

THE FUTURE OF THE WASTE MANAGEMENT SECTOR

TRENDS, OPPORTUNITIES AND CHALLENGES FOR THE DECADE

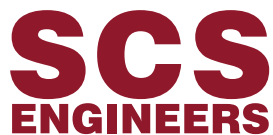
[2021-2030]



iSWA

International Solid Waste Association

WITH SUPPORT OF



ABOUT ISWA

The International Solid Waste Association is a global, independent and non-profit making association, working in the public interest to promote and develop sustainable waste and resource management, and a transition to a circular economy. ISWA membership is open to individuals and organisations from the scientific community, public institutions and public and private companies from all over the world working in the

field or interested in waste management. As the only worldwide waste association with members in over 110 countries, ISWA allows you to network with professionals, companies and institutional representatives on a global scale. ISWA's unique mix of members spans the whole waste sector for the promotion and development of sustainable waste management across the world.

ISWA.ORG



FOREWORD



This decade will present a unique opportunity to make positive changes to drive towards the future we want. If we do not, the world will reach the point of no return in terms of global warming, pollution and degradation of natural resources.

ISWA has an important role to play, as THE international association working towards adequate waste and resources management; to support the transition to a circular economy and to ensure the waste sector as a net reducer of green house gas emissions.

The Association is the Hub for information, innovative researchs, knowledge exchange, and integration of different stakeholders, from the private and public sectors, academia, financing institutions and NGOs, who are all aiming at delivering this relevant mission to ensure better quality of life in different parts of the world, by combining efforts, both on an global, regional and local levels.

In order to deliver its mission, it's important to know - and anticipate - trends, challenges and opportunities in the coming years, considering the variables that will influence waste generation and its management systems, new social behaviors, production and



consumption patterns and global interactions in terms of communication, development, population growth, commerce and demands.

There are issues to be resolved to ensure everyone has access to adequate waste management systems (improve waste collection and adequate destination for all is a basic and urgent improvement). This is a fast developing industry, using new technologies, automated systems and advanced solutions, showing it's possible to improve the current situation.

We present this publication as a contribution based on the scientific and technical experience from ISWA Working Groups and other major groups, who have the best knowledge required to assess the situation, analyze the emerging problems and anticipate the required steps towards the development of this sector and the potential to move to ensure that current challenges will be transformed into opportunities.

At ISWA, we are ready to move forward into the new decade, and would like to contribute to a better and enjoyable future on our planet, in which everybody has the right to enjoy a clean and healthy environment.



Carlos Silva Filho

President of ISWA



Björn Appelqvist

Chair of ISWA STC



BRIEF INTRODUCTION AND VIEWS FOR THE DECADE

Waste is the by-product of daily human activities. It is expected that **municipal solid waste generation will increase all over the world under a business-as-usual scenario, from around 2 billion tonnes/year generated in 2016 to 3.4 Billion tonnes in 2050¹.**

According to those estimates, **most of this increase will be seen in low-income countries**, where waste generation is expected to triple.

However, the world is still lacking of an equitable waste management system and **sound waste management is a global human right**. According to Article 3 of the Universal Declaration of Human Rights, "everyone has the right to life" and Article 25 states that **"everyone has the right to a standard of living adequate for the health and well-being of himself and of his family"**.

Inadequate waste management poses a direct threat to the environment, to biodiversity and to human health, both at local and global levels, affecting billions of people around the world.

In order to deal with increasing amounts of wastes and tackle most of the negative impacts, there is an urgent need to follow the order of actions established by the waste hierarchy and, as an immediate step, enable adequate waste destination systems as the prevailing practices.

Moving up on the hierarchy, **waste prevention, minimization, re-use, shared economy and "cascades" are the focus of research, communication, publications, and policy development.**

Besides supporting the transition towards circular and low carbon economies, climate change is also on the agenda, not only for the waste sector, but as a priority issue for all sectors and businesses.

Considering current developments, **it is likely that waste management will become an in-depth data-driven industry and a central pillar for the future economic role-model, based mostly in the circularity and the recovery of goods, materials, chemicals and energy.**

¹ Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

In low-and-middle income countries, it is expected that waste management will move from an outdated and informally organized sector taking care of a few valuable materials while the rest is disposed, dumped and burned, to a formally organized sector where materials are all managed with up-to-date technologies.

