LOCAL CIRCULAR BIOECONOMY ACTION PLAN

CITY OF VARAŽDIN

Version 1

2022

Template Guidance Notes:

The Innovation Agenda already developed through the CITYCIRCLE project (CECOMs process) concluded that: "cities should work intensively towards a mission to create integrated bioeconomies that are circular, regenerative, resilient, non-wasteful and healthy."

The purpose of this template is to help city communities to start responding to this challenge by developing Local Circular Bioeconomy Action Plans. Please also refer to the supporting guidance: Circular Bioeconomy Value-Chains: Harnessing Opportunities, as a companion to this template.

The primary target audience for this template and attached guidance are the city teams and partners working under the CITYCIRCLE project. The completed Local Circular Bioeconomy Action Plans will become parts of the final CITYCIRCLE project Transnational Circular Economy Strategy.

Any other community changemakers interested in creating a local circular bioeconomy should also find value in this template and the guidance document.

While this template and guidance have been prepared with a focus on local circular bioeconomies, they are easily adaptable to other circular economy value chains and/or other sustainable development action areas. In this template 'bioeconomy' can largely be replaced with another area of interest. Section 4 "Design for Action" of the Circular Bioeconomy Value-Chains: Harnessing Opportunities guidance is equally relevant to Sections 3-7 of this template, even if another circular value-chain or area is chosen as the focus for systemic action.

Therefore, in case CITYCIRCLE partners prefer to develop a Local Circular Economy Action Plan that is focussed on a different value chain, this template can be used with minor adjustments. Partners will need to do their own further research into value-chain opportunities to supplement what is provided in Section 3 "Circular Bioeconomy Value-chain Opportunities" of the Circular Bioeconomy Value-Chains: Harnessing Opportunities guidance.

Also note that realistically the remainder of the CITYCIRCLE project will not provide sufficient time and resources for project partners to work fully with their community through all the steps discussed in the guidance and sections of this template. CITYCIRCLE project teams should therefore undertake a light version of this process, using available resources and working with a close group of local stakeholders, to develop a first version of a Local Circular Bioeconomy Action Plan. They can then seek additional resources and funding to further test, expand and refine this initial version through wider and deeper community engagement and co-creation processes. As developing a circular bioeconomy must be an iterative process, the best way forward is 'learning by doing' from starting to put an initial plan into practice and then improving along the journey.

For the Local Circular Bioeconomy Action Plans developed under the CITYCIRCLE project, to keep things simpler the sections and notes highlighted in grey in this template can be skipped or completed at the discretion of the partners for each region. Areas not highlighted in grey should be completed for all regions.

The finally unused sections of this template should be removed from the final CITYCIRCLE project deliverable. These can be retained in a parallel version for ongoing development beyond the CITYCIRCLE project.

CONTENT

INTRODUCTION

1. The CITYCIRCLE project

The CITYCRICLE project aims to bring innovation and sustainable economic growth to peripheral regions of the European Union through implementation of circular economy practices.

This Local Circular Bioeconomy Action Plan for the City of Varaždin draws on the guidance contained in the *Circular Bioeconomy Value-chains: Harnessing Opportunities report,* and *Innovation Agenda* already developed through the CITYCIRCLE project. Together with other city action plans, this document makes up part of the final CITYCIRCLE project Transnational Circular Economy Strategy.

This action plan elaborates how the Northwest Croatian community can build on our current assets and take forward the opportunities of developing a world-leading circular bioeconomy in and around our city.

According to the methodology of the Joint Research Centre (JRC), the bioeconomy is observed within the economy through the production of biomass and the conversion of biomass into value-added products such as food, animal feed, biomass products and biomass energy.

Sustainable and circular bioeconomy finds an alternative to products that use fossil carbon from petroleum products and natural gas in the production process either through a replacement product (e.g. biofuel) or through the replacement of fossil carbon with renewable carbon from biomass (e.g. bioplastics) (HAOP, Biljana Kulišić, Sektorska analiza, 2021.)

2. Overview of City of Varaždin Context

The City of Varaždin is the seat of Varaždin County and the largest city in the county in terms of population. The geographical location of the City of Varaždin significantly affects it importance in transport infrastructure. It is well connected by motorways with Hungary (towards Budapest) and Zagreb, as well as Rijeka and Split towards the Adriatic Sea. In the west-east direction, of great importance is the so-called Drava Corridor, which opens Croatia across the Danube to the Black Sea.

The geo-traffic position of the City of Varaždin enables the unhindered transport of goods and services, which is an important factor necessary for the development of the local bioeconomy. In addition, given the characteristics of areas that primarily relate to natural features that are largely characterized by the richness of agricultural land, encourages the development of agriculture with social (employment) and economic (profit, trade) contributions, all with environmental protection and landscape conservation. In cosideration of the previuosly mentioned, the development of bioeconomy in the City of Varaždin is largely based on the following possibilities:

- formulation and implementation of policy measures that will provide conditions for the introduction and implementation of a sustainable and circular bioeconomy
- improvement of the biowaste management system - reduced disposal of biowaste and intensification of separate collection of biowaste
- Encouraging cooperation between the public and private research sectors in the field of new product and technology development
- developing markets and competitiveness in biomass-based sectors
- production of fuels based on renewable sources

- sustainable management of public urban areas.

As part of the CITYCIRCLE project, a pilot project is being implemented which examines the potential of the circular economy of the City of Varaždin in the field of bioeconomy, all for the purpose of testing tools and guidelines given from the CITYCIRCLE project. According to the daily accumulation of people, the pilot project is being implemented at the City Market d.o.o. in the City of Varaždin. The project is based on the basic principles of the circular economy, and the goal of the project is to monitor the sorting, collection and treatment of all types of waste from the city market in a period of 24 months. Emphasis is placed on biodegradable waste that is treated in the biogas plant while the produced digestate is used on hazelnut plantations owned by the City Market. The treatment of biodegradable waste produces biogas, which is a renewable energy source.

The main goal of the pilot project is to point out the fact that waste can be viewed as a valuable material from which it is possible to obtain useful raw materials and/or energy and thus close the circle and present the transition from linear to circular economy.

Stakeholders who have signed the Memorandum of Understanding, and who are ready to implement the circular economy in their existing business activities are: City of Varaždin, Development Agency North - DAN Ltd, City market Ltd., Regional Energy Agency North - REA, Čistoća d.o.o. - waste management, Family farm OPG Vrček, Local Action Group Northwest, Technology Innovation Center Medjimurje (TICM), Lokvina d.o.o., Technolgy Park Varaždin d.o.o., Association for the promotion of sustainable lifestyle "GREDICA", Student Centre Varaždin, Public Institution for the Regional Development of the Varaždin County (JURA), Parkovi Ltd., The Sustainable technologies development centre Ltd (CROTEH), AVEOR tech Ltd. Their main ambition is to establish a circular economy by establishing a waste management system in their organizations.

