

LET'S GO CIRCULAR!

Paving the way for a circular transition of cities

Thematic Article 4

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THE LEADING PARADIGM OF OULU'S ALLIANCE SERVING DIGITALIZATION AND CIRCULAR ECONOMY



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The leading paradigm of Oulu' alliance serving digitalization and circular economy

Forerunners in digitalisation and ICT

Oulu has more than 50 years of experience in developing wireless technologies, making the region's pioneership in the field indisputable. Mobile technologies developed in Oulu are being used by almost 3 billion people around the world daily. The 5G technology has largely been developed in Oulu, and visionaries at the University of Oulu are already hard at work creating 6G, the next generation of wireless communications.

Lately, the business and innovation ecosystem in Oulu has become a hub of international product development companies, carrying excellence in different fields, producing high level ICT solutions and applying them in various industries, such as health care. Oulu is also the home of printed electronics which creates groundbreaking visions for the automotive industry.

And all that, accounting that Oulu is a city, municipality and a seaside resort of just about 210000 inhabitants in the region of North Ostrobothnia, Finland. It is the most populous city in northern Finland. Population has a middle age of 39.4 years, gender balanced. Once known for wood tar and salmon, Oulu has evolved into a major high-tech centre, particularly in IT and wellness technology. Other prominent industries include wood refining, chemicals, pharmaceuticals, paper, and steel. The GDP per capita was 39 669€ in 2020. Unemployment rate rather high though, reaching almost 12%.

Overall, Oulu is also considered one of Europe's "living labs", where residents experiment with new technology on a community-wide scale. The University of Oulu is regionally known in the field of information technology.

Circular Economy forerunners

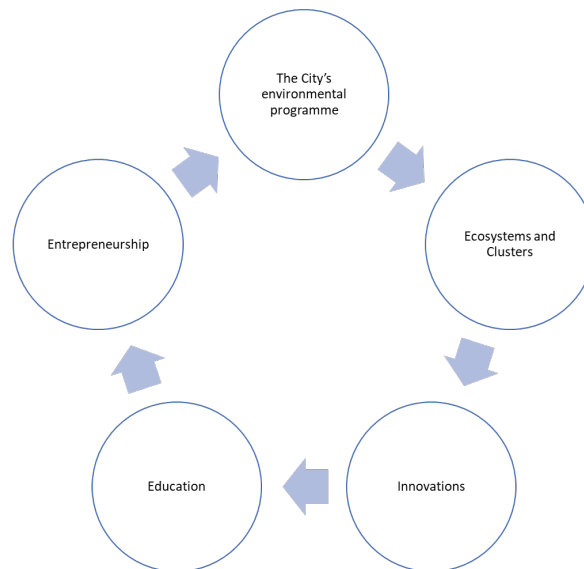
City of Oulu was among the first to sign the circular economy cities declaration in Europe.

Relevant national strategies and development plans are the listed below:

- Finland's RoadMap to the circular economy 2.0
- Finland's Strategic program to promote a circular economy
- Circular Economy Green Deal
- Oulu Region's Smart Specialisation 2021-2025 - Council of Oulu Region

At local level, the City Board has approved the 2021 Oulu's RoadMap towards circular economy, which covers the year 2021-2030. In addition, Oulu has a City Strategy, Environmental Program and Sustainable Energy and Climate Action Plan.

There is so much going on in Oulu, serving circular economy. Principally, the way is pointed by the City itself. The approved Oulu's RoadMap towards circular economy is supported also by the Environmental Programme which includes relevant actions and measures.



Moreover, the City supports and works closely with Clusters and Innovation/ Business Alliances, and this relation is bidirectional; the City is always up to date concerning the latest technological and business developments and has the opportunity to support and work with startups, whereas the Clusters and Alliances also benefit from being aware of the City's intentions, latest strategic programmes and development plans, which are then passed on to their members. Through the Alliances, the City gets better connected with the research institutions as well, and again, the benefits are mutual.

