



DIRECT HUBS

DIRECTIVE REGENERATIVE CO-CREATIVE
TRANSFORMATION HUBS

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Kurzfassung

Das heutige urbane Ernährungssystem zeichnet sich durch einen linearen Ressourcenfluss aus ländlichen Gebieten in Städte aus, wo der Großteil der produzierten Lebensmittel konsumiert und organisches Material als Abfall entsorgt wird. Städte tragen dabei das enorme Potential von Ressourcensenken zu Ressourcendrehkreisläufen zu werden. Im Zuge des Projekts [DIRECT HUBS](#) wurden Umsetzungsmöglichkeiten kreislauffähiger, urbaner Ernährungssysteme ermittelt und hierzu ein Konzept sogenannter Kreislauf-Hubs entwickelt, welche als dezentrale Orte der urbanen Lebensmittelproduktion, sozialen und technologischen Transformation, Ressourcenumwandlung und -rückgewinnung, sowie als Experimentier- und Lösungswerkstätten für ernährungsrelevante und damit zusammenhängende Bereiche in der Stadt dienen können. Dabei folgen sie den drei Grundprinzipien: Kreislauffähigkeit, Naturbasiert und Partizipation. Alle Ergebnisse des Projekts DIRECT HUBS konnten in einen Leitfaden zur Replikation des Kreislauf-Hubs-Konzepts einfließen. Dieses wird zudem in einem Auftrag der Stadt Wien weiterentwickelt und für die Implementierung im Stadtentwicklungsplan 2035 konkretisiert. Die Zugänglichkeit der Ergebnisse kann durch die niederschwellige Konzeptionierung der Projekt-Webseite „[kreislaufwirtschaft.at](#)“ gewährleistet werden, die auch weiterhin als Plattform für Wissen und Information rund um Kreislaufwirtschaft dienen soll. Alle relevanten Ergebnisse wurden inhaltlich in die Webseite integriert, oder über den Blog auf dieser disseminiert und sind frei zugänglich.

Schlagworte: Kreislauf-Hubs, Ernährungsraum Stadt, Kreislaufwirtschaft, kreislauffähige Lebensmittelsysteme, Konversionstechnologien, Nährstoffrückgewinnung

Abstract

Today's urban food system is characterized by a steady flow of resources from rural areas to cities, where most of the food is consumed and organic material is disposed of as waste. Cities have the enormous potential to transform from resource sinks to resource hubs. In the course of the [DIRECT HUBS](#) project, implementation possibilities of circular, urban food systems were identified and a concept of so-called circularity hubs was developed, which can serve as decentralized places of urban food production, social and technological transformation, resource conversion and recovery, as well as experimental and solution workshops for nutrition-relevant and related areas in the city. In doing so, they follow the three basic principles: circularity, nature-based and participation. All the results of the DIRECT HUBS project could be incorporated into a guideline for replicating the circularity hubs concept. This will also be further developed on behalf of the City of Vienna and concretized for implementation in the Urban Development Plan 2035. The accessibility of the results can be ensured by the low-threshold conception of the project website "[kreislaufwirtschaft.at](#)", which will continue to serve as a platform for knowledge and information about the circular economy. All relevant results have been integrated into the website or disseminated via the blog and are freely accessible.

Keywords: circularity hubs, urban food space, circular economy, circular food systems, conversion technologies, nutrient recovery

Introduction

In the course of the [DIRECT HUBS](#) project, implementation options for circular, urban food systems were developed in the form of a concept of so-called circular hubs, which can serve as decentralized places of urban food production, social and technological transformation, resource conversion and recovery, as well as experimental and solution workshops for food-relevant and related areas in the city. Circularity hubs are guided by the main principles: participation, nature-based innovation and circularity.

The following report presents the main results and procedures for the development of the concept of circularity hubs and their implementation in the urban food area.

Stakeholder mapping and Best-Practice-Collection

The project started with the research of key local or regional stakeholders as part of a multi-stakeholder mapping. The aim was to make existing or emerging social ecosystems visible as well as to support innovative processes for sustainable development by stakeholders who have not yet exchanged ideas.

The mapping was continuously supplemented during further project phases and also includes the research of local, regional and international best practice projects in the context of circular food production in the city. Research of interested stakeholders in Vienna's districts was carried out using the "snowball principle". At the same time, communication channels were established to inform interested stakeholders about DIRECT-HUBS topics. Social and eco-entrepreneurs in Vienna and on the urban periphery were identified as a key stakeholder group, who can contribute particularly actively to the public discourse with their business models and are interested in forming cross-sectoral partnerships.