3. Mission Context in City of Varaždin

The current vision of the City of Varaždin, which is related to the Development Strategy of the City of Varaždin until 2020[1] is to make the city prosperous and pleasant to live in, i.e. the urban center of the region that offers citizens conditions for quality family life, economic improvement, education and employability and rich cultural and tourist contents.

The vision includes the basic principles of directions for the development of the City, namely education, culture and tourism related to rich cultural heritage, economic growth achieved through employment, better wages and better opportunities in entrepreneurship and environmental and better security and social conditions for a quality community life.

The mission of the City of Varaždin, which is related to the city's development strategy, is to enable a quality life for citizens using social and economic resources and environmental resources according to the principles of sustainable development.

The existing mission and vision of the City of Varaždin are in line with the European Bioeconomy Strategy and its objectives, which are as follows:

- ensure food supply
- manage natural resources in a sustainable way
- reducing dependence on non-renewable resources
- climate change mitigation and adaptation
- creating jobs and maintaining European competitiveness.

[1] https://varazdin.hr/upload/2016/12/strategija_razvoja_grada_varazdina_do_2020_godine_584e471f6dd4f.pdf

These goals relate to the establishment and application of the concept of bioeconomy in the City of Varaždin, which includes production from renewable resources and their conversion into vital products and energy from biomass.

BIOECONOMY OPPORTUNITIES

1. Greatest Local Bioeconomy Assets

The natural position of the City of Varaždin, located along the banks of the Drava River, is responsible for the availability of natural resources that are important for the quality of agricultural land (soil type, moisture, nutrients, etc.), and thus the quality of the final product. The application of the concept of sustainable agriculture is important for the development of agriculture as well as the whole economy. In addition to food or energy production, this sector employs people in rural areas of the City of Varaždin, which can greatly reduce the problem of declining population because of emigration.

Due to the development of agriculture, the City of Varaždin has a great potential for the use of agricultural biomass and waste from agricultural production. By processing agricultural biomass and waste from agricultural production biogas is produced. Biogas is a renewable energy source and can replace the use of fossil fuels. This way of exploiting the potential of an individual biomass source enables the production of products with higher added value, which is the basis for the establishment and development of the bioeconomy.

Local Food System Assets

AGRICULTURAL PRODUCTION IN THE CITY OF VARAŽDIN

The basic prerequisite for agricultural activity is the availability of agricultural land. Agricultural land is divided into privately owned land and state-owned land. In the area of the City of Varaždin there are a total of 1727.06 ha of agricultural land. Of the total area, valuable arable land occupies 454.93 ha, while other arable land occupies an area of 1272.13 ha. The total area of agricultural land owned by the state in the City of Varaždin is: 190.3323 ha. Considering the availability of arable land in its area, the City of Varaždin has a large capacity for agricultural production.

The application of the principles of sustainable agriculture primarily refers to the use of natural resources such as biological nitrogen fixation, soil regeneration, the use of natural preparations in plant protection and the use of agricultural by-products (digestate, compost, etc.). Sustainable agriculture is based on organic production, which excludes the use of pesticides, i.e., implies the application of basic principles of environmental protection, thus protecting the biodiversity and integrity of people and other living organisms.

The main stakeholders of agriculture in the City of Varaždin and Varaždin County are family farms (OPG). Such farms are primarily organized according to modern principles of sustainable agriculture. Such farms mostly have their own agricultural land and/or take arable land in concession. Agriculture is oriented towards agriculture and horticulture (cultivation of plants such as vegetables, fruits, flowers and forest tree plantations and seed cultivation). Sustainable agriculture is primarily related to the organic cultivation of products based on cultivation without the use of harmful substances (e.g. the use of natural fertilizers: manure, slurry, compost, digestate, etc.).

Family farms can offer their products on various available markets, and one of the examples is the city market in Varaždin. Family farms are focused on the production of high-quality domestic food. This is precisely the reason why local family farms sell their products to local consumers such as hotels, restaurants, kitchens in dormitories, school kitchens, kitchens in kindergartens, etc. Such products, although sometimes higher in price than available commercial products, have been tested and are of extremely high quality, and the purchase of such products encourages the development of the local bioeconomy. Although organic farming is on the rise, one of the main drawbacks is that organic products are still not sufficiently recognized. In addition to the previously mentioned, it often happens that the population in Croatia cannot afford an organic product due to its price.

In addition to organic farming, family farms are increasingly focusing on agritourism. Agrotourism on family farms has the function of a value-added product, because in addition to the main agricultural activity, it serves the economy as a source of additional income. Services related to agritourism refer to services related to the promotion of certain agricultural activities, active participation of visitors in agricultural activities, recreational activities, introduction to the farming, holding creative and educational workshops, gastronomic offers, bed & breakfast, etc.

Table 1 lists the family farms that are engaged in activities that mainly belong to horticulture and market their products at the city market in Varaždin. Considering that they lease sales stands from the city market, these family farms are also participating in the implementation of a pilot project to establish a circular economy related to the establishment of a system of sustainable waste management. These family farms are a positive example for rural development, which greatly contributes to the development of the local bioeconomy in the City of Varaždin.