In brief, we will see a drastic increase of municipal waste generation all over the world which will need a drastic increase of collection and treatment capacities combined with useful applications for the

recovered materials. These developments will need a significant increase of financing which, in parallel, will need measures to ensure that the collected funds are really used for the collected purpose, with strong governance, and transparency measures.

Models for financing waste management operations deserve full attention. The guiding principles behind such models shall be the duty of preventing pollution, the life-cycle concept, the polluter-pays principle, and the adequate internalization of costs. Again, there will be a great need for exchange of experience and for cooperation to avoid too many shortfalls and failures.

THE (POTENTIAL) CONTRIBUTION OF THE WASTE MANAGEMENT SECTOR TO THE FUTURE OF OUR WORLD

- Protecting human health and improving livability
- Protecting nature and ecosystems
- Providing secondary raw materials, nutrients and soil quality improving materials
- Producing green and renewable energy and fuels
- Mitigating climate change
- Contributing to economic development by generating jobs and wealth to cities and regions



CURRENT CHALLENGES

- Low collection coverage
- Lack of safe and proper destination to all the waste generated
- Pollution caused by inadequate practices (dumpsites, open burning, littering etc)
- Low demand for secondary raw materials
- Harmful / Hazardous substances in material's composition
- Lack of funding / minimum required resources



FOCAL POINTS FOR THE DECADE





PROTECTING HEALTH AND THE ENVIRONMENT

Protection of human health and the environment is the original rationale of waste management and naturally, it still maintains a fundamental place in any waste management system.

After all, adequate living conditions ensuring one's health is a fundamental human right. To help improving public health, a waste management system has to deliver two major functions: the removal of waste from human dwellings and the provision of an adequate destination to all substances and materials thrown out by the society.

Therefore, providing full-coverage and well-functioning waste collection and treatment services is essential. There is still significant progress to be made, especially in low income and lower-middle income countries. Moving away from open burning and dumping of waste towards a treatment infrastructure with engineered landfills and well-functioning biological and thermal treatment facilities is key.

Poorly managed waste has an enormous impact on health, local and global environment, causing harm to terrestrial and aquatic ecosystems, losses in biodiversity and water supplies and to the economy. There are well proven technological tools to solve the problems, however in some areas these are not implemented. In addition to those means, moving up the waste hierarchy to recycling, reuse and reduction even further provides environmental protection, since such initiatives reduces the need for virgin material extraction, which has a large environmental footprint. However, lack of financing and robust governance systems are the main barriers to overcome.

Waste is still considered a burden for many, **but the waste and resources management sector, on the other hand, is a part of the solution, not the problem.**

KEY MESSAGES

- a. Focus on providing efficient and environmentally sound waste management to all, including collection and treatment services.**
- b. Ensure that all inadequate operations are stopped and closed.**
- c. Promote the transition from badly managed dumpsites to well-managed engineered landfills.**
- d. Make sure that hazardous and harmful substances are phased out and that proper final sinks are available.**

MITIGATING CLIMATE CHANGE

Although Coronavirus pandemic temporarily may have pushed the climate debate to the background, **climate change is the greatest challenge of our time.**

Many industrialized countries already demonstrate **that curbing greenhouse gases (GHG) emissions is not detrimental to economic growth, and in fact climate mitigation measures offer opportunities to establish innovative technologies and approaches.**

Although the direct GHG emissions from solid waste management, according to the International Panel on Climate Change (IPCC), only contributes to around 2-3% of the total global emissions, the waste management sector can play a vital role in climate mitigation through a multitude of actions.

The sector can reduce its direct emissions through proper operations of landfills, anaerobic digestion (AD)

and composting plants, by introducing methane capture measures, such as landfill gas wells and biocovers at landfills and by the usage of green energy to power collection, sorting and treatment systems.

Thermal and biological treatment plants, such as waste incineration and AD, can be used to produce electricity and thereby support the electrification of our energy systems or utilized for production of fuels, and if equipped with carbon capture systems, such plants can even further contribute to the reduction of GHG emissions.