In a further step, the results of the stakeholder mapping and the determination of the needs, possible synergies, obstacles and solutions of different, relevant stakeholder groups were summarized in a [stakeholder map](#)¹ using the example of the Viennese food region and published graphically on kreislaufwirtschaft.at.

In a best practice collection, 100 international examples were evaluated on the basis of five overarching categories. The 30 inspiration projects with the highest score were contacted and published in profiles on the www.kreislaufwirtschaft.at² page. National projects have also been added to the stakeholder map.

The urban structure of Vienna and possible integration of circularity hubs

Biogenic waste and wastewater streams and resource potentials for a circular food region Vienna

In order to estimate the current status and the potential of secondary resources for a circular food region of Vienna, relevant biogenic waste and wastewater quantities from statistics for the reference year 2019 were used. The resource conversion potentials were quantified based on the amount of waste and wastewater. In 2019, more than 89 thousand

¹ <https://kreislaufwirtschaft.at/ernaehrungsraum-wien-stakeholder-map/>

² <https://kreislaufwirtschaft.at/entdecken/#projekte>

tons of organic waste were generated in Vienna. This corresponds to more than 47 kg of biogenic waste per person³. The proportion of biogenic waste in residual waste is higher in Vienna than in the other provinces. At 39%, this is well above the average of 29% in Austria in the reference years 2018/19⁴.

The aim was to assess the potential of circuitry of resources in the Vienna food region. For this purpose, an Excel-based input-output calculation tool was created, which provides approximate values for the potentials from selected recovery processes with which components of biogenic waste and wastewater could be recovered and returned to food production. Ten recovery processes were selected in exchange with the project team and include technologies that can be implemented on a decentralized scale.

As an example scenario for the implementation of decentralized exploitation methods, a hypothetical district was chosen: the Rothneusiedl urban development area. Two example scenarios for the decentralized and circular recovery of waste and wastewater were calculated. Scenario 1 and Scenario 2, for the recovery of resources from wastewater, are to be understood as alternatives (either-or): Scenario 1 for the separate collection of black water and its liquid and solid fractions and Scenario 2 for the collection and processing of wastewater without separation.

Table 1: Resource potentials of wastewater scenarios 1 and 2 in the Rothneusiedl application example

Wastewater scenario	Indicator	Specification/ Parameters	Quantity
Scenario 1	Water supply	Water recovery for irrigation	8.100 m ³
	Nitrogen	in liquid fertilizers (example Aurin)	80 t
	Phosphorus		7.30 t
	Nitrogen	in plant soil (example Terra Preta)	11 t
	Phosphor		3.66 t
	Scenario 2	Düngerpotenzial	Area of crop cultivation whose fertiliser requirements could be met with secondary nutrients
703,39 ha			
Water supply		Water recovery for irrigation – 50% constructed wetland	892,120 m ³

The comparison of energy generation in the current state with the circular scenario shows a lower energy output, as higher amounts of waste are recovered. The recovery of all coffee grounds by a mushroom cultivation plant saves over 1 ton of biogenic waste for collection and recycling and produces 310 kg of edible mushrooms. By using decentralized systems, some of the nutrients contained in wastewater, such as nitrogen or phosphorus, can be recovered. For the evaluation of the recovery methods for wastewater treatment and processing, 2 scenarios were defined, which are compared with the currently used processes of centralized wastewater treatment in wastewater treatment plants. One advantage of scenario 1 is the saving of fresh water when going to the toilet. Scenario 2 uses recycling technologies that do not require separate collection and treatment of

³ I. and T. Federal Ministry for Climate Action, Environment, Energy, Mobility, "The Inventory of Waste Management in Austria - Status Report 2021," 2021.

⁴ P. Beigl, "Evaluation of the Composition of Residual Waste in Austria 2018 / 2019," 2020.

different wastewater fractions. The resource saving potentials in the Rothneusiedl application example are summarized in Table 1.

With the treatment technologies in scenario 1, 8,100 m³ of water can be recovered, in scenario 2 it is 892,120 m³. The fertilizable area, on the other hand, is higher in scenario 1 (1,092.38 ha) than in scenario 2 (703.39 ha).

