Waste management and transition to a circular economy

As opposition to society's 'throwaway culture' grows, so does the realisation that recycling and waste management are not only needed but desired by the public. Dr Pekka Peura at VEBIC, University of Vaasa, Finland, in collaboration with Dr Olli Voutilainen of the Natural Resources Institute Finland and Professor Jussi Kantola of the University of Turku, review the evolution of a waste-management system implemented in Finland's Vaasa region in 1984, which saw the establishment of the waste management company 'Ab Avfallsservice Stormossen Jätehuolto Oy (ASJ)'. ASJ and the subsequent formation of Westenergy have been instrumental in Finland's drive to transition to a circular economy.

Human activities increasingly impact the environment and wildlife. At the same time, opposition to society's 'throwaway culture' has been growing. Over the last 40 years, the need to reuse, recycle, and take waste management seriously has gained traction with the public, and this change in public attitude is being felt by companies and governments. 'Sustainable development' has become a familiar term; however, with more than 300 definitions it means different things to different people, and is proving difficult to achieve globally.

Dr Pekka Peura at VEBIC (Vaasa Energy Business Innovation Center at the University of Vaasa) and his colleagues, Dr Olli Voutilainen and Professor Jussi Kantola, trace the emergence and development of an innovative waste-management system implemented in the Vaasa region of Finland. They highlight its contribution to Finland's transition to a 'circular economy' – meaning the use and recycling of materials, the reduction in the need for natural resources, the minimisation of waste, and consequently the production of a more sustainable and green economy.

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COLLABORATION IN ACTION

The first Waste Management Act in Finland came into effect in 1979, before which public health legislation regulated only waste disposal. In 1984, the pioneering waste-management company 'Ab Avfallsservice Stormossen Jätehuolto Oy (ASJ)' was established in the Vaasa region of Finland, including the city of Vaasa and the neighbouring municipality of Mustasaari. Stormossen was the first biogas plant to be part of such a regional waste-management system and has been central to the success of the region's waste-management strategy.

Over the course of 20 years, ASJ expanded to include the neighbouring municipalities of Maksamaa, Vähäkyrö, Isokyrö, Vöyri, Maalahti, and Korsnäs; Oravainen also joined in 2015 when it merged with Vöyri. The companies that made this expansion possible were Vestia waste management and Ekorosk to the north of Vaasa, Millespakka and Lakeuden Etappi to the east, and BotniaRosk to the south; this collaboration formed the company Westenergy in 2007. Westenergy and Stormossen have been at the forefront of the region's waste-management innovation. Stormossen provided organic waste management for Lakeuden Etappi and BotniaRosk until they established their own biogas plants.

Peura and colleagues identify this collaboration and the Stormossen biogas plant, along with Westenergy's incineration plant and the comprehensive collection of reusable materials and hazardous waste, as key components of the waste-management system in the Vaasa region.

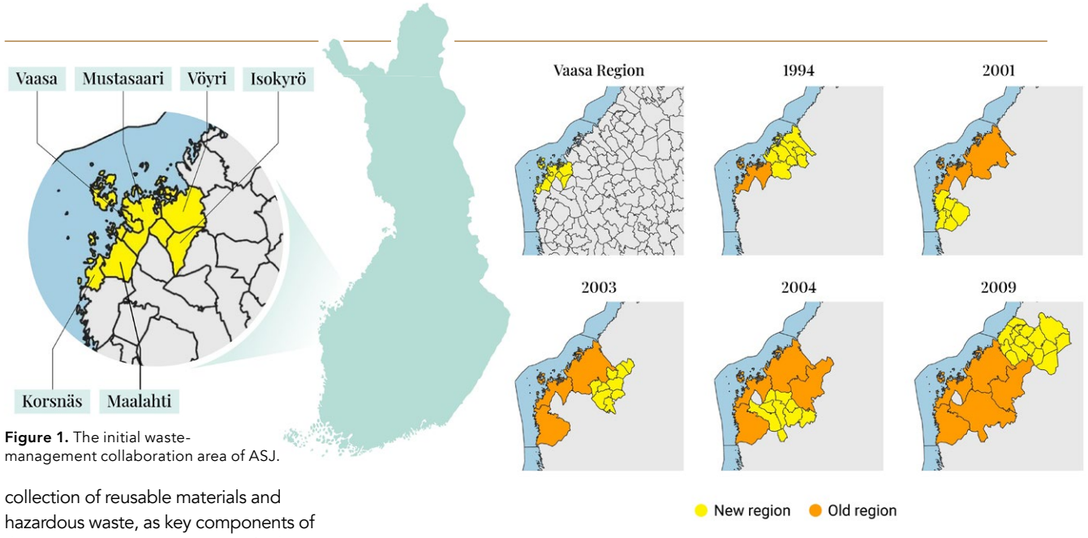

Figure 1. The initial waste-management collaboration area of ASJ.