Oulu local government is very innovation-oriented; digital tools that can really play a significant role in enhancing the city's sustainability are known and are being exploited in several cases. Most of these tools, have been developed by the companies that are members of the local ecosystem.

At the same time, the local government is putting a lot of effort in developing educational programmes, where climate action, management of resources and environmental – social related topics hold a special place. Overall, the ecosystem in Oulu is powered by a versatile representation of stakeholders in education, research, business, and the public sector.

The City's Environmental Programme

The Environmental Program is one of the implementation programs of the city strategy "Oulu 2035." The goal of the program is to maintain a good environmental condition and ensure the vitality of the city. The measures in the environmental program also include the so-called preparation of sub-programs / operational programs, some of which have already moved into the implementation phase.

The Environmental Programme of Oulu has 3-4 main goals, each one of which is reflected through actions and a set of indicators. The strategic focus areas are depicted below.

- ❖ Oulu is Finland's most Business-Friendly International Growth Centre
We cooperate with businesses and networks that promote the circular economy. We serve as a platform for circular economy experiments and pilots.
- ❖ Oulu will be carbon-neutral in 2035
We implement the Circular Economy Roadmap.
Education builds a sustainable and international Oulu.
- ❖ Oulu is Finland's most actively learning circular economy city.
We build a multiprofessional circular economy learning community.

Circular economy related goals and actions

The ambition of Oulu in terms of circular economy is to act resource-wisely, while the goal is to establish a functional circular economy. The Circular Economy Roadmap covers a wide range of various circular principles and actions. The roadmap applies to the entire city and all city organizations have participated in its creation. The circular-economy related measures are depicted below.

- ❖ Circular Economy Roadmap actions are implemented as planned.
- ❖ City planning creates the preconditions to the use of surplus waste and recycled material.
- ❖ Material flows and mass flows emerging from city activities are investigated and a control and utilisation plan for the largest components is composed.
- ❖ Sharing economy and joint use are promoted by developing libraries, community spaces etc, as centres of sharing economy and encouraging for communality.
- ❖ Positive attitude towards circular economy is promoted with positive, exciting, and open communication.

The themes of the roadmap are listed below:

- Energy Production and Energy Efficiency
- Sustainable Procurement
- Sharing Economy
- Education and Communication
- Land Use and Planning
- Material Cycles
- Built Environment
- Sustainable Food System

The roadmap includes different 123 actions, whose implementation was reviewed by the circular economy coordination group in December 2023.

Oulu's efforts to promote the circular economy have been assessed and proved effective; the majority of the actions were considered completed.

For more information: Maarit Talvitie, Climate Specialist, Environment Office of the Oulu Region and Petteri Tuuttila, Circular Economy Expert, City of Oulu.

Ecosystems and Clusters supporting innovation and circular economy in Oulu

BusinessOulu

BusinessOulu is a public utility of the City of Oulu, established to develop business and employment in the Oulu region. BusinessOulu's mission is to promote the vitality of the city by creating opportunities for success for the region, residents and companies. We are building a strong northern growth center that is attractive as a youthful business, residential and study location.

For more information about BusinessOulu: Maria Vuorensolamaria, maria.vuorensola@businessoulu.com

ICTOulu

ICTOulu is a service network dedicated for ICT-companies operating in Oulu region and it is provided by BusinessOulu. As a public utility of Oulu, BusinessOulu is dedicated to providing its services equally for every Oulu-based company. ICTOulu is very open for cooperation with public and private sector organizations, who are willing to start new digital initiatives or achieve world class digital solutions.

ICTOulu is the City's service platform for enterprises, created to boost the members' business, the development of new products and solutions, and foster their export to the international market. ICTOulu bases its activities on a collaborative way of doing things – the Oulu-way.

According to Niina Heikkinen, the new digital frontiers that enable circular economy are depicted below.



For more information about ICTOulu: Niina Heikkinen,
niina.heikkinen@businessoulu.com

Oulu Innovation Alliance

The OIA was established in 2009 to support the unique collaboration so fluently carried out between different stakeholders in Oulu. The Oulu Innovation Alliance (OIA) is a strategic alliance of the most significant research, development and innovation actors in the Oulu region, strengthening the region's innovation capacity and the global competitiveness of Northern Finland.

