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New research group wants to promote sustainability of future circular bioeconomy society



Kuva [vero bouss Pixabaystä](#)

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New research group promoting sustainable solutions and business

Four research groups started at Tampere University of Applied Sciences (TAMK) in the beginning of February 2020. TAMK is an acknowledged actor in the research, development and innovation (RDI) activities and an attractive multidisciplinary educator with over 10 000 students and over 40 degree programmes. The Master's degree programme in Risk Management and Circular Economy (RIMCE) is a forerunner. This is an excellent basis for the developmental actions.

Target of the “Next level circular bioeconomy actions” research group is to strengthen TAMK's impact as a promoter in future sustainable solutions and business. It originates from the existing expertise and research projects, and meets the challenge of a multidisciplinary team sharing a common goal. In this article we describe TAMK's research topics and achievements in circular bioeconomy, and aims and actions of the new research group. TAMK's role in the regional innovation ecosystem is also discussed.

From table to table – research closing nutrient and material loops

No food is grown without fertilization and energy input in agriculture. Due to diminishing phosphorus reserves, nutrient recovery and reuse is essential in the future. Promising results have been achieved in terms of using, for example, source-separated urine as such, or nutrients recovered from urine, as a fertilizer. Tampere University of Applied Sciences has coordinated in 2015–2019 several research projects related to nutrient recovery and reuse (Viskari et al., 2018, Malila et al., 2019b), and therefore has a lot of experience in promoting circularity and sustainable livelihoods. The research and development also aim at raising discussion about the acceptability, safety and administrative challenges of these fertilizer products. Furthermore, different technological solutions, like a mobile nutrient-recovering toilet unit in the field use have been tested (Malila et al., 2019a).

Food production, including the whole value chain, is one of the key factors in lowering carbon emissions. Also, the source of protein in our diet has importance. Concrete outcomes of the research projects are for example the initiation of Tampere Hall roof plantations and edible park of the Lielähti Manor, in the project where urban agriculture was implemented and pilot plantations established in the city of Tampere (Asikainen et al., 2017). Use of local and seasonal food has been promoted by recipe development and piloting, with special emphasis on seasonal ingredients and local foodstuffs (Elinvoimaa lähiruosta, 2018). In addition, new sustainable food products, menus and business models have been created to Särkänniemi area as an outcome of carbon-neutral food chains development, [which is more widely described also in this journal](#) (Heikkilä & Lindell, 2019; Heikkilä & Lindell, 2020). Together with five research partners, know-how of economically feasible insect production has been developed. Towards insect bioeconomy project, in which TAMK participated, searched for the latest know-how on biomass, that could be utilized in insect rearing systems, profitability of production, and the cornerstones of the economy, new business models, insect product development, consumer preferences, and the health and welfare effects of insect products (Vihuri & Wickman-Viitala, 2020).

Food and packaging industries aim at using sustainable packages and replacements for plastics in packaging. In Finland, oat paper is the first circular economy package application utilizing side streams of the food industry (Hägglom & Viitaharju, 2020). Other side streams like barley shells, mash, peels of carrots and potatoes are the next target of the research (Ecodesigncircle, 2020). Alongside technical development of innovative materials, an important activity has been a dialogue between creative industries and multidisciplinary student teams. This has resulted in bio-based package and service innovations commissioned by the industry (Hägglom et al., 2017). To promote low carbon bio-based society, a testing environment for biodegradability and compostability of materials and products is important. A testing environment has been built and is available for research and testing of biodegradable materials and products (PIHI, 2020).



Figure 1. How would it sound to you to purchase an oat bread which is packed in a bag partly made of oat shell waste? This might be possible in near future, while first pilot bags have already been manufactured.

Actions are needed to reach the next level

Frølund and coworkers have studied key elements of collaboration between universities and companies for a long time. They underline that collaboration between companies and universities is a critical driver of the innovation economy, and that even smaller, more regionally oriented companies have come to believe that universities are key ecosystem stakeholders in supporting and shaping their regional economies. However, the distributed governance of expertise at universities is recognized one of the key problems in university-industry collaboration (Frølund et al., 2018). To tackle the challenge of distributed governance, need for regular stakeholder meetings in the Campus was identified but also the need to walk off campus. Universities of applied sciences are in the core of regional innovation ecosystems, and although there is never enough communication and interaction, regular and jointly agreed meetings make stakeholder collaboration systematic.

Four types of actions were identified to increase the impact of the research and development in the field of circular economy:

1. Better communication of present RDI strengths and competences
2. Strengthening stakeholder relationships and analysis of their needs
3. Strengthening relationships with international partners and customers
4. Conceptualizing ideas based on the needs of the stakeholders.

To sum up, mapping of one's own expertise and experts, more communication and interaction with national and international stakeholders, and development of one's own

processes to support flexible collaboration are key factors. This might look self-evident but still needs a systematic approach and resources, which are now available at TAMK.

The next level in practice

Previous projects and studies have revealed that there is a lot of unused potential in Pirkanmaa region to promote circular economy in several fields of industry (Halonen et al., 2017; Ramboll, 2016). Also, there is a lot of opportunities to develop circular economy service business, while so far the focus has been mostly on material circulation and less on services (Ramboll, 2016). Coordination of FISS (Finnish Industrial Symbiosis System) regional workshops is not yet organized in Pirkanmaa region, which is an opportunity for TAMK to take the leading role. Purpose of the workshops is to find companies and other actors in the region, which have exploitable waste and side streams to be used as a resource for new products and services. Regionally, industrial symbiosis put circular economy in practice.

Construction industry is a significant field of business in the national economy. TAMK is one of the biggest and strongest construction and civil engineering educator in Finland. For promotion of sustainable circular bioeconomy, there are already research actions, for example in monitoring and measurement of hazardous substances in construction materials, which is crucial in demolition and renovation projects, in terms of occupational and environmental health (Viskari et al., 2018, 2019). Further actions will include research and development in carbon neutral construction, promotion of wood construction and taking sustainable housing and human viewpoint into focus. New initiatives have already been mapped and cooperation with construction companies, urban development actors and cities are initiated.

Combining nutrient recycling with new nutrient recovery technologies in an urban environment, creating and initiating sustainable food systems and packaging materials, and promoting new entrepreneurship, products and business opportunities around these themes will be key drivers in the future actions of the research group. For example, in the city of Tampere the new housing area of Hiedanranta and development of Särkänniemi Theme Park sustainable food street offer extremely innovative live labs for the development.



Figure 2. Implementation of alternative sanitation technologies and nutrient recovery in Hiedanranta area in the City of Tampere (Photo: Trung Dang).

The way forward

The research group approach is a development project as such. One of the goals is to create continuity of research topics instead of separate projects. Collecting TAMK's circular bioeconomy projects together made existing capacity "visible". Analysis of the content of the projects resulted in identification of "from table to table" research theme, presented in this article. Further, six different internal stakeholder groups have been identified also promoting sustainability. TAMK's role in the regional innovation ecosystem is important not only through RDI activities but also because of the capacity of international networks and collaboration.

The aims, actions and opportunities we have described here do not correspond with the traditional research group. We have deliberately chosen the strategy with strong stakeholder involvement, both inside and outside the organization. We want to strengthen TAMK's impact as a promoter of circular bioeconomy, which we associate with proactivity, co-creation and even crazy multidisciplinary ideas with a strong involvement of students as innovators. In our vision, solutions for challenges in the future circular society are not conventional, and that is why new multidisciplinary and multi-stakeholder platforms are needed.

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