Finally, waste prevention and recycling initiatives contributes by reducing the demand for virgin raw materials and thereby also the GHG emissions from extraction and refining of such materials. **Altogether, the effects of waste prevention, recycling and replacement of fossil fuels and virgin raw materials through use of secondary raw materials from waste streams offer potential GHG reductions in the magnitude of up to 20% of the global emissions.**





CITIES & CLIMATE CHANGE

The relevance of intensifying climate support for cities is obvious. Cities consume almost 80% of the world's energy and produce almost 70% of all greenhouse gas emissions. Inadequate urban infrastructure leads to traffic congestion, puts excessive pressure on the supply of electricity and water and spreads diseases due to insufficient wastewater treatment and solid waste management, whereas circular economy is hardly addressed and utilized in order to face out BAU and the prevailing linear economy business models.

In this context the EU as well as FAO (2020) and UN Habitat as custodian for the SDG 12 related waste management aspects in cities formulated city-support programs. For example, EU proposes as part of the EU Green Deal to enter into climate plans/contracts with 100 cities in EU to support their climate related initiatives and investments. FAO on the other hand wants to focus on 100 cities in view to demonstrate how to enhance the food value chain in cities whereas food waste management would play a relevant role. If all food waste produced globally would be considered as 'a country' it would rank number 3 considering global GHG emissions after US and China.

In ISWA's Circular and Low Carbon Cities (CALC) initiative we are contributing to a modelling tool that will help cities in estimating the effects of waste management measures to reduce both GHG emissions and improve circularity.



KEY MESSAGES

- a. Reduce GHG emissions from waste management operations, through proper operations of landfills, composting plants, AD and by utilizing new technologies**
- b. Incentivize waste to energy technologies to support the electrification of energy systems and other treatment technologies for producing fuels from waste**
- c. Invest in the research, development and implementation of carbon capture technologies for waste treatment**
- d. Acknowledge and reward the climate mitigation effects in other sectors (extraction and manufacturing) by utilization of secondary raw materials over virgin raw materials**
- e. Support the implementation of climate goals and actions into practice by developing bankable projects, through cross-sectoral cooperation**

DRIVING RESOURCE EFFICIENCY AND THE CIRCULAR ECONOMY

The current linear economic system is exhausted, putting increased pressure on the environment, depletion of natural resources and negatively influencing the climate. This situation urgently calls for a transition to a more sustainable and circular system where products and resources are recovered and sustainably kept in the cycle as long as possible. It is imperative for the waste management sector to shoulder the responsibility of the recovered resource and material provider of the circular economy and partner up with other actors along the value chain work persistent and proactively to promote waste prevention, reduction and reuse.

It is evident that the waste management sector is well placed when it comes to recover materials from the technical cycles and reintroduce them into manufacturing processes as well as making sure that materials from the biological cycles are recovered and used as biochemical feedstocks, soil quality improving compost, fertilizers and feedstock for production of biofuels. However, there are multiple challenges to overcome.

Sustainable resource efficiency and circular approaches calls for detoxification of the material loops. Focus on phasing out harmful legacy substances is evident, but also constant focus on the introduction of new materials and substances into material processing and manufacturing is important.

The challenge consists of two main elements; first, finding the fine balance between the advantages to production efficiency and product quality of introducing a substance into a process on one side and the harm to humans, the environment and recyclability on the other side and secondly, finding the technological solutions to substitute unwanted substances in the production phase as well as to identify and isolate them at end-of-life of products and materials.

Defining and communicating what circular economy is remains a challenge. A simple internet search can bring hundreds of differing definitions of the concept. Further defining and simplifying the definition of a circular economy as an important task to take on as is the development of appropriate metrics for the circular economy.

