Developing and Managing Innovation Ecosystems in the Circular Economy

- Outline of a Digital Monitoring Tool

Innovation ecosystems are vitally important for facilitating sustainable regional economic growth and stakeholder cooperation, particularly within the circular economy. This policy brief examines the new digital monitoring tool developed by the Council of Tampere to compile relevant data on ongoing circular economy initiatives and actions, including information on essential actors, material flows and current stakeholder collaborations.

This policy brief outlines the main aims and features of the digital monitoring tool and makes recommendations for how to support the development and management of effective innovation ecosystems, such as the importance of fostering a culture of open data sharing amongst key regional innovation actors.

Photo: Tampere / Juha Suhonen

BACKGROUND: REGIONAL INNOVATION ECOSYSTEMS AND THE CIRCULAR ECONOMY

Policy- and decision-makers have embraced regional ecosystem-based thinking in innovation policy, as increasing cooperation between key public and private stakeholders is needed to turn research into marketable products and services. The European Commission is promoting place-based innovation ecosystems as an important tool in facilitating sustainable regional economic growth and development (JRC Report 2017). Regional innovation ecosystems are vitally important in the development and implementation of the circular economy, where stakeholders along the production and consumption chain must work closely together to increase the use of renewable products and reduce the consumption of raw materials and energy (European Environmental Agency Report 2016).

Innovation ecosystems are dynamic and co-evolving communities of diverse actors who drive regional economic growth through close collaboration. Ecosystems describe sets of actors (e.g. companies, research institutes and public authorities) and their operational dynamics in a given environment. Innovation ecosystems are more dynamic than traditional clusters, as they are not industry-specific or geographically confined, but are open, self-organized and promote interdependent cooperation between diverse stakeholders. Collaboration through innovation ecosystems is important in a globalized economy in which industries and businesses can no longer work alone and must pool resources to achieve the critical mass needed to remain competitive. This is particularly the case in relation to the circular economy, which depends on interaction between different stakeholders across regions, both nationally and internationally.

Developing and implementing the circular economy is a complex process that requires fundamental change throughout the value chain, from product design and production processes to new business models and consumption patterns (European Environment Agency Report 2016). This requires considerable evolution in industrial practices, with a view towards overcoming challenges such as a lack of investment and low levels of stakeholder collaboration. The development of effective regional innovation ecosystems can contribute to this transition and help regional businesses and citizens maximize the benefits of the circular economy agenda, including resource security, cost savings, a cleaner environment and job creation (European Environmental Agency 2016). The Ellen MacArthur Foundation has been working with Google to explore what role digital technology can play in helping regions make the transition to the circular economy. Their joint report, Cities in the Circular Economy: The Role of Digital Technology, argues that digital technology offers opportunities to enhance transparency in product and material flows and to increase links between producers and consumers via the collection and analysis of data on materials, people and external conditions (Ellen MacArthur Foundation 2017). This requires digital monitoring using real-time data, but there is a large amount of inefficiently used data across different resources. To tackle the problem of scattered data and reap the benefits of the vast amounts of existing information available, the Council of Tampere Region, Finland, has initiated a process to develop a real-time open data-based visualization and analysis tool for monitoring the development and management of circular economy ecosystems.

CASE STUDY: DEVELOPING CIRCULAR ECONOMY ECOSYSTEMS IN THE TAMPERE REGION

The monitoring and analysis of local ecosystems has long been part of innovation management in the Tampere Region. Local innovation stakeholders have increasingly been interested in the need to complement existing analogical indicators and metrics with new digitalized technologies that can visualize existing ecosystems. Tampere University of Technology, VTT Technical Research Centre of Finland and Stanford University conducted research that focused on visual network analytics of innovation ecosystems (Russell et al 2011). This research caught the attention of the Council of Tampere Region, which decided to pilot an ecosystem-monitoring tool for the circular economy under the BSR Stars S3 project. The circular economy was chosen as a key theme because the transition to a circular economy is regarded as an essential contributory factor in the Tampere Region's innovation goals, i.e. developing a sustainable, low-carbon, resource-efficient and competitive economy. Petri Räsänen, Director of Innovation and Foresight at the Council of Tampere Region, notes that:

"In the Tampere region, the circular economy is one of the focus areas in the smart specialization strategy, and it is considered highly important. Our role is to coordinate the development of a regional circular economy by providing information on its potential and facilitating cooperation between circular economy actors locally, nationally and internationally. With the help of the ecosystem tool, we aim to monitor the development of the circular economy ecosystem and the effectiveness of policy measures within the field."