Table 1. List of certified family farms at the city market in Varaždin

NAME/TITLE	ACTIVITY	NAME/TITLE	ACTIVITY
OPG ANTOLIĆ VJEKOSLAVA	Production of agricultural products: flowers (perennials) and ornamental plants	OPG CAFUK MARIJA	Production of the following agricultural products: carrots, parsley, onions, lettuce, beans, peas, tomatoes, cucumbers, cabbage, peppers, garlic, leeks, cauliflower, broccoli, potatoes, chard, strawberries, spinach, dill, radishes, eggplant, kale, pumpkin seed oil
OPG BEK DENIS	Production of the following agricultural products: flower seedlings, geraniums, cyclamen, primroses, stepmothers, surfinia, multiflora	OPG CAFUK VID	Production of the following agricultural products: vegetable seedlings, herbs, tomatoes, peppers, chillies, eggplant, potatoes, beans, peas, legumes, cabbage, kale, cauliflower, broccoli, onions, spring onions, leeks, garlic, beets, radishes, zucchini, cucumbers, lettuce, dill, spinach and chard
OPG BOCKO VLADIMIR	Production of agricultural products: seedlings of seasonal, garden and balcony flowers, cut flowers, multiflora, poinsettias	OPG HIŽAK VESNA	Production of the following agricultural products: arugula, blueberries and strawberries
OPG BOROVEC KREŠIMIR	Production of agricultural products: gladioli, lilies, kale, dahlias, onions, peas, beans, lettuce, potatoes, peaches and plums	OPG HLEB DRAGO	Production of the following agricultural products: vegetable seedlings, onions, leeks, radishes, lettuce, cabbage, beets, cauliflower, kohlrabi, kale, potatoes, peppers, tomatoes, pepperoni, beans, peas, legumes, pumpkins, celery, carrots, parsley, pumpkin seed oil
OPG BOŽIĆ ZDRAVKO	Production by performing the following agricultural products: beans, peas, legumes, potatoes, spring onions, onions, leeks, peppers, carrots, cabbage, Varaždin cabbage, pumpkin seed oil	OPG HORVAT BOŽENA	Production of the following agricultural products: strawberries, tomatoes, peppers, cucumbers, lettuce, onions, peas, pumpkins
OPG BREZOVEC MILEVA	Production of the following agricultural products: tomatoes, cucumbers, cabbage, kale, lettuce, chillies, eggplant, pepperoni, walnuts, pumpkin oil, pumpkin seed oil	OPG CAFUK MARIJA	Production of the following agricultural products: carrots, parsley, onions, lettuce, beans, peas, tomatoes, cucumbers, cabbage, peppers, garlic, leeks, cauliflower, broccoli, potatoes, chard, strawberries, spinach, dill, radishes, eggplant, kale, pumpkin seed oil
OPG BRGLES IVANKA	Production of the following agricultural products: garlic, cauliflower, parsley, celery, carrots, eggplant, beets, kohlrabi, leeks, lettuce, tomatoes, peppers, potatoes, beans, onions, sweet potatoes, horseradish, kale, cucumbers, dried flowers, chrysanthemums, potted plants, pumpkin, pumpkin seed oil	OPG CAFUK VID	Production of the following agricultural products: vegetable seedlings, herbs, tomatoes, peppers, pepperoni, eggplant, potatoes, beans, peas, legumes, cabbage, kale, cauliflower, broccoli, onions, spring onions, leeks, garlic, beets, radishes, zucchini, cucumbers, lettuce, dill, spinach and chard
OPG HORVAT IVAN	Production of the following agricultural products: strawberries,	OPG KOŠIĆ MARIO	Production of the following agricultural products: seedlings of vegetables and

	beans, cherries, sour cherries, walnuts, peaches		*flowers, lettuce, carrots, parsley, celery, potatoes, cabbage, cauliflower, broccoli, tomatoes, peppers, leeks, beets, spring onions, parsnips, young beans, cucumbers, beans, pumpkins, pumpkin seed oil*
OPG HORVAT MARKO	*Production of the following agricultural products: leeks, garlic, beans, peas, carrots, parsley, parsnips, celery, peppers, tomatoes, onions, beets, cabbage, kale, kale, cauliflower, broccoli, green beans, spinach, lettuce, lettuce, endive, chicory, cherries, dried flowers, potatoes, zucchini and walnuts*	*OPG KOTIŠČAK DANIJEL*	*Production of the following agricultural products: honey, pumpkin seed oil, millet porridge, buckwheat porridge, corn flour and potatoes*
OPG HORVAT ŠTEFA	*Production of the following agricultural products: strawberries, cherries, plums*	*OPG KRANJČEC VERA*	*Production of the following agricultural products: carrots, parsley, celery, chard, spinach, arugula, cabbage, beets, lettuce, kale, broccoli, cauliflower, onions, garlic, tomatoes, peppers*
OPG ISTER VID	*Production of the following agricultural products: apples, peaches, plums, pears, grapes, blackberries, blueberries, carrots, parsley, peas, beans, spinach, lettuce, potatoes, cabbage, beets, celery, leeks, cauliflower, broccoli, kale, pumpkin, pumpkin seed oil*	*OPG KRANJEC VJEKOSLAV*	*Production of the following agricultural products: flower seedlings (garden and balcony), pansies, primroses, chrysanthemums, multiflora, peppers, beans and eggplant*
OPG IVANČEK VIŠNJA	*Production of the following agricultural products: transplants of balcony and garden flowers, geraniums, sufrinia, pansies and multiflora*	*OPG LAMBREŠĆAK IRIS*	*Production of the following agricultural products: blackberries, raspberries, currants, chokeberries, walnuts, apples, strawberries, syrups, jams, dried fruits*
OPG JAGIĆ ZDRAVKO	*Production of the following agricultural products: flowers (perennials, balcony flowers, summer seedlings, chrysanthemums, ornamental flowers), multiflora, herbs*	*OPG LESKOVAR MARKO*	*Production of the following agricultural products: sauerkraut, Sauer beet, pumpkin seed oil, pumpkin seeds, beans*
OPG KEREŠA MARIN	*Production of the following agricultural products: raspberries, peaches, plums, pears, apples, haskap, blueberries, chokeberries, hazelnuts, walnuts, peppers, chilies, cherries, cherries, nutmegs, eggplant*	*OPG LONČAR ZRINKA*	*Production of the following agricultural products: peppers, tomatoes, lettuce, onions, spring onions, leeks, spinach, radishes, potatoes, carrots, parsley, celery, cucumbers, beets, beans, peas*
OPG KOREN BOŽIDAR	*Production of the following agricultural products: seedlings of vegetables and spices, potatoes, cabbage, peppers, tomatoes, beans, beans, peas, carrots, celery, parsley, cauliflower, broccoli, kale, cucumbers, lettuce, onions*	*OPG LJUBEK EDUARD*	*Production of the following agricultural products: sauerkraut, sauer beet, cabbage, beans, garlic, beets, pumpkin and pumpkin seed oil*
OPG KOŠIĆ DRAŽENKA	*Production of the following agricultural products: beans, peas, legumes, tomatoes, pumpkins, carrots, parsley, onions, spring onions, leeks, celery, cabbage, garlic, potatoes, radishes, cucumbers, pumpkin seed oil*	*OPG MALIĆ BRANKO*	*Production of the following agricultural products: hazelnuts, pears, peaches, apples, onions, leeks, tomatoes, lettuce, beans, green beans, pumpkins, garlic, pumpkin seed oil*
OPG MARTINEZ KARMEN	*Production of the following agricultural products: carrots, parsley, eggplant, peppers, cabbage, potatoes, pumpkins, lettuce, chard, kale, beans, peas, pumpkin seed oil*	*OPG MEĐIMUREC DRAŽENKA*	*Production of the following agricultural products: seasonal and balcony flowers, geraniums, begonias, verbena, daisies, water lilies, pansies and multiflora*
OPG MAŠIĆ LJILJANA	*Production of the following agricultural products: seedlings, tomatoes, peppers, radishes, cucumbers, carrots, parsley, eggplant, celery, cauliflower,*	*OPG MELNJAK DARIO*	*Production of the following agricultural products: seedlings, radishes, spring onions, leeks, spinach, celery, lettuce, tomatoes, peppers, chard, cucumbers,*