The City of Oulu is one of the OIA partners. Other partners include the Natural Resources Institute Finland (Luke), Oulu University of Applied Sciences (Oamk), Oulu Vocational College (OSAO), University of Oulu, the Wellbeing Services County of North Ostrobothnia, Technopolis, and VTT Technical Research Centre of Finland Ltd.

The aim is to support growth based on their spearhead programs along with boosting talent attraction and matching capable talent with the needs of companies. Success stories are available here.

Talent stories can be found here: <https://oulu.com/en/talent/stories/>

Some spearhead programs are depicted below.

New solutions for waste and side streams

The goal of this spearhead programme is that new high-value and high-volume products from various waste and side streams are developed in the Oulu region, while aiming to achieve low-carbon goals. The programme supports the goal of companies developing circular economy solutions operating in the region, to be an internationally recognized center for the circular economy and a leading partner in increasing the value of waste streams.

H2 ResearchHub and environmentally friendly steel

Steel industry is a significant international industry in the region of the Bothnian Arc, covering the whole value chain from large locomotive companies to smaller operators and top research in the field. Steel industry is also one of the largest individual carbon

dioxide emission producers of the world, because of which the companies and researchers of the field have an important role in the green transition.

With the help of this programme, an innovation ecosystem is enabled which combines effectively top research in this field to the business of the companies. The goal is a world-class programme in renewing the value chain of carbon neutral steel.

Water know-how, digitalisation and export opportunities: Smart solutions to global water challenges through the cooperation of research and companies.

Digital tools that are used for water flows mapping, for risk minimisation, reduction of leakages, reassurance of water quality, operational operatibility and improved operational efficiency. The Arctic Water TestBed, for example is a platform to test customer's ideas or solutions and develop in real wastewater environment.

DIWA (Digital + Water) combines observations, modeling and services to support water management in real time and long term. DIWA brings together a group of experts in the multidisciplinary water sector, spatial information and information technology. Through DIWA flagship, doctoral education is boosted, with 60PhD positions, developing 3-4 programme for PhD career outside universities.

For more information: Pirkko Taskinen, Oulu water cluster pirkko.taskinen@oulu.fi

Spearhead programme of startup entrepreneurship

This programme aims to build the most attractive and effective startup ecosystem in northern Europe in Oulu. The energetic core of the ecosystem consists of innovative people whose teams are supported by diverse services, programmes, and events. The main goal of the spearhead programme is to connect Oulu's startup ecosystem to the global startup network and thereby strengthen the image of Oulu as a hub for innovation-driven business.

Talent stories: <https://oulu.com/en/talent/stories/>

Circular Cluster Oulu and digital solutions

The strong ICT sector being the central feature of Oulu region, offers excellent opportunities to find digital solution providers to support circular economy. The region of Oulu has acknowledged that and has established the Circular Economy Cluster, with the support of European funds. The Circular Economy Cluster has been established in Oulu to boost collaboration between the City and the businesses and to manage having everyone aligned and up to date regarding the latest developments, either in the field of innovation or in the field of local strategies and plans. Close collaboration partners of the circular economy cluster include, the Oulu Innovation Alliance (OIA), ICTOulu, Oulu Automotive Cluster, and the University of Oulu.

Since the beginning of 2022, the activities of the Circular Economy Cluster have gathered over 400 people in business, R&D and public sectors to discuss questions of circularity. The Cluster's main event so far has been KiertotalousAreena 2023 – Circular Arena Oulu 2023, with high class seminar speakers and a circular trade fair with over 50 companies and other exhibitors showcasing their circular solutions.

The Circular Economy Cluster's main activities include helping Cluster companies to find customers and collaborators. For this reason, the Cluster organises presentations,

matchmaking events and pitches, as well as delegation and trade fair visits. Opportunities are being sought together with domestic and foreign development companies, Clusters, and other actors.