Figure 2. The expanding operational area of ASJ from its beginnings to the present.

EARLY BENEFITS OF THE COLLABORATION

In 1990, the initial Vaasa region produced 62,300 tons of municipal waste, primarily from industry and the city of Vaasa. This increased by approximately 33% with the expansion of the collaboration to neighbouring municipalities, with a third of all household waste being organic. Although the recycling of paper, cardboard, and metal was well established in the region, individuals were required to take these materials to dedicated collection points, and materials were either not sorted or sorting was voluntary. These collection points were incorporated into a waste-management collection system in the early 1990s. At the same time, further unoccupied waste reception stations (eco points) were added. Each eco point was expected to serve 400 to 500 inhabitants, and most were located in areas with detached houses. By the mid-1990s, there were approximately 100 eco points in the Vaasa region, plus ten occupied controlled reuse stations that served 4,000 to 5,000 inhabitants each.

During this early stage of the waste-management strategy, recycling in the area became routine. ASJ was responsible for a significant decrease in waste dumping (from 90% to 50%) and a reduction in the number of dumping sites. The closing of dumping sites was strictly regulated, ensuring adequate wastewater management, landfill gas collection, and landscaping to restore the environment; these processes were expensive, time-consuming, and required expert knowledge. Today, rather than the multitude of small unregulated dumping sites, the Vaasa region has only one which is also strictly regulated. A closed-loop system prevents water leakage and emitted gases are collected and incinerated to prevent their release into the atmosphere.

After 2012, the volume of waste treated by ASJ tripled, and by 2017, up to 60% was recovered into energy by Westenergy.

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STRATEGY EVOLUTION IN THE 21ST CENTURY

As the collaboration grew, so did the benefits to the Vaasa region. Waste reuse and the collection of hazardous waste became more efficient, and waste dumping continued to decrease. Peura and colleagues identify the establishment of Westenergy in 2007 as being the biggest reform. After the formation of Westenergy, organic and combustible waste was sorted at source, improving the quality of incoming waste and increasing the efficiency of the waste management system.

By 2012, only 3% of waste from the Vaasa region was being dumped, recycling efficiency had reached 45%, and 'waste to energy' efficiency had reached 60–65%. After 2012, the volume of waste treated by ASJ tripled, and by 2017, only 0.5% of all waste was dumped and up to 60% was recovered into energy by Westenergy.

Westenergy and Stormossen continue to take a central role in supporting Finland's journey towards better waste management and a circular economy by developing new technical solutions to meet the future needs of the Vaasa region and the country.