	leeks, broccoli, beans, legumes, beets, potatoes, cabbage, spinach, onions, garlic, lettuce, kale, zucchini, dill and other root vegetables and cabbage		*cabbage, kale, broccoli, kohlrabi, cauliflower, potatoes*
OPG MEDVED IVICA	*Production of the following agricultural products: potatoes, cabbage, kale, cauliflower, kohlrabi, celery, carrots, parsley, tomatoes, peppers, cucumbers, beans, peas, legumes, onions, leeks, eggplants, lettuce, beets and vegetable seedlings*	*OPG NAMJESNIK MLADEN*	*Production of the following agricultural products: honey, propolis, pollen, wax candles, honey brandy, cherry brandy, fruit brandy and cherry wine*
OPG PAVLOVIĆ SANJA	*Production of the following agricultural products: vegetable seedlings, tomatoes, peppers, potatoes, onions, spring onions, carrots, eggplant, parsley, radishes, beans, cauliflower, lettuce*	*OPG POCEDULIĆ MARIJA*	*Production of the following agricultural products: seedlings of seasonal, garden and balcony flowers, cut flowers, gladioli, dahlias, cloves, kale, carrots, potatoes, parsley, kale, onions, garlic, beans, peas, beans, beets, lettuce, leeks , spinach, chard, sweet potatoes, raspberries, blackberries, apple cider vinegar, jam*
OPG PLANTIĆ ĐURĐICA	*Production of the following agricultural products: seedlings of vegetables and herbs, perennials, chrysanthemums, multiflora*	*OPG POKOS ANTUN*	*Production of the following agricultural products: honey, bee products, honey vinegar, apple vinegar, blackberry wine, apples, peaches, figs, grapes, blackberries, pears*
OPG PLANTIĆ VESNA	*Production of the following agricultural products: carrots, parsley, celery, leeks, onions, lettuce, dill, peas, beans, potatoes, cabbage, kale, cauliflower, broccoli, pumpkin, tomatoes, peppers, arugula, cucumbers, eggplants, spinach, kohlrabi, pumpkin seed oil*	*OPG POZDER FRANJO*	*Production of the following agricultural products: seedlings of vegetables, cabbage, beets, celery, potatoes, carrots, parsley, lettuce, spinach, dill, beans, beans, peas, tomatoes, peppers, cucumbers, garlic, onions, parsnips, blackberries, blueberries and pumpkin seed oil*
OPG ROG BOŽIDAR	*Production of the following agricultural products: vegetable and flower seedlings, potatoes, cabbage, onions, legumes, kale, peas, beans, lettuce, celery, dill, beets, garlic, peppers, tomatoes, zucchini, spinach, eggplant, leeks, kohlrabi, cauliflower and pumpkin seed oil*	*OPG VITEZ STJEPAN*	*Production of the following agricultural products: onions, garlic, peas, beans, legumes, tomatoes, peppers, carrots, parsley, spinach, chard, cabbage, kale, strawberries, apples, blackberries, pears and cherries*
OPG ŠEGOVIĆ NADA	*Production of the following agricultural products: onions, root vegetables, potatoes, tomatoes, apples, cherries, sweet cherries, peaches, figs, raspberries*	*OPG VRUČINA ĐURĐICA*	*Production of the following agricultural products: vegetable seedlings, beans, lettuce, carrots, parsley, cucumbers, peppers, tomatoes, radishes, peas, chard, spinach, eggplant, cauliflower, kale, cabbage, leeks, broccoli, green onions, arugula, dill*
OPG ŠIMAK BRANKO	*Production of the following agricultural products: rose and kale seedlings, cut roses and kale*	*OPG VUKOVIĆ NIKOLA*	*Producing the following agricultural products: carrots, celery, parsnips, onions, leeks, parsley, cauliflower, broccoli, cabbage, eggplant, peppers, potatoes, beans, cucumbers, lettuce, beans, kale, peas, strawberries, melons, watermelons, and dried flowers*
OPG ŠINCEK IVANA	*Production of the following agricultural products: flower seedlings, seasonal flowers, spring onions, beans, cucumbers, tomatoes, peppers, peas, lettuce, root vegetables and eggplants*	*OPG ZAGOREC FRANJO*	*By producing the following agricultural products: vegetable seedlings, potatoes, cabbage, peppers, carrots, parsley, lettuce, onions, beans, peas, legumes, spinach*
OPG ŠIPEK DARKO	*Production of the following agricultural products: strawberries, cherries, apples, asparagus, tomatoes, cucumbers, peppers, leeks, kale, kale, beans, cabbage, cauliflower, broccoli, lettuce, spinach, dill, spring onions, garlic,*	*OPG ZAGOREC KATICA*	*Production of the following agricultural products: potatoes, cabbage, parsley, carrots, leeks, lettuce and other vegetables*

	chard, radish pods, pumpkin seed oil		
OPG ŠIPEK MARIJA	*Production of the following agricultural products: apples, grapes, cherries, sour cherries, lettuce, tomatoes, cucumbers, peppers, onions, garlic, carrots, parsley, beans, potatoes, pumpkin, beets and other vegetables, pumpkin seed oil, apple cider vinegar*	*OPG ZAGOREC MARIO*	*Production of the following agricultural products: seedlings of vegetables and flowers, herbs, potatoes, beets, beets, cabbage, kale, lettuce, kohlrabi, celery, onions, leeks, garlic, parsley, carrots, peppers, tomatoes, cucumbers, chard, beans, legumes , peas, beans, spinach, dill, arugula, radishes, eggplants, pepperoni, pumpkins, sweet potatoes, rhubarb, pumpkin seed oil*
OPG ŠIPEK MARIJA-OTOK VIRJE	*Production of the following agricultural products: flower and vegetable seedlings, balcony flowers, seasonal flowers*	*OPG ZAGOREC ZDRAVKO*	*Production of the following agricultural products: seedlings of vegetables, tomatoes, peppers, beans, peas, legumes, potatoes, cabbage, cucumbers, onions, onions, leeks, garlic, carrots, parsley, celery, cauliflower, broccoli, beets, pumpkins, eggplants, pumpkin seed oil*
OPG ŠKREB STJEPAN	*Production of the following agricultural products: seedlings, potatoes, cabbage, peppers, eggplants, broccoli, lettuce, spinach, kale, cauliflower, carrots, parsley, tomatoes, cucumbers, dill, arugula, pumpkins, leeks, legumes, watercress, onions, beans, and pumpkin seed oil*	*OPG NOVAK JOSIP*	*Production of the following agricultural products: hazelnut, plum, apple, cherry, pear, apricot*
OPG TKALEC NIKOLA	*By producing the following agricultural products: apples, pears and apple cider vinegar*	*USLUŽNA ULJARA PRESEČKI*	*by producing the following agricultural products: pumpkin seed oil*
OPG TOMAŠIĆ MARIJA	*Production of the following agricultural products: seedlings, spring onions, potatoes, peas, beans, legumes, carrots, parsley, peppers, tomatoes, lettuce, leeks, cucumbers, cauliflower, broccoli, kale, beets, chokeberries, pears, apples, plums, cherries, cherry and pumpkin seed oil*	*OPG VITEZ STJEPAN*	*Production of the following agricultural products: onions, garlic, peas, beans, legumes, tomatoes, peppers, carrots, parsley, spinach, chard, cabbage, kale, strawberries, apples, blackberries, pears and cherries*