Moreover, the Cluster connects companies with each other and also with research institutions, in order to accelerate the development of circular economy solutions and to put forward innovation. Hence, the link between business and research becomes stronger.

Another mission of the Cluster is to share information and expertise with regards to circular economy, such as company news, information on legislative reforms, funding opportunities, and potential partnerships.

According to Aila Ryhänen, Circular Economy Specialist, it is of vital importance to boost circularity by design (with an aim to reach 90%) and to build circular business models, briefly introduced below:

1. Circular materials. Designing sustainable, repairable, and recyclable products. Utilizing renewable, biobased, simple, recycled, or other circular economy materials and energy sources.
2. Sharing platforms. Multiple actors using the same services or products without ownership. Facilitating resource sharing (e.g., rental, sharing, and co-use). Often digital.
3. Extending product lifespan. Prolonging the use of products through design, social acceptability, repair, maintenance, contracts, updates, and resale
4. Product as a service. Payment for performance or functionality, not ownership. Revenue from service or lease agreements (e.g., “Oil as a Service”).
5. Resource recovery. Recovering materials and energy from waste, production by-products, and processes. Sparing use of energy and materials.

For more information: Aila Ryhänen, Circular Economy Specialist,
aila.ryhanen@businessoulu.com

Circular economy and digital business cases in Oulu

The transition to a circular economy is being significantly bolstered by advancements in digitalization and ICT solutions. These technologies are transforming traditional methods, optimizing resource use, and minimizing environmental impacts. One notable example of this transformation is the work of Mikko Hauru, CEO of a 65-year-old family-owned company recognized for its innovative approach to waste management.

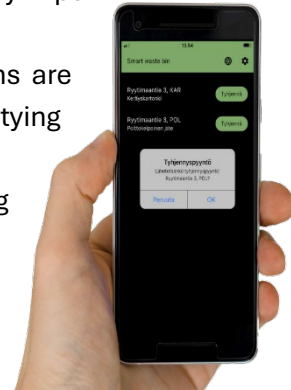
Hauru Smart: Revolutionizing Waste Management

Hauru Smart represents a leap forward in waste management through the integration of smart technologies. By fitting waste containers with Jaete sensors, the company has revolutionized how waste is collected and managed. These sensors, developed by Oulu-

based IoT system developer iProtoXi Oy, transmit real-time data to a cloud-based service. This service is accessible to various stakeholders, including authorities, enabling detailed analysis of waste types, volumes, and associated environmental impacts.

Hauru Smart’s implementation has resulted in several key benefits:

- **Optimized Waste Collections:** Real-time data allows for dynamic route planning and optimized collection schedules, reducing unnecessary trips and minimizing carbon footprints.
- **Cost Efficiency:** The technology ensures that only full bins are emptied, eliminating the extra costs associated with emptying partially full containers.
- **Enhanced Customer Experience:** Customers, including households and housing companies, can use an app to request waste collection as needed, ensuring flexibility and convenience.



Mikko Hauru explains, *"Hauru Smart is about providing our customers with smart solutions to problems such as overflowing bins and reducing our carbon footprint at the same time. This benefits both our customers and the environment."*

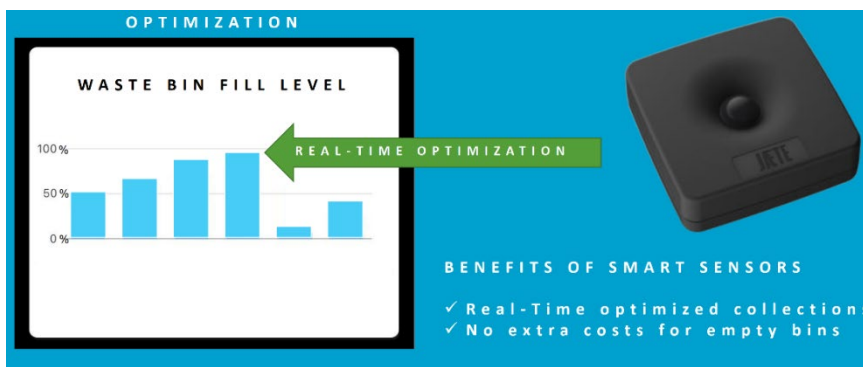
Technical Innovation with Jaete Sensors

The Jaete sensor is a cornerstone of Hauru Smart’s success.