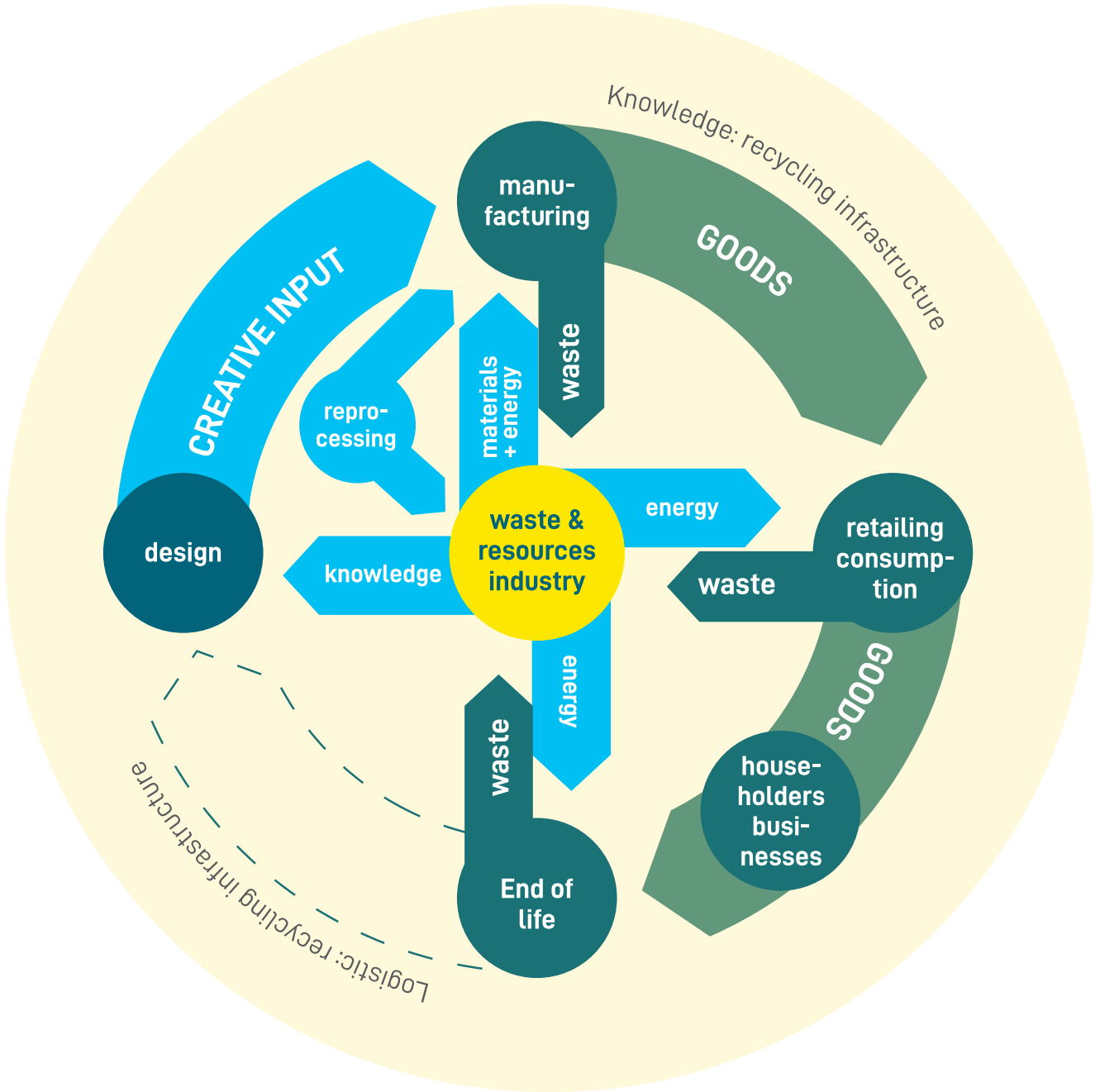
A circular economy cannot exist without functioning markets for secondary materials. The situation right now is that new production from virgin materials in many cases are cheaper than applying reuse solutions or utilizing recovered raw materials. Strong policy decisions and introduction of economic instruments can incentivize the creation of markets for materials and circular solutions. Embedded cost, carbon and pollutant taxes and eco-modulation tariffs are examples of such instruments.

Thus, sound waste management is an essential pillar to realize the circular economy, performing a relevant service for the design, production, assemblage and distribution phases as well as transforming waste into new materials and fuels.

KEY MESSAGES

- a. Divert waste from residual waste treatment by reduction, reuse and recycling
- b. Focus on reducing and substituting harmful substances in materials and products
- c. Further develop the concept of cascade utilization
- d. Develop appropriate metrics for the circular economy
- e. Promote policy decisions and introduction of economic incentives to drive circularity and create sound markets for materials

THE WASTE INDUSTRY IN THE HEART OF THE CIRCULAR ECONOMY



Source: Circular Economy, Trends and Emerging Ideas. ISWA, 2014

PROMOTING GOOD GOVERNANCE AND INCLUSION

People are not accepting anymore that the remains of post-use products end-up in the environment and lawmakers are reacting to this demand by drafting legislation to introduce proper waste and resource management.