As part of a pilot project at the city market in Varaždin, 88 sets of waste separation containers (plastic, paper, glass and biowaste containers) were distributed to tenants at the market. In addition to the containers, each user received instructions on how to separate the waste. The amount of waste collected is recorded every month. Figure 1 shows a graphical representation of the quantities of separately collected waste by components (mixed municipal waste, plastic, paper, biowaste and wood). The graph shows that, considering the initial quantities, the amount of mixed municipal waste generated at the market decreased by approximately 40%, while the amount of separately collected biowaste increased by approximately 60%.

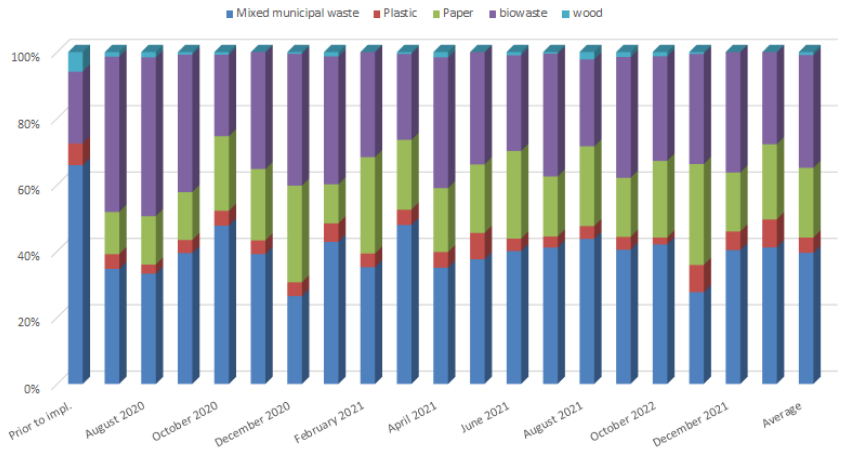


Figure 1. Fractions of separately collected waste throughout the pilot

The reduction of the total amount of mixed municipal waste indicates the fact that a smaller amount of waste is disposed of in landfills, which greatly contributes to environmental protection and reducing the generation of greenhouse gases.

Biowaste consists of biodegradable waste from gardens and parks, food and kitchen waste from households, offices, restaurants, wholesale, canteens, catering facilities and similar waste from food production. In the total amount of biowaste over 70% is food waste.

According to available data published by the Ministry of the Economy and Sustainable Development[2], the Institute for Environmental and Nature Protection, based on a survey, a total of 286,379 tons of food waste is generated in the Republic of Croatia annually. Of the total amount of food waste, 216,345 tons are generated in households, and 70,034 tons in the business sector. If we look only at the business sector in primary production, which includes family farms, 58.5%, restaurants and catering facilities produce 21.5%, in the processing and production sector 14.1%, while retail and other food distribution produce 5.9% of the total amount of food waste. If we look at the average amount of food waste per capita in a region, then it is 53.6 kilograms per capita per year, and if we look at the region in which Varaždin (Northern Croatia) is located, the average amount of food waste per capita is 51 kilograms. Large quantities of food waste are disposed of in containers for mixed municipal waste (approx. 33%), part of food waste is disposed of in biowaste containers (approx. 17%). In rural areas, waste food is used for animal feed (approx. 23%), while the rest ends up in the sewerage network or is disposed of in some other way.

In agricultural production, which belongs to the primary production, in addition to the waste food that is generated, animal manure, which is a by-product in animal husbandry, is also generated as a waste stream. Currently, manure is mainly disposed of in a biogas plant as an additional substrate that is added to corn silage for biogas production. This is one of the most favourable ways of disposing of manure, because according to the legal regulations, manure cannot be utilised uncontrolled on agricultural land. One of the biggest impacts on the environment is the agri-food sector. According to a report by the Intergovernmental Panel on Climate Change (IPCC), about a third of the world's greenhouse gas emissions come from food production systems. Exactly one third of total greenhouse gas emissions come from food-related activities, such as land use, production, processing, transport, storage, food preparation and, ultimately, food waste. In the Republic of Croatia, food waste accounts for 4.6% of total greenhouse gas emissions, which ca be compared to emissions emitted by 415,000 cars. In order to reduce this, the application of basic principles of bioeconomy in agriculture are currently encouraged in order to encourage the development of "innovative economy with low emissions" or to ensure the sustainability of agriculture with sustainable use of renewable biological resources (biomass) in food industry, while protecting biodiversity and the environment and reducing the amount of landfilled waste.

EXAMPLES OF GOOD PRACTICE IN THE AREA OF THE CITY OF VARAŽDIN

- STUDENT CENTRE VARAŽDIN

One example of good food waste management practice is the example of how waste is managed at the Student Centre in Varaždin. Student Centre Varaždin provides accommodation for about 800 students and food for about 2,500 students, so they have large amounts of waste, but have a very well-organized waste management system. Waste separation starts already in the rooms of students who have bins for sorting, and then the contents of the bins are emptied into underground containers. The same principle applies in the student restaurant where special care is taken about food waste. Waste food (leftovers) are grinded, dried to form briquettes that are sold to a company in Zagreb. The student centre annually produces about 10 tons of dehydrated organic waste. Waste oil is also utilised, and the water generated in the dehydration process is released into the sewage, therefore they have a complete and functioning waste management system.