For the calculated quantities, the protein content was compared in order to determine how many kilograms of alternative protein sources can be replaced. For the example calculation, a recycling share of 25% of the biogenic waste generated in the urban development area was chosen. With a population of 20,000, this corresponds to a quantity of 235 tons/year. This results in 117.61 tons of insect larvae, as well as 11.45 tons of nitrogen fertilizer replacement.

Legal framework in Austria

In order to provide a low-threshold overview of the legal situation in various areas related to the circular economy and circular hubs, four [Factsheets](#)⁵ were produced on the following topics:

1 Food waste

The legal situation regarding the rescue and transfer of food is being clarified. Good practice examples of food rescue in Vienna show where one can volunteer.

2 Circulation of nutrients

The recycling of nutrients is already being carried out in Vienna by the MA48. Other small-scale, decentralized approaches are also described that can be applied to Vienna. In addition, questions about the use of nutrient-rich waste generated in one's own household are answered.

3 Water reuse

How water can be reused, whether it is allowed to reuse wastewater from one's own household and what needs to be considered when treating water with nature-based solutions.

4 Single-use plastics

Describes what the goals for the avoidance of plastic waste in Austria are, which measures are in force or are to be implemented in the future, as well as examples of where unpackaged food can be bought.

For this purpose, the current and foreseeable legal situation at various levels (global, EU and Austria) was researched. Existing knowledge from previous projects was integrated, legal text databases such as [Eur-Lex](#)⁶ and [RIS](#)⁷ were used, and examples from the best practice and stakeholder mapping were implemented.

Identification of underutilized infrastructures

The aim was to define urban and peri-urban underutilized infrastructures, such as vacancies, that can be repurposed as circularity hubs as well as to determine criteria and strategies to identify such unused spaces in cities. On the basis of the defined criteria, vacant buildings and parts of buildings can be evaluated for their conversion possibilities in order to determine a target-oriented use of the offered parts of the building and to

⁵ <https://kreislaufwirtschaft.at/durchstarten/rechtliches/>

⁶ <https://eur-lex.europa.eu/homepage.html>

⁷ <https://www.ris.bka.gv.at/Bund/>

elaborate the possible circularity hub services that can be made available to the surrounding neighborhood or the district (see Table 2).

Through an extensive literature and best practice analysis, a set of criteria was developed to identify underutilized infrastructures that are suitable for the installation of circular hub-related services. These can be adopted and applied e.g. by civil society, co-creative projects, and urban development programs. In addition, these criteria are adapted and applied to an [interactive online map for Austria](#)⁸, in which people can enter and share underused infrastructures.

Table 2: utilization of building parts and best-practice-examples of implemented solutions

Building Parts	Utilization	Best-Practice-Examples
Underground space	Hydro- & Aquaponics	Underground Green Farming (CH) ⁹
	vertical farming & Hydroponics	Growing Underground (UK) ¹⁰
	Mushroom cultivation	Hut & Stiel (AT) ¹¹
	Insect breeding	Callio edible insects from Mine (FIN) ¹²
Facades	Greening	Vertikal Green (AT) ¹³
	Vertical farming	LiveWall (USA) ¹⁴
	Wastewater recycling	Rathaus von Venlo (NL) ¹⁵
	Rainwater harvesting	vertical rain garden (UK) ¹⁶
Roofs / roof surfaces	Greenhouse production	Lufa Farm (CND) ¹⁷
	Aquaponics & Hydroponics	Roof-Water-Farm (GER) ¹⁸
	Urban Gardening & Greening	Smart City Rooftop Farming (AT) ¹⁹
	Solar energy & Rainwater harvesting	Optigrün (GER) ²⁰

⁸ <https://kreislaufwirtschaft.at/karte/>

⁹ SCAUT Underground Green Farming Available online: <https://www.scaut-association.com/en/Home> (accessed on 2 December 2021).

¹⁰ Growing Underground Available online: <https://growing-underground.com/> (accessed on 19 November 2021).

¹¹ Hut und Stiel Available online: <http://www.hutundstiel.at/> (accessed on 15 December 2021).

¹² Callio Edible Insects From Mine Pyhäjärven Callio Available online: <https://callio.info/2017/wp-content/uploads/CEIFM-press-release-december-2020.pdf> (accessed on 2 December 2021).

¹³ GmbH, V.G. Vertical Green Available online: <https://vertical-green.at/> (accessed on 1 March 2022).