A critical component for any successful waste management system is to make sure that a reliable, inclusive and transparent governance model is in place. The model has to be supported by a robust legal framework that ensures efficient and sustainable waste management operations and a viable long-term financial and organizational model supporting continuous operations a proper enforcement of the legal framework.

Furthermore, the governance model must make sure that policy makers, public servants, operators and the users of the system all are held responsible and accountable to the system. A very useful tool for designing such a governance models and for successfully operating a waste management systems is the integrated sustainable waste management framework.

A crucial prerequisite for any such system to be successful is that adequate financing, political, social and public awareness are in place, which calls for real inclusion and professional and straight forward communication. There is also a need to follow legal and normative developments, to ensure the technical aspects are taken into consideration and guarantee that the required resources are available.

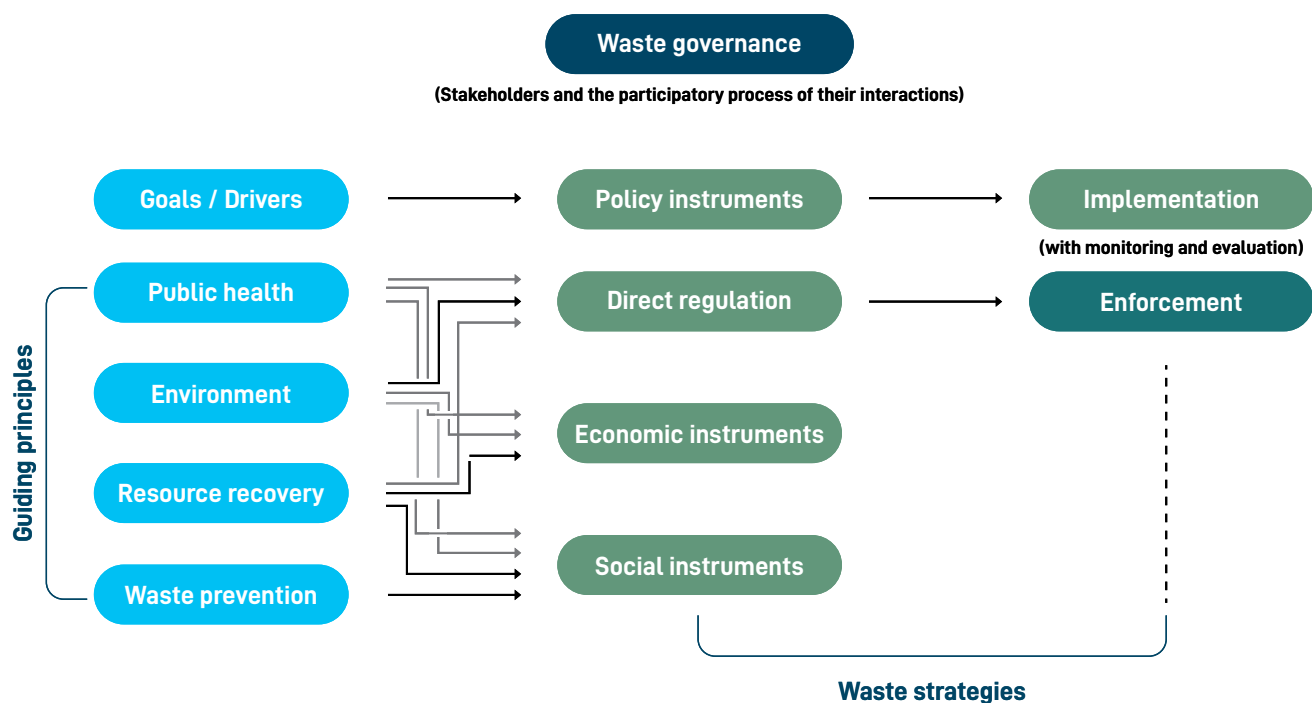
Models for financing waste management operations deserve full attention. Such models shall preferably be fee based than tax based and, ring-fenced and securing full

cost-coverage for the provided services and operations. The guiding principles behind such models shall be the duty of preventing pollution, the life-cycle concept, the polluter-pay principle, and the adequate internalization of costs in order to ensure sound and sustainable management from planning and communication through collection to treatment and recycling. In addition, the implementation of extended producer responsibility (EPR) schemes becomes more common, not only in Europe and North America, but as funding cannot only come from waste management fees paid by our inhabitants, funding via EPR will become more and more important, also for developing countries. There is a great need for exchange of experience and for cooperation to avoid shortfalls and failures.

