sustainable future. As such, live enterprises that can deliver on these expectations by leveraging the powers of IT-OT, data, AI, and next-gen technologies like AR/VR, will find themselves naturally fitting into this new world. And equipped with not just the right tools, but the right mindset, they will also find it easier to navigate the way ahead.

In the next part, we'll look at the genome that constitutes a Live Enterprise and enables it to evolve and become sentient.

[The Next-Gen 'Live' Waste Management Enterprise]

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