In spring 2017, the Council of Tampere Region launched a pre-commercial procurement process for developing the ecosystem monitoring tool. As part of this process, relevant software companies were

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Director of Innovation and Foresight at the Council of Tampere Region

invited to design a tool for mapping and analyzing the circular economy ecosystem in the Tampere Region, including developing and piloting a prototype. Two companies, Vainu.io and Dexmen Oy, were chosen to develop their own concepts of the ecosystem tool in collaboration with the Council of Tampere Region. The conceptualization and prototype phase has also been a transnational activity, in which stakeholders from other countries were invited to discuss the development of the ecosystem tool in workshops and virtual meetings (via Skype) as part of the BSR Stars S3 Project.

TAMPERE ECOSYSTEM MONITORING TOOL Q&A

What is the ecosystem monitoring tool?

The ecosystem tool consists of online software that compiles relevant data on circular economy ecosystems. It converts data into a user-friendly form that visualizes key actors within the ecosystem and how they interlink. The tool creates the basic information needed to build up an overview of the local circular economy and is constantly updated with real-time data. The tool enables the monitoring of ecosystem development – both temporally and regionally – and reduces the time needed to create regional overviews. The ecosystem tool will be an integral part of ecosystem-based development and knowledge management, and is a first step towards creating digital monitoring tools for innovation ecosystem management.

What is the main aim of the ecosystem monitoring tool?

The Tampere Region has been analyzing and monitoring its regional innovation environments and ecosystem for a long time. This monitoring process has been based on traditional indicators and information sources, such as official statistics (e.g. Statistics Finland databases) or case studies. However, the official statistics are updated intermittently and only offer information at a regional/local authority level. A need was therefore recognized for more up-to-date and actor-specific information. The main aim of the ecosystem tool is to build up a better understanding of the actors present in the innovation ecosystem and the networks they form. This requires not only new data sources, but also new ways of combining data from several different sources. It would be time-consuming and highly ineffective to gather and process the various data sets and search for relevant actors manually. Digital solutions, however, enable information to be gathered and combined efficiently and automatically.

Why does the ecosystem tool focus on the circular economy?

The circular economy is increasingly relevant at international, national and regional levels, but there is still little information available on how to develop, implement and monitor effective initiatives. The ecosystem tool is designed to combine ecosystem thinking with the circular economy by providing diverse, real-time information on circular economy ecosystems. Growth in the circular economy depends on cooperation between different actors across regions and sectors. The ecosystem monitoring tool strengthens the conditions for growth by providing open information on circular economy ecosystems that can foster stronger collaborative links between

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> **CEO of Dexmen Oy**

companies, public organizations and researchers. The added value of the tool is that it is using real-time digital data and metrics enables better analysis and monitoring of operational (innovation) environments by introducing both new and existing knowledge into the regional development policy process. According to Harri Räisänen, CEO of Dexmen Oy, "the ecosystem tool makes it easier and faster to identify the central actors and to create a situational picture of the local circular economy. The tool will save everyone's time, from business developers to researchers and public officials, who would otherwise have to collect this data manually."

How does the tool work and what are its key features?

The tool uses data from multiple sources to provide information on the regions' circular economy actors and their interactions, the ecosystem structure, key stakeholders and emerging circular economy themes. The software visualizes data in an easily understandable, user-friendly form, using information from both open databases (the internet) and private databases (e.g. closed national databases). Some of the data is retrieved by web crawling, i.e. the tool uses circular economy keywords to process website information. Through web crawling, the tool categorizes circular economy actors, such as companies, into different ecosystems by analyzing the terms used on their websites.