Designed to withstand Finland’s harsh weather conditions, including ice, snow, and water, these sensors are built for durability and long battery life. The sensors measure various parameters such as surface level, temperature, humidity, and location, providing comprehensive data for optimizing waste management.

iProtoXi Oy’s focus on low-power IoT solutions facilitated the development of Jaete, which integrates seamlessly with customers' logistics and route optimization systems.

This integration supports automated dynamic routes based on real-time occupancy data, streamlining logistics and customer service operations.



Expanding Digital Solutions with Wastebook Oy

Another key player in the digital waste management arena is Wastebook Oy. This Oulu-based company leverages IoT technology from iProtoXi Oy to address waste management challenges. Wastebook's solutions include fitting sensors onto various waste containers to monitor fill levels and environmental conditions, thereby optimizing waste collection schedules and reducing operational costs.

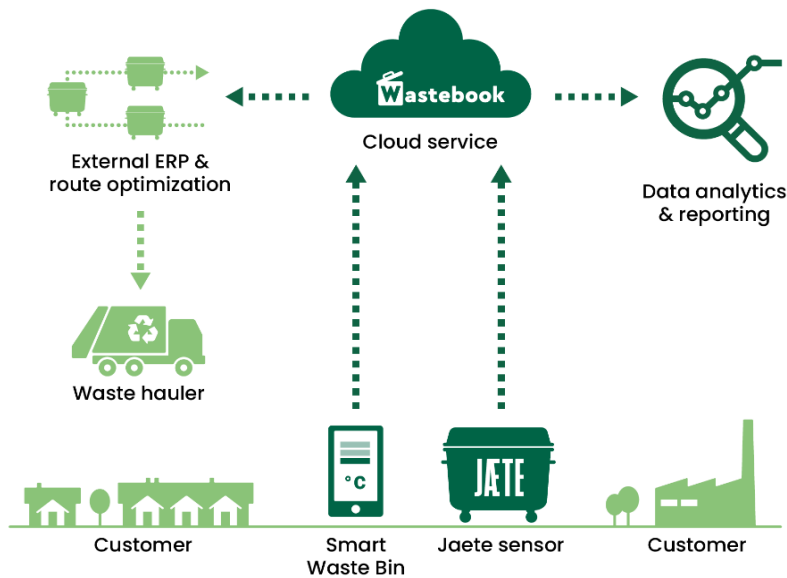


Figure 1. Source Hauru, Wastebook Oy, iProtoXi Oy

Wastebook's approach benefits multiple stakeholders:

- Waste Management Operators: Integration with logistics systems for automated route optimization and dynamic collection schedules.
- Municipalities and Companies: Monitoring and optimization of waste management efficiency, supporting sustainable development reporting.

The smart waste bin app developed by Wastebook enables residents to request waste collection as needed, promoting efficiency and cost savings. For example, housing companies can save significant amounts annually by choosing appropriate waste containers and optimizing collection intervals.

Beyond Waste Management: The Danyel Simulation Platform

Joonas Heikkinen, CEO of Digikierto Oy, presented the Danyel simulation platform, designed for optimizing profitability and emissions in manufacturing and energy production. This platform supports ecosystem-wide planning, from raw materials to delivery, and is suitable for companies optimizing existing operations or planning expansions.

The Danyel platform has been applied to various projects, such as:

- Muhos Biopark: Modeling over 30 production facilities to generate investment-ready cases with automatically generated OPEX data.
- Steel Surface Treatment Company: Simulating logistics and production concepts across multiple locations to optimize profitability and reduce emissions.

Recent learnings from these projects highlight the importance of logistics optimization

Oulu’s investment in education

The most educable city in circular economy

Circular economy solutions call for a new mindset and new kinds of value chains. They call for learning that requires research, development, experimentation, successes, and sometimes also failures.