In order to prevent the unwanted effects to the environment, human health and society as described above, legislation has been implemented at an international as well as on regional and national levels. Despite the regulations in place, reports suggest that large amounts of waste are exported from the European Union to transition and developing countries, such as China, other Asian and West African countries. Waste trafficking as a truly international criminal action that causes harm to human health and the environment as well as to society, both by the effects related directly to improper handling of waste, but also by impairing sound market mechanisms hindering the establishment of the infrastructure needed for sound waste management. Therefore, there is a need for global cooperation to promote the interaction between multiple stakeholders to provide exchange of information, share experiences, investigations and action plans to fight waste trafficking in all its forms.



WASTE GOVERNANCE CONCEPTUAL MODEL AND ELEMENTS



KEY MESSAGES

- Ensure efficient waste governance systems considering the achievement of the goals set by the 2030 Agenda, with multi-stakeholder participation and harmonized rights and obligations, are in place
- Use the integrated sustainable waste management framework as a guiding tool and follow the principles of duty of preventing pollution, a life-cycle based approach, the polluter-pay and internalization of costs
- Work effectively for the establishment of transparent and ring-fenced cost coverage tariff systems for waste management
- Provide adequate investments in global structural research and funding for waste and resource management infrastructure and services
- Make sure that planning initiatives are cross-sectoral, securing a holistic planning paradigm and a common view on human ecosystems



INFORMAL SECTOR

The recovery of valuable materials from waste is a long-standing activity. In many countries, the economic need and poor public management in relation to recovery of materials from wastes has created an opportunity for the development of this activity through an informal sector. It cannot be denied that the activity carried by waste pickers has grown and that it has differentially contributed to the achievement of a citizen environmental awareness in relation to recycling and to "put the matter in the public agenda". It cannot be ignored that waste pickers, apart from making a living of it, to some extent have been providing an additional waste management service avoiding the disposal of a certain amount of waste.

Despite having been recognized by the legal system in several countries, professionalization and formalization of the informal sector is yet to take place. This would contribute to higher productivity, larger transparency and potential for better systemic coordination of the waste management system, and especially, it would promote the protection of health, as well as the access to dignified employment.

ALL IN ON OCCUPATIONAL HEALTH AND SAFETY

As for any industry, health and safety is a priority for the **waste business**, to be incorporated as part of its culture, by converging efforts, attitudes, values and directives towards the main goal to reduce incidents that can cause injuries to the work force.

In the waste management sector where mechanised collection in many places is the norm, where urban areas rapidly becoming denser populated and where mechanical, biological and thermal treatment methods are becoming more and more technologically advanced, the need for constant focus on and development of well-functional occupational health and safety procedures is essential.

Some guidance on that topic is brought by the ISO 45001 with the objective of helping organisations to identify and minimize risks at the workplace, improve labor conditions by providing standardization and minimum requirements. It's an international consensus that **adopting and implementing a health and safety program is a necessary step for any business**, no matter its size nor where it occurs. In order to be successful, such programs focus on full leadership engagement and commitment and on an active role by the staff, mostly by those working on the field.

COVID-19 pandemic has highlighted some additional risks to waste workers and crucial improvement in occupational health and safety conditions was created. In the coming decade these advancements should stay with no changes, especially in regions of the world where the safety standards are still falling short.

Technological advancements can also be helpful to mitigate risks and prevent accidents, both when it comes to developing and improving personal protection equipment and support for manual handling and heavy lifting, but also for monitoring activities in the field and at facilities and thus supporting working procedure optimization and removing risky and unsafe conditions.

KEY MESSAGES

- a. **Truly empower the workforce of the sector.**
- b. **Implement extensive training programs in the sector and induce a huge cultural paradigm shift, changing the view on waste management workers from low-status jobs at the bottom of the societal pyramid to essential agents of change in the green transition.**
- c. **Improve labor conditions by providing minimum requirements at the workplace and by benefitting from the continuous advancements in technological development.**

FIVE TO STAY ALIVE, SWANA

SWANA, ISWA National for the United States and Canada, has developed a safety campaign of five simple tips to help solid waste workers stay safe on the job aiming at creating a positive safety culture in the workplace. Five to Stay Alive safety tips are specialized for workers based on job function and location. These materials are meant to provide basic information to help reduce accidents and injuries.