[2]http://www.haop.hr/sites/default/files/uploads/dokumenti/021_otpad/Statistike/Otpad%20od%20hrane%20-%20prezentacija.pdf

➢ MEDIATORS IN FOOD DONATION

Table 2. Mediators in food donation [3]

NAME OF MEDIATORS	ADDRESS / HEADQUARTERS	VAT ID	CONTACT	LOCATION AND TYPE OF FACILITY
CARITAS BISHOPRICS OF VARAŽDIN	Pavlinska 4, 42000 Varaždin	02475035518	phone: 042/320 205 mobile phone: 098/164 1152 e-mail: caritas.biskupije.varazdin@gmail.com	Caritas soup cuisine Bombellesova 15 42000 Varaždin
FRANCISCAN WORLD ORDER OF ST. IVAN KRSTITELJA VARAŽDIN	Franjevački trg 8, 42000 Varaždin	72243415660	Phone: 099/213 9616 e-mail: socijalna.samoposluga.vz@gmail.com https://web.facebook.com/Socijalna-samoposluga-Kruh-sv-Antuna-Vara%C5%BEdin-233976963450223/?ref=bookmarks	**Social self-service shop** "Kruh Sv. Antuna" Varaždin Josipa Kozarca 26 42000 Varaždin
CROATIAN RED CROSS-City Society of the Red Cross Varaždin	Stanka Vraza 8, 42000 Varaždin	91631060626	Phone: 042/ 214 496 fax: 042/213-813 e-mail: ck-varazdin@vz.t-com.hr	**Donated food collection center** GDCK Varaždin Stanka Vraza 8, 42000 Varaždin
CROATIAN RED CROSS-City Society of the Red Cross Ivanec	Đure Arnolda 11, 42240 Ivanec	63082439481	Phone: 042/781 534 e-mail: danijela.kasal@crveni-kriz-ivanec.hr	**Donated food warehouse** HCK Ivanec Đure Arnolda 11, 42240 Ivanec
CROATIAN RED CROSS-City Society of the Red Cross Novi Marof	Kralja Tomislava 16, 42220 Novi Marof	12203961791	Phone: 042/611 401 e-mail: crveni.kriz-novi.marof@vz.t-com.hr	**Donated food warehouse** Kralja Tomislava 16 42220 Novi Marof

➢ PILOT PROJECT CITYCIRCLE

The purpose of the pilot project implemented by the City of Varaždin at the City market is to raise awareness of users of the city market about the need to sort waste (which includes food waste), thus reducing the amount of municipal waste generated at the market. Separately collected organic waste is processed in a biogas plant where digestate is produced which is in turn used as fertilizer for the hazelnut plantation owned by the City Market.

➢ EUVITA CLUSTER

EUVITA Cluster [4] for Rural Development and Entrepreneurship is organized as an association in the Northwest of Croatia with the aim of developing, increasing competitiveness and exporting products/services of SMEs, processors of fruits, vegetables and medicinal plants in the region. The basic program goals of the cluster include projects of rural development and green entrepreneurship related to the implementation and improvement of plans and projects of the Regional and Rural Development Strategy, especially the Program of Healthy Nutrition, Natural Medicine and Nutritional Supplements and Natural Cosmetics. Special program for the development of rural tourism includes as well as projects for the multipurpose use of biomass for the production of energy and organic products, in cooperation with foreign partners.

Conventional production development programs are based primarily on the organization of optimal models of cooperation with the aim of the highest possible degree of processing, i.e., value-added chains of products, with the gradual creation of conditions for organic production and processing in line with market trends and joint development programs/projects with partners from the European Union. In addition to the previously mentioned, EUVITA is also a co-founder of the

[3] **https://poljoprivreda.gov.hr/istaknute-teme/hrana-111/sprjecavanje-nastanka-otpada-od-hrane/doniranje-hrane/registar/3718**

[4] https://www.euvitacluster.com/

national cluster HKKPPS (Croatian Cluster of Competitiveness of the Food Processing Sector). The activities of the cluster are focused on the field of bioeconomy, and thus the "circular economy" with the application of digitalization. For this purpose, the cluster is a co-organizer of expert conferences on this topic, and expert conferences on "green" energy and rural development through innovation and development of complete value chains of sustainable food production and rural tourism, considering the international cooperation that the EUVITA cluster has with individual organizations in Austria, Switzerland, Germany, and Hungary. In addition to the previously mentioned, further goals of the cluster, which greatly contribute to the development of the bioeconomy in the City of Varaždin, include the following activities:

a) Further development and organization (connecting/consolidating) of organic food producers in the chain of primary production and processing primarily in the Varaždin County, in general the area of development of new products and joint market presence. In addition to short (local) sales chains, the internationalization of products is envisaged depending on the interest of the partner or the needs of the market.

b) Development of low-energy greenhouses with the use of solar foils and digitalization of management and the use of independent solar irrigation stations.

c) In cooperation with the University Sjever (EUVITA cluster has signed a Cooperation Agreement with the University Sjever) the development of innovation processes and entrepreneurship in food production will be initiated. The planned cooperation is to be realized through joint EU projects.

- ASSOCIATION FOR THE PROMOTION OF SUSTAINABLE LIFESTYLE "GREDICA"

The Association for the Promotion of Sustainable Lifestyles "Gredica" [5]is a non-profit organization based in Varaždin. The main goal of the association is to promote and implement practical local solutions related to a wide area of sustainable living. The association is recognized by the public mostly for the successful project of a social garden called Wonderful Gardens (Čudesni vrtovi), which currently brings together more than 100 citizens from the area of Varaždin. The association also regularly organizes and conducts highly attended lectures and workshops in the field of the association (sustainable living):

- organic agriculture and horticulture,
- renewable energy sources, ecological construction,
- ecological (urban) traffic,
- alternative economy,
- alternative social models, etc.

One of the most important projects of the association related to sustainable agriculture and bioeconomy development is related to the project established with the support of the City of Varaždin and related to the ecological social garden called "Wonderful Gardens (Čudesni vrtovi)". The gardens bring together about a hundred users (citizens and their families) who garden and socialize together and produce organic fruits and vegetables for their personal needs. The gardens are equipped with nine tool sheds filled with common tools and machines, then with eight garden pumps, they are fenced and about 50 trees and fruit bushes have been planted on the common areas. The project has an important impact on raising awareness of sustainable food farming. Gardens contribute to improving the quality of life of their users, not only in financial terms related to the cultivation of their own fruits and vegetables, but also in health terms as it encourages the consumption of healthy organic foods from their own cultivation. The project promotes healthy living, i.e. it enables outdoor recreation and socialization and social inclusion of often marginalized groups (retired people), many of whom are garden users.