¹⁴ Edibles - LiveWall Vertical Plant Wall System. *LiveWall Green Wall System*. <https://livewall.com/> (accessed on 1 March 2022).

¹⁵ Venlo City Hall Available online: <https://epea.com/en/references/venlo-city-hall> (accessed on 14 December 2021).

¹⁶ Landscape Institute London Bridge Home to World's First Vertical Rain Garden. <https://www.landscapeinstitute.org/news/london-bridge-home-to-worlds-first-vertical-rain-garden/> (accessed on 14 December 2021).

¹⁷ Lufa Farms Montreal Available online: <https://montreal.lufa.com/en> (accessed on 26 November 2021).

¹⁸ ROOF WATER-FARM Available online: <http://www.roofwaterfarm.com/en/> (accessed on 18 November 2019).

¹⁹ Joanneum Research - LIFE Smart City Rooftop Farming Available online: <https://rooftopfarming.at/> (accessed on 15 December 2021).

²⁰ Optigrün Gründach-Systeme & Regenwassermanagement | Optigrün Dachbegrünungen Available online: <https://www.optigruen.de/> (accessed on 15 December 2021).

Ground floor rooms (and living rooms)	Workshops	WUK Werkstätten (AT) ²¹
	Co-Working-Space	Impact HUB Wien (AT) ²²
	Repair shops	R.U.S.Z (AT) ²³
	Storing Rooms	FoodCoops (AT) ²⁴

General mood inquiry and co-creation process

The starting point of the co-creation activities in DIRECT HUBS was the ideal image of a city that acts as a potential catalyst for a (more) sustainable food system and enables a circular-based food supply oriented towards ecological-regenerative and participatory approaches. In addition to extensive secondary research, structured discussions were implemented in an adapted World Café setting during two DIRECT HUBS Impact Cafés with different stakeholders and supplemented by interviews with district representatives and a focus group. A balanced interplay of civil society-driven developments and initiatives ("community driven" or "bottom-up") and, for example, agendas, instruments, and programs anchored in the city administration ("top-down") was identified as a major challenge for co-creation processes.

During a **series of interviews with 12 Viennese district representatives** and a focus group with 14 stakeholders, as well as structured discussions on the occasion of the two DIRECT HUBS Impact Cafés already mentioned, with e.g. social entrepreneurs and innovators as well as representatives of civil society and financing partners, it was repeated that a sustainable urban food space is only possible on the basis of a distinctive **neighbourhood thinking** that combines consumption and production in public spaces or in so-called third places ("third places" according to Ray Oldenburg 1989²⁵) and in private spaces and enables socially innovative and ecologically sustainable business models.

Roadmaps for three circularity hubs in Vienna

In the course of inquiring the mood of the City of Vienna, some possible locations for circularity hubs in Vienna were identified and mapped through exchange with stakeholders in co-creative processes as well as through neighborhood walks. These locations can be found in the online map on kreislaufwirtschaft.at²⁶. In order to create neighborhood-related implementation scenarios for circularity hubs that reflect the range of different implementation options of such, three of these city locations were internally selected and described in roadmaps. These are (1) the Zukunftshof Rothneusiedl²⁷ in the 10th district, (2) the former old people's settlement in the Hugo-Breitner-Hof²⁸ in the 14th district, and (3) the former school at Kinkplatz²⁹ in the 14th district.

²¹ WUK Wien Werkstätten - WUK Available online: <https://www.wuk.at/angebot/werkstaetten/> (accessed on 15 December 2021).

²² Impact Hub Vienna Available online: <https://vienna.impacthub.net/> (accessed on 15 December 2021).

²³ R.U.S.Z – Reparatur- und Service-Zentrum. <https://rusz.at/> (accessed on 15 December 2021)

²⁴ FoodCoops: <https://foodcoops.at/> (accessed on 15 December 2021)

²⁵ R. Oldenburg. The Great Good Place: Cafes, Coffee Shops, Bookstores, Bars, Hair Salons, and Other Hangouts at the Heart of a Community. New York: Paragon House, 1989.