BECAUSE SAFETY MATTERS

FIVE TO STAY ALIVE

SWANA wants you to go home to your family every day, safely. In addition to these five important tips, be sure to follow your employers' safety rules and perform thorough pre- and post-trip inspections EVERY TIME.

For more [#SWANAsafety](#) info and resources visit [SWANA.org/safety](https://www.swana.org/safety)

Safety Tips for Waste Collection Employees



Always wear PPE, especially high visibility vests and/or outwear



Never use your cell phone or text while driving the truck at a disposal facility



Don't exceed the speed limit and dont rush



Always comply with safety belt rules



Don't ride on the step if the truck is BACKING or going forward faster than 10 mph or farther than 1/5th mile

Following these rules will help keep you safe!

ADVANCES IN TECHNOLOGIES

The perception is that this decade will be the period in which advances in technologies will become mainstream and profoundly change the waste industry. There is a wide trend of introducing Internet of Things (IoT) applications to waste collection practices (e.g. iPads for drivers, RFID tags on containers, etc.) as well as within transfer stations and electric vehicles. The deployment and wide dissemination of Remote Monitoring & Control (RMC) for the different facilities will also follow.

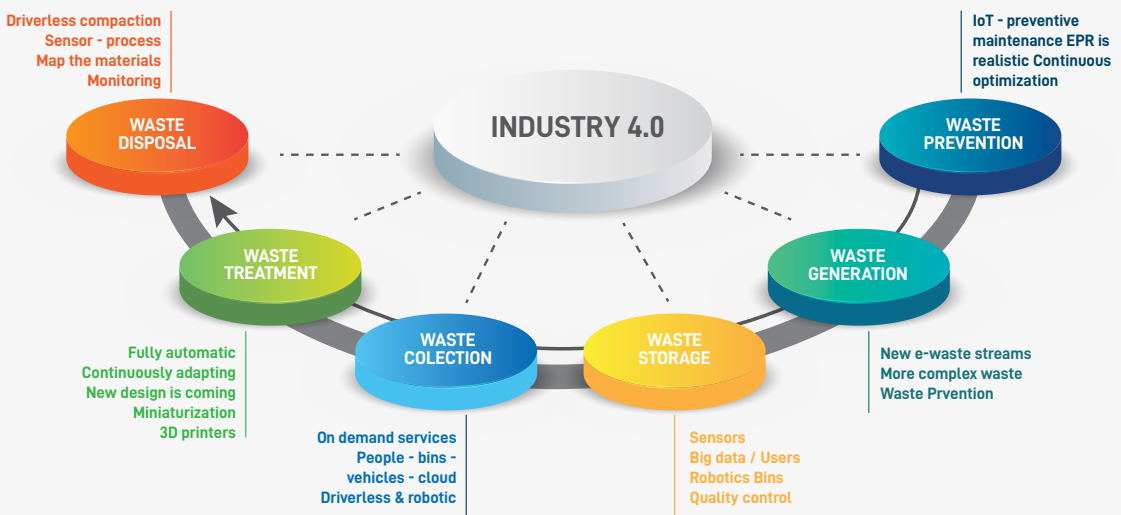
In terms of recycling, decontamination processes will shift from low-cost material recovery solutions to specific processes for high quality recycled materials and higher value of recyclates and secondary materials. Improvements on mechanical sorting and chemical recycling will open up new opportunities to put resources to better use by including more waste streams in the recycling industry and creating a resource for new products.

When dealing with organic wastes, Bio-waste treatment facilities will be operated as bioreactors in order to create and extract chemicals and novel products from AD (and to a lesser extent composting), and technologies for contaminant removal will be in place.

KEY MESSAGES

- a. Make sure a broad array and combinations of treatment technologies will be adopted.
- b. Apply AI and other digital solutions in forecasting, planning, operation and follow-up for waste management systems and technologies.
- c. Drive resources to ensure that innovative waste and resource management systems and technologies can keep up with the pace of advancements in material and manufacturing technologies.

WASTE MANAGEMENT STAGES AND THE IMPACT OF IND 4.0



Source: How Industry 4.0 Transforms the Waste Sector, ISWA, 2019.