- CITY OF VARAŽDIN - DISTRIBUTION OF ORGANIC PELLETED FERTILIZER TO CITIZENS

In addition, the City of Varaždin, through public invitations, annually allocates organic pelleted fertilizer to citizens with the aim of encouraging citizens to grow healthy food for their own needs.

[5] http://www.gredica.hr/

Integrated Bio-Industry Assets

Public service companies in the Republic of Croatia are obliged to take measures to encourage recycling, including composting and digestion of waste, home composting and measures to promote the use of materials produced from biowaste.

Regarding biowaste recovery capacities, composting, anaerobic digestion, and energy recovery capacities of biowaste are available in Varaždin. One of the important development issues in the field of bioeconomy is solving the issue of anaerobic digestate quality and placing compost and anaerobic digestate on the market.

In addition, one of the long-term directions that is recognized at the European level, and which is considered to have better potential for the exploitation of waste fractions than composting and anaerobic digestion is the so-called valorisation of biowaste such as conversion to chemicals or raw materials to be used in biorefineries.

Bioeconomy is a new model for the economy defined as the use of renewable energy sources from land and water for food, materials, and energy. In addition, the bioeconomy model encourages the use of recycling and reuse of various materials, which seeks to establish a circular economy. In addition to industry and transport, intensive agriculture, as the main consumer of energy comes to the fore, characterized by high yields with mass use of chemicals and, high water consumption and soil depletion. To reduce the use of chemicals and fertilizers, sustainable agriculture promotes the use and application of natural fertilizers.

- BIOGAS PLANT OPG VRČEK

Within the CITYCIRCLE project, which is being implemented in Varaždin, the potential of the circular economy will initially be examined at a pilot level, and then, if it proves feasible, it will be expanded to a full-scale level. During the pilot project, each market user (mostly family farms) has received waste separation containers (glass, plastic, paper, biowaste) in order to improve the waste separation system in addition to the existing mixed municipal waste containers. Emphasis is placed on biodegradable waste. Local municipal company Čistoća d.o.o takes separately collected biowaste to the OPG Vrček. biogas plant, where biogas is produced from biowaste, while the produced digestate is used on a hazelnut farm owned by Market of City Varaždin.

The OPG Vrček biogas plant has a permit for waste management, i.e., for the following procedures:

1. R3: Recycling / reclamation of organic waste materials not used as solvents (including composting and other biological conversion processes)
2. R12: Modification of waste to apply any of the recovery procedures R1 to R11
3. R13: Storage of waste before any of the recovery operations R1 to R12 (excluding temporary storage at the place of origin, before collection)

The biogas plant is based on anaerobic digestion technology. Anaerobic digestion is a technological process of waste management where with the help of microorganisms in anaerobic conditions in a reactor, processes and stabilizes biodegradable waste with the production of biogas. In the biogas plant, in addition to biodegradable waste defined by the key number (20 02 01 - biodegradable waste) and listed in the Ordinance on by-products and revocation of waste status (OG 117/2014), waste under key number 20 01 08 - biodegradable kitchen and canteen waste and waste under key number 20 03 02 - waste from markets, can be treated.

- SOCIAL COOPERATIVE HUMANA NOVA

In addition to the example of the OPG Vrček biogas plant which processes biodegradable waste, in the area of the City of Varaždin the Social Cooperative Humana Nova Čakovec also operates and is a stakeholder in the pilot project as well. Social cooperative Humana Nova is a social enterprise engaged in the production and sale of quality and innovative textile products from ecological and recycled materials. Humana Nova produces for both domestic and foreign markets and encourages the employment of socially excluded people and people with disabilities. Through its activities, it actively and directly contributes to building a society of tolerance and cooperation and helps socially excluded people and their

families to raise self-confidence and quality of life. It also actively contributes to the sustainable development of the local community, poverty reduction and nature conservation.

Establishing an adequate system of separate waste collection would help in the collection of larger quantities of useful textiles, because separately collected textiles are of significantly higher quality than textiles found in mixed municipal waste.

- COMPOSTING PLANT VARKOM D.D.

Varkom's composting plant is equipped with modern technology that produces useful compost from municipal sludge from wastewater treatment plants for certain agricultural areas that citizens can acquire free of charge. Dehydrated municipal sludge up to 22% of dry matter is mixed with the addition of grinded wood biomass (wood chips) and the composting process gives the finished compost product (3rd class). Varkom composting plant processes up to 700 tons of municipal sludge per year from its own wastewater treatment plant, which has been completely converted into compost for growing and fertilizing lawns, flowers, ornamental plants and shrubs, and for soil revitalization in forests and parks.

SUPPORTING INSTITUTIONS FOR BIO-INDUSTRY DEVELOPMENT IN VARAŽDIN

To establish a circular economy system, it is very important to educate entrepreneurs about the importance of investing in innovative technologies and services. To this end, it is important to provide entrepreneurs with all the information related to the possibilities of co-financing the purchase of advanced, green technologies through funds from the European Union. In addition to the previously mentioned, it is very important to educate entrepreneurs regarding the application of new technologies that are primarily related to save energy and reduce waste (reuse, recovery, recycling).

- UNIVERSITY SJEVER

One of the relevant research centres is the University Sjever, which consists of the University Centre in Varaždin and the University Centre in Koprivnica. Considering the areas covered by the University Sjever, the academic community can provide research support in the technical, biomedical, social and artistic fields. Considering that one of the study programs is related to environmental protection, recycling and packaging, the University has the opportunity to conduct research related to the treatment and utilization of waste streams for energy production, which is one of the basic principles of bioeconomy.

- FACULTY OF GEOTECHNICAL ENGINEERING

In the area of the City of Varaždin the Faculty of Geotechnical Engineering operates, which belongs to the University of Zagreb. At the Faculty of Geotechnical Engineering[6], students can enrol in the study of Environmental Engineering. This study program covers topics such as waste management, environmental protection, water protection, geotechnics, green energy and circular economy. Education in the study of Environmental Engineering, allows future engineers to actively participate in the field of green jobs.

- TECHNOLOGY PARK VARAŽDIN

In addition to the University, one of the centres for research and development of entrepreneurship is the Technology Park Varaždin. Technology Park Varaždin is a company for establishing an incubation centre for innovative technological start-up companies, for establishing a mechanism for improving existing technologically innovative companies, improving knowledge transfer from universities and development centres to the economy, networking of companies, educational institutions, development agencies and innovative individuals and changing perceptions of innovation in order to promote the foundation of the new economy.

[6] https://www.gfv.unizg.hr/static/za-maturu

Bio-Energy Systems Assets

Considering that in the area of the City of Varaždin, biodegradable waste is one of the sources of biomass, the development of the bioenergy system can greatly contribute to the improvement and expansion of existing plants and construction of new biogas plants for biodegradable waste streams from separately collected waste.