The City of Oulu wishes to be the most educable city in circular economy while also promoting the development of stakeholders.

Oulu City has built their own ”Learning Stream for Sustainable Future” which takes us to the know-how and lifestyle of a sustainable future.

The learning stream has three main themes. Each theme has school-level specific goals, activity examples and supporting topics and organizations.

Through these themes, the stream advances towards eco - social lifestyle and individuals - from a realistic picture of the situation towards a desirable future.

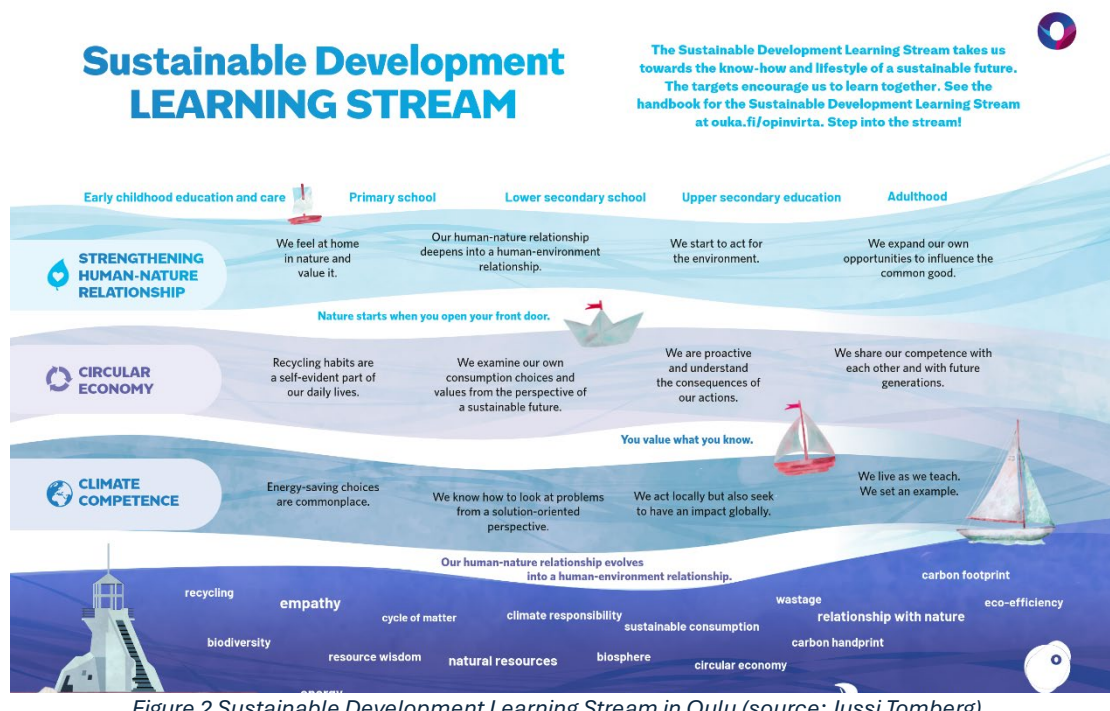


Figure 2 Sustainable Development Learning Stream in Oulu (source: Jussi Tomberg)

Climate Upper Secondary Schools

This autumn, six upper secondary schools from Oulu, Ii, Kuusamo and Ylivieska will take climate actions seriously as they participate in the City of Oulu's project "Climate Upper Secondary Schools".

Each school will find out their current carbon footprint and create an action plan on what they could do as a community to lower the school's environmental burden.

"It means simple choices made in everyday life. For example, not taking hundreds of small juice cartons to a school trip where they would end up filling 18 garbage bags. Instead, everyone could just take their own bottle that can be filled. The values of the school have a major impact on students," says education developer Jussi Tomberg, the leader of the project.

As support for planning their climate actions, the schools can use a digital learning environment called Repair Manual for Schools. Together with Häme University of Applied Sciences, they will also design a climate calculator tailored for schools.

For more information: Jussi Tomberg, Senior Advisor for Sustainability

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