FINAL REMARKS

The COVID-19 pandemic has highlighted how crucial the waste management sector is to all societies, mainly because of the function it plays in public health and safety. Our sector originated from the need to keep cities clean in order to secure public health. This purpose will remain paramount no matter where in the world you are. Adequate living conditions ensuring good health is a fundamental human right.

During the current decade improvements in sustainable waste and resource management practices will support improvement in public health, environmental protection, climate change mitigation and sustainable materials management globally. Waste is still in many instances rightly considered as a problem, causing harm to the environment and public health, but the waste and resources management industry, on the other hand, is part of the solution, not the problem.

To be successful, we must simultaneously follow two paths of development:

On the one hand, the provision of basic waste management services globally shall be a priority. Ensuring that waste collection services and proper waste treatment are available to everybody globally will support the endeavor

to close all open dumpsites still in operations and stop open burning of waste.

On the other hand, supporting the transition towards sustainable resource management and the circular economy is also crucial. Millions of tonnes of reusable, recyclable and recoverable products and materials are today being wasted. By truly implementing the principles of the waste hierarchy through an ambitious but pragmatic approach based on scientific evidence we can accelerate this transition and enter the era of a new and more sustainable economy, based on a symbiotic partnership with active participation of different stakeholders.

There are four main enablers that need to be in place to make this development happen: Good governance, adequate funding, collaborative research and development and proper communication.

Good governance rests on the three pillars of reliability, inclusiveness, and transparency. It is supported by a robust legal framework a viable long-term financial and organizational model. Furthermore, the governance model must make sure that policy makers, public servants, operators and users of the system all are held responsible and accountable.



Financing of waste management systems deserves full attention. Any financing models shall preferably be fee based than tax based, ringfenced and securing full cost-coverage for the provided services. The guiding principles shall be the duty of preventing pollution, the life-cycle concept, the polluter-pays principle, and the adequate internalization of costs.

Research and development is fostered by a collaborative and symbiotic partnership where governments, companies, universities, non-governmental organizations and citizens jointly implement research, disseminate and put into practice the principles for new solutions and technologies.

Communication is crucial, but too often forgotten. After all, understanding, acceptance and support is crucial in everything that has to do with the waste management sector. Support for the development of new policy, support for implementing and respecting this policy, support for active participation, support for respecting measures and achieving objec-

tives, support for the realization of important infrastructure projects, support for knowledge sharing and solidarity.

Finally, it is utterly important to remember that when it comes to sustainable waste and resource management there is no silver bullet. The only successful way forward is to pursue an integrated approach where different technologies and solutions all together contribute to the common goal.

The main and obvious conclusion is that, if done in the right way, the solid waste management system will be significantly improved during the next 10 years, bringing pragmatic and real solutions to the problems inherited from the twentieth century and thereby fulfilling the needs and demands that the twenty-first century imposes.

WASTE AND RESOURCE MANAGEMENT SYSTEMS ARE GLOBAL AND HAVE TO BE ADDRESSED BY COORDINATED GLOBAL ACTIONS. THE ERA OF LOCAL CONTAINMENT ONLY IS OVER.

ISWA IS THE WORLD'S LEADING NETWORK REPRESENTING ALL ASPECTS AND STAKEHOLDERS TO PROMOTE PROFESSIONAL AND SUSTAINABLE WASTE - AND RESOURCE - MANAGEMENT SUPPORTING THE TRANSITION TO A CIRCULAR ECONOMY.

ACKNOWLEDGEMENTS

This report is a collective work that has been prepared with the valuable inputs and insights from the ISWA Working Groups, Regional Chapters and the Young Professionals Group.

General coordination, editing and review

Carlos RV Silva Filho, Björn Appelqvist and Anne Woolridge

Compilation and editing

Aditi Ramola, Gabriela Otero and Fernanda Romero

Graphic design

@agenciapituri

This report has also been made possible thanks to the generous support of the following ISWA Members

Be'ah, DELTTA, Lagos Solid Waste, Polyeco, Ramboll, RECICLAD'OR, SCS Engineers and WEHRLE

The authors would like also to **acknowledge** the support given by the ISWA Board Members: Ana Loureiro; Arne Ragossnig; Atilio Savino; Doron Sapir; Goran Vujic; Gunilla Carlsson; James Law; Melissa Tan; Nancy Strand

And a **special thanks** to the ISWA Team!

October 2021

Copyright 2021

ISWA – The International Solid Waste Association



ISWA.ORG



ISWA.ORG