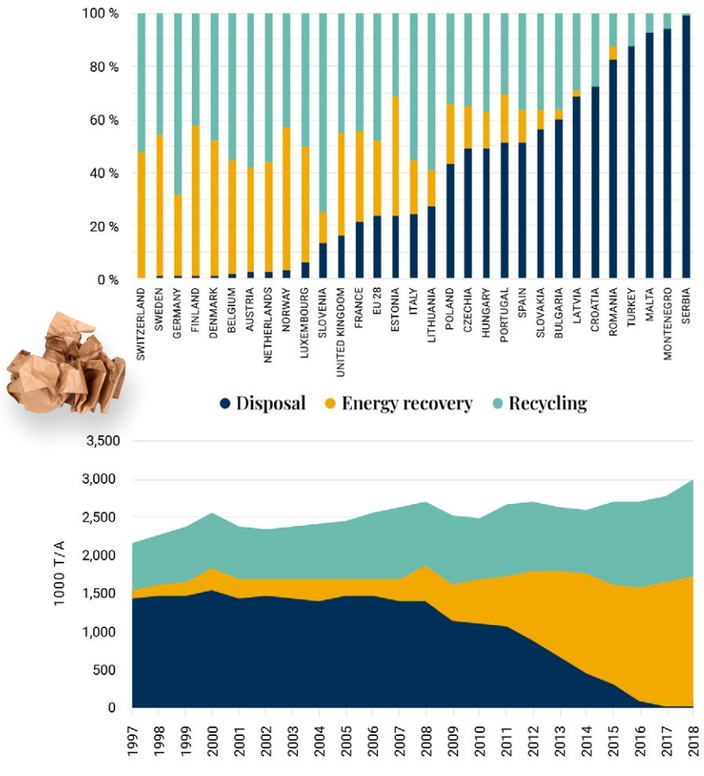

Figure 3. Municipal waste by waste-management operations. Top: European countries in 2018 (source: Eurostat). Bottom: Finland 1997–2018 (source: Statistics Finland).

CAN THIS SUCCESS BE REPLICATED ELSEWHERE?

The success in the Vaasa region has been replicated across Finland, although the share of energy recovery is higher within ASJ. Across Europe, the dumping of waste has decreased significantly since 2010, suggesting similar methods of waste management have been implemented in other European countries. However, dumping of waste still accounts for a sizable proportion of waste disposal, and serious challenges to increasing energy and material recovery remain in many countries. In 2018, the level of waste dumping in Finland, Switzerland, Sweden, Germany, and Denmark was less than 1% – substantially lower than other major European economies such as the UK (15%), France (21%), Italy (24%), and Spain (51%).

Peura and colleagues state that direct replication of the success in the Vaasa region via the same regional collaboration and large investments may be difficult, as the combination of local conditions, stakeholders, and the success of local systems are likely to be unique to the region. However, they suggest that the key result – creation of a circular economy – can be achieved by creating regional product–services system (PSS) concepts and preparing roadmaps for achieving PSSs. While the technologies used will be different, according to what is relevant to the local and regional circumstances and characteristics, the vision and strategy will be the same. A network of regional PSSs that can operate independently and cooperatively may enable nations to achieve their goals. Such systems require not only policymakers to introduce supportive policies but economic benefits for continued investment and maintenance of the system and success in the longer term. An example of such an economic benefit is the production of biogas, which is an economically valuable product due to its increasing use as a transport fuel. However, it is worth noting that the economic feasibility of such a waste-management system is reliant on a supply of large volumes of waste, which conflicts with the waste-minimisation goal of most regulators. Also, separation of waste material at source is essential, but can be expensive for the waste producer – securing suitable volume of waste to enable continued economic success may be a challenge.

THE NEXT STEPS

Peura and colleagues suggest the continued transition from a throwaway culture to a circular economy requires a shift from waste management to material management – using and reusing materials in a more environmentally sustainable way. This, along with a move from solely public services to the inclusion of feasible businesses, would allow the division of roles and specialisation of waste-management companies, further increasing efficiency and economic viability.

Any waste-management infrastructure will function efficiently only when all components are present, requiring waste producers to become members. Circular Economy Hubs, areas for businesses with the necessary infrastructure (such as electricity, heating, other energies, smart web connections, and logistics) organised by the public sector, are promoting the concept of circular economies. Such hubs provide the opportunity for cooperation between companies, bringing them close to raw materials, energy, partners, and other infrastructure requirements. This creates positive operational environments and the opportunity for small enterprises to become involved. A suitable area for a Circular Economy Hub has been reserved within the ASJ and Westenergy, and the practical organisation commenced.

The continued transition from a throwaway culture to a circular economy requires a shift from waste management to material management.

Behind the Research

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Research Objectives

Dr Peura analyses waste management in the Vaasa region, Finland.

Detail

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Collaborators
- Dr Olli Voutilainen, Natural Resources Institute Finland
- Professor Jussi Kantola, University of Turku

References

Peura, P, Voutilainen, O, Kantola, J, (2022) From Garbage to Product and Service Systems: A Longitudinal Finnish Case Study of Waste Management Evolution. *Waste Management*, 120, 143–153. doi.org/10.1016/j.wasman.2022.01.025

Personal Response

Does a successful circular economy need to be international, even global, with cross-border collaboration between waste producers and waste management consortia?

"In some cases, a proper material management may require international collaboration, even global contacts, such as rare minerals, metals, etc. Otherwise, the main thing is to establish local and regional closed circles where logistics are minimised."

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