In addition to biowaste, the biogas plants also treat manure, which presents difficulties to farmers due to the legally prescribed method of disposal (in accordance with the Nitrates Directive of the European Union). The construction of biogas plants is one of the best examples of a system for closing the production and processing agricultural processes, because it enables the production of heat and electricity as well as to ensure quality fertilizer. The produced electricity is transferred to the network, while the produced heat is used for the needs of processing raw materials for biogas production. For the purchase of electricity, an Agreement is signed with the Croatian Energy Market Operator (HROTE) at a preferential feed-in tariff, which is adjusted annually according to inflation and rising energy prices.

OPG Vrček, is guided by the principle of food - waste - energy. In addition to a pig farm, they also built a 250 kW biogas plant. In this way, manure from the farm, with the addition of organic matter, is used as a renewable energy source for the production of electricity and heat. Electricity is placed in HEP's distribution network, and the generated heat is used to maintain the temperature in the technological process and for the needs of heating the farm. At the same time, fermentation produces a high-value humus fertilizer for ecological fertilization of fields that are used to enrich the soil. This reduces the amount of biowaste disposed of in landfills, which is in line with European Union guidelines, and reduces the amount of greenhouse gases generated by the decomposition of biowaste.

Biogas obtained by anaerobic digestion usually contains 50-65 vol. % methane and 35-50 vol. % of carbon dioxide, 0-12 vol. % water vapor and small amounts of hydrocarbons, nitrogen, hydrogen, oxygen, ammonia and hydrogen sulphide (in some cases also Cl, F, Si). If biogas is purified and upgraded, biomethane is formed as a product. Biomethane is a gas containing more than 95 vol. % methane. Biomethane is a renewable alternative to fossil fuels as its composition and energy strength are very similar to natural gas. Biomethane can be injected into gas networks and used as natural gas in various proportions or used as fuel in vehicles. As an example of the use of biomethane, some cities in Europe already use the produced biomethane as a fuel for vehicles that perform public transport.

Opportunities for the development of the market for biogas production are firstly the construction of micro biogas plants that correspond to the capacity of small livestock farms (for capacities 10 - 50 kW) and secondly joint biogas plants at the municipal or city level. In this way, the concept of closing the life cycle of products in the food processing industry is enabled, which contributes to the establishment of the circular economy concept.

Renewable energy production in the form of biogas, in addition to solving the problem of biodegradable waste disposal, has the following impacts on the existing system:

- Contribution to the replacement of fossil fuels with renewable energy sources
- Reducing energy dependence on other countries
- Increasing the number of employees
- Reduction of harmful gas emissions
- Reducing the CO_2share in the atmosphere.

The Regional Energy Agency North (REA Sjever) deals with the preparation of projects in this area and with various models of financing energy efficiency and renewable energy projects. Regional Energy Agency North (REA North) is a public non-profit institution established in 2009, which operates mostly in northern Croatia, and in other parts of the country as required. One of the founders of the agency is, along with the City of Koprivnica and the City of Virovitica, the City of Varaždin. REA Sjever cooperates with local and regional governing units, public sector institutions, small and medium-sized enterprises, citizens and other stakeholders in the implementation of business plans related to sustainable development.

In addition to the Regional Energy Agency North, the Varaždin Energy Association and the Geothermal Energy Association (HUGE) operate in the field of energy efficiency in the City of Varaždin.

The Varaždin Energy Association is an association that deals with training for energy professions. The Association of Power Engineers Varaždin is an association of citizens, within the Community of Technical Culture, which brings together power engineers and operators of power plants.

The aim of the Association of Geothermal Energy (HUGE) is to encourage research, development, and use of geothermal resources of the Republic of Croatia by collecting, publishing, and exchanging scientific and technical information within the community of geothermal experts and the necessary communication with the public.

In addition to the goals related to energy efficiency, the City of Varaždin participates in the following initiatives:

- On October 24, 2012, the City of Varaždin joined the European Covenant of Mayors for Climate and Energy.
- In 2020, the City of Varaždin signed the Declaration on Good Energy by which the city accepts cooperation in the field of renewable energy sources, energy efficiency and other environmental projects and in the same year hosted the Good Energy Tour - Green Energy Cooperative educational program promoting solar power plants.
- In 2020 and 2021, the City of Varaždin, in cooperation with the Regional Energy Agency North, provided technical advice and information in the Varaždin office of REA Sjever and held public forums for citizens who want to apply for a public call for energy renovation of family house financed by the Fund for Environmental Protection and Energy Efficiency. The City of Varaždin continued to provide support to citizens in the field of energy efficiency and renewable energy sources, as it had previously provided for the installation of micro-solars.
- The City of Varaždin will additionally co-finance energy renovation projects for family houses, which will receive co-financing through a tender of the Fund for Environmental Protection and Energy Efficiency.

2. Current Local Bioeconomy System Mapping

Local Bioeconomy Priorities

From the process of collective asset and local systems mapping, what priority bioeconomy opportunities can your team identify for your community? Described these briefly. Why have these stood out as priorities (eg. linked to lots of existing assets, and/or filling a clear identified gap in the local system)? How do they link to the existing community vision/missions/context described above?

By analysing the subject area, it was determined that the main input raw materials, which can be processed for the purpose of energy production, are waste substrates. Waste substrates include:

- Separately collected biowaste,
- Biodegradable waste from the market,
- Waste food from restaurants and kitchens,
- Animal waste slurry.

The technology that can be used to treat biodegradable waste, which includes separately collected biowaste, biodegradable waste from the market, food waste from restaurants and kitchens and animal waste slurry is the anaerobic digestion technology.

Anaerobic digestion technology is carried out in a biogas plant, where the biodegradable substrate is degraded without the presence of oxygen by microorganisms. Biogas and digestate are formed as a product of decomposition. Digestate is mostly a high-quality organic fertilizer.

Biogas is a renewable energy source that can be used to produce electricity or can be injected directly into the energy grid and replace the use of natural gas. Biogas can be further purified and upgraded to biomethane.

PRIORITIES IN THE DEVELOPMENT OF BIOECONOMY OF THE CITY OF VARAŽDIN:

- collect separately at least 40% of the mass of produced biowaste which is an integral part of municipal waste
- reduction of biowaste disposal in landfills
- improve the biowaste management system (solving the problem of biowaste in the summer months, especially in residential buildings)
- prevention of food waste production
- establishment of short supply chain systems and localized agri-food systems
- encouraging home composting
- establishment of a system for donating surplus food
- Establishing sustainable public transport through the production and use of biomass fuels

BIOECONOMY MISSION

Mission