The tool gathers knowledge of regional actors and how they are interlinked within the context of company location. The circular economy's strength lies in actor constellations, and therefore the tool's main
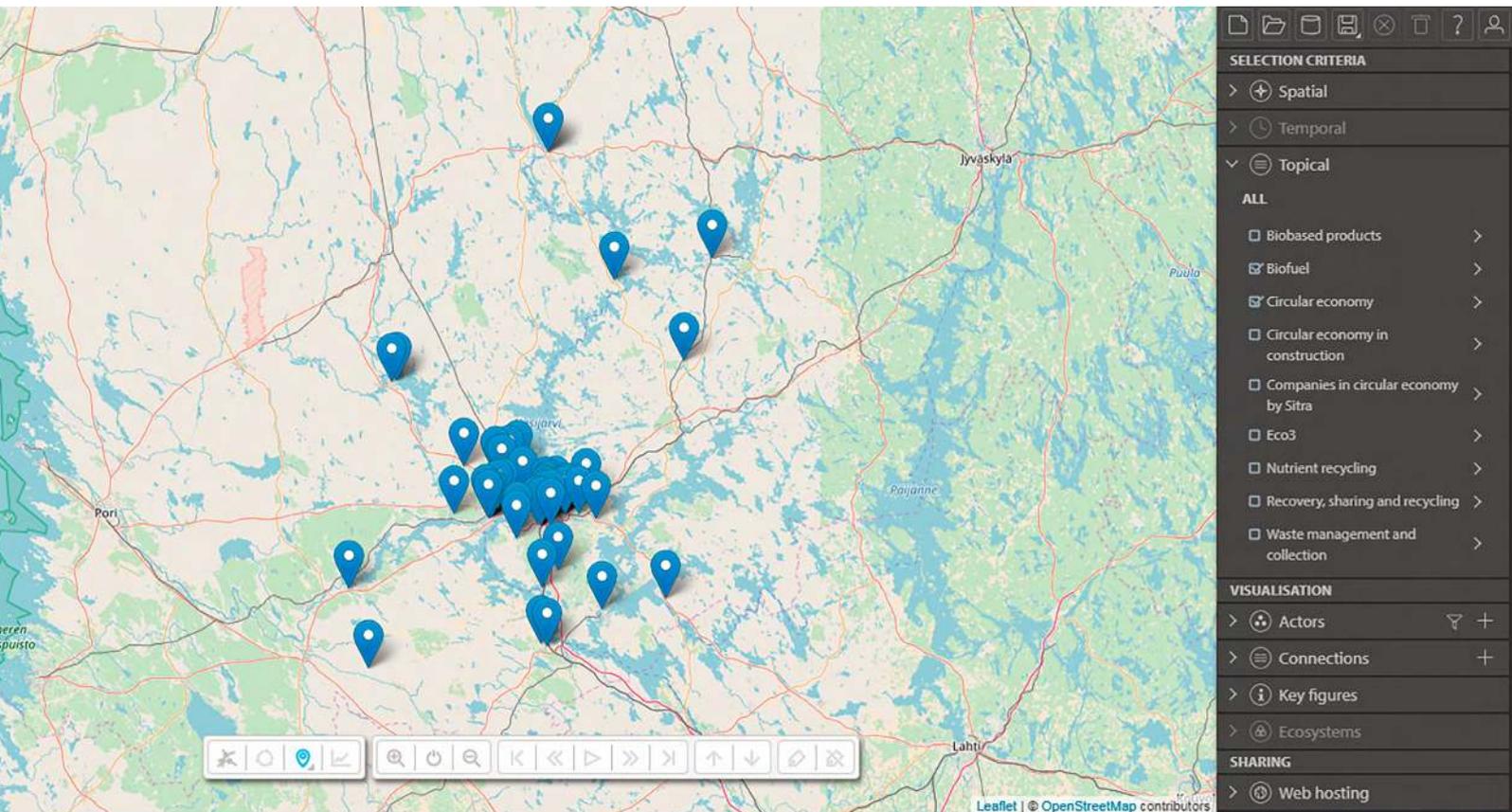
Photo: The ecosystem-monitoring tool is an online software that compiles real-time data and builds up an overview of the local circular economy. The tool visualizes key actors within the ecosystem and how they interlink / The Council of Tampere Region