²⁶ <https://kreislaufwirtschaft.at/karte/>

²⁷ <https://www.zukunftshof.at/>

²⁸ <http://socialdesign.ac.at/current/heimstaetten-fuer-alte-leute>

²⁹ <https://www.azw.at/de/artikel/sammlung/helmut-richters-schule-am-kinkplatz-in-wien-14/>

Implementation, business models and financing strategies

The requirements for the implementation of resource conversion can be broadly divided into the following categories: (a) spaces and areas, (b) accompanying measures, (c) legal frameworks, (d) collaborative operator models and workforce. From these requirements, it can be deduced into which urban infrastructures these circular processes could be integrated. Further information on this, spatial integration options and the individual implementation steps are described in [the guideline to the implementation of circularity hubs](#)³⁰.

Participatory processes were the focus of the DIRECT HUBS project, including the development of financing strategies for implementation concepts. Together with representatives of various stakeholders who could contribute to the implementation of urban circularity hubs in the food sector – SMEs, start-ups, non-profit organizations (NPOs), as well as representatives of the financing and funding sector, experiences and expertise were exchanged, and business models and financing strategies were jointly developed. The completed Business Model Canvas for each of the processed use cases as well as the list of key resources, the assigned financing and funding opportunities, as well as the type of financing (e.g. grant, loan, cooperation, guarantee) are publicly available on kreislaufwirtschaft.at³¹ and can serve as reference examples for other entrepreneurs and project initiators.

The financing database³², funded by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), provides an overview of financing instruments and funding offers for financing measures to implement the circular economy. Various factors influence the choice of financial instruments. In the funding database, results can be filtered by factors. These include, for example, the form of organization, type of activity, type of funding and region.

Scaling and replication of the methodology

All previous results and methods were collected to create a general [guideline](#)³³ for the implementation of circularity hubs. This guideline has been supplemented by experts from different regions of Austria in order to optimize the feasibility to other regions. In the guideline, the realization of circularity hubs was divided into nine basic steps. In the first three steps, the basic requirements are worked out: (1) resource flows, (2) underused infrastructure, (3) needs and stakeholders must be identified. Subsequently, (4) technologies will be evaluated and (5) a vision of circularity hub will be created. This vision of the future must then be compared with the (6) legal framework and the (7) required space. Subsequently, (8) business and financing models can be created before the (9) planning of an implementation and monitoring plan for the circularity hub can go into concrete execution. The guideline also presents complementary city scan tools. These can

³⁰ https://kreislaufwirtschaft.at/website/wp-content/uploads/2023/05/D4_Leitfaden-zur-Umsetzung-von-Kreislauf-Hubs.pdf

³¹ https://kreislaufwirtschaft.at/website/wp-content/uploads/2023/04/MS8_Geschaeftsmodelle-und-Finanzierungsmoeglichkeiten.pdf

³² <https://kreislaufwirtschaft.at/financial-instruments/>

³³ https://kreislaufwirtschaft.at/website/wp-content/uploads/2023/05/D4_Leitfaden-zur-Umsetzung-von-Kreislauf-Hubs.pdf

help to identify potentials and goals, which provides cities with additional information about the possibilities and control of their own progress.

Communication and participation

Targeted communication was an essential part of the stakeholder activation process for the co-creative development of the project results. This was just as important for the dissemination of the results and news to reach and inform different target groups. One advantage was the project website kreislaufwirtschaft.at³⁴, which was designed in such a way that all relevant information was offered at a low-threshold level and uses interactive tools to promote civil society participation.

In addition to low-threshold communication via the website and social media channels, networking events offered space for involvement and exchange with experts and actors in the different areas of the project topics and for follow-ups. In addition, press releases, partner newsletters and a scientific publication were published in order to reach different stakeholder groups. Towards the end of the project, a [brochure](#)³⁵ with all important results was also prepared and published.

Conclusion and outlook

Circularity hubs can create significant added value for cities and the surrounding region by promoting sustainable and circular business models, conserving natural resources, relieving the burden on the environment and promoting social innovation and empowerment. In this way, circularity hubs can help create more resilient and equitable communities and food systems.

In a follow-up commission from the City of Vienna, the secondary resource flows within the city are determined and circularity hub archetypes as well as their spatial requirements and integration possibilities in the urban structure will be determined. This is to be incorporated into the Urban Development Plan 2035 and the Climate Protection Targets 2040. Thus, a concrete further development of the methodology for the city of Vienna could be initiated, which can subsequently be replicated by other cities.

³⁴ <https://kreislaufwirtschaft.at/>

³⁵ https://kreislaufwirtschaft.at/website/wp-content/uploads/2023/05/D5.1_Broschuere.pdf