THE TOOL HAS THREE LEVELS OF OBSERVATION:

Topics: Highlights key circular economy actors in different thematic areas (e.g. bioenergy, nutrient recycling, bio-based products)

Flows: Outlines the different flows of, e.g. raw materials and waste

Projects: Shows connections between actors working in ongoing collaborative circular economy projects (planned for the commercial version of the tool).

advantage is its ability to categorize circular economy actors into thematic groups. For instance, it will be possible to monitor different circular economy sub-ecosystems, such as those that focus on e.g. textile

circulation or fertilizers. The tool's visualizations allow for an analysis of ecosystem development, including of growing and declining thematic areas, and both strong and missing links between actors.

Which stakeholders is the tool aimed at?

By providing necessary data on key regional stakeholders to help focus strategic decisions, the tool will serve local, regional and national authorities responsible for developing innovation policy, regional development, S3 strategies, as well as ecosystem and cluster policy. The tool will also be useful for industries and companies looking to develop their own circular economy processes and business opportunities by helping them to visualize potential networks, projects and material flows. Companies can also use the tool to support investment and location decisions, as it identifies relevant actors in the area. Finally, the tool can be used by researchers interested in studying innovation ecosystems, the interconnections between different actors and the capacity for greater co-operation and industrial symbiosis at regional, national and international level.

Photo: *Interaction between circular economy stakeholders was promoted in BSR Stars S3 project also by organizing matchmaking events that focused on challenge-based discussion between public, research and private actors / Joonas Tähtinen*

CONCLUSIONS AND RECOMMENDATIONS

The ecosystem tool makes circular economy data open, transparent and, most importantly, available, and therefore contributes towards ecosystem-based development and management by connecting key stakeholders throughout the production and consumption chain. The tool also fits in with regional smart specialization schemes that identify domains within the circular economy. Although the tool is currently in the prototype phase, it already shows significant potential for helping to facilitate the monitoring of innovation ecosystems in the circular economy. A real-time tool that compiles data from different sources is a step towards realizing the potential of open (and closed) data in developing and implementing circular economy activities. As the CEO of Dexmen Oy, Harri Räisänen, points out, "in the end, the tool can enable bigger real-time overviews of the circular economy, even at national level. Currently, we are in the process of developing the tool, and its success will be due to the databases available to it."

The prototype ecosystem tool is currently being tested within the context of the circular economy. However, if successful, it is envisioned that the tool can be used to cover other thematic areas (e.g. smart cities, industrial symbiosis, advanced manufacturing and the experience economy), and to create synergies between different funding mechanisms. Indeed, providing that relevant data is made easily available, the tool could be used in other sectors, and offers a new approach to regional innovation ecosystem management. Data availability is an essential factor when it comes to the usefulness of the tool. For example, the dynamics and engagement between different actors can only be visualized if there is data covering these interactions.

Based on interviews with key actors from the Council of Tampere and Dexmen Oy that have been involved in developing the tool as part of the BSR Stars S3 project, the following key recommendations are outlined for formulating regional innovation ecosystems:

■ Establish an up-to-date overview of national and regional innovation ecosystems, identifying potential challenges in their development (e.g. actors missing in the value chains) and explaining the potential benefits of participation to relevant actors.

■ Ensure funding instruments have a stronger focus on developing innovation ecosystems and encouraging data production, especially in selected smart specialization fields of the region.

■ Promote a culture of data production and sharing, including the development of shared infrastructure, data models and APIs (application programming interfaces), as well as incentives and regulations for data sharing.

■ Public authorities to raise awareness of the benefits of data sharing and the potential of open data to create new business opportunities and partnerships (e.g. in the transportation and energy sectors).

■ Ensure the use of commensurate and standardized data in machine readable format, with terms and conditions that allow the re-use of data, such as, already existing globally established standards of data formats, structures and APIs that make it easier to utilize and combine data at different levels.

■ Private stakeholders need to consider what part of their data could be made open and the possibility of using anonymized data, by identifying which data is commercially sensitive and what can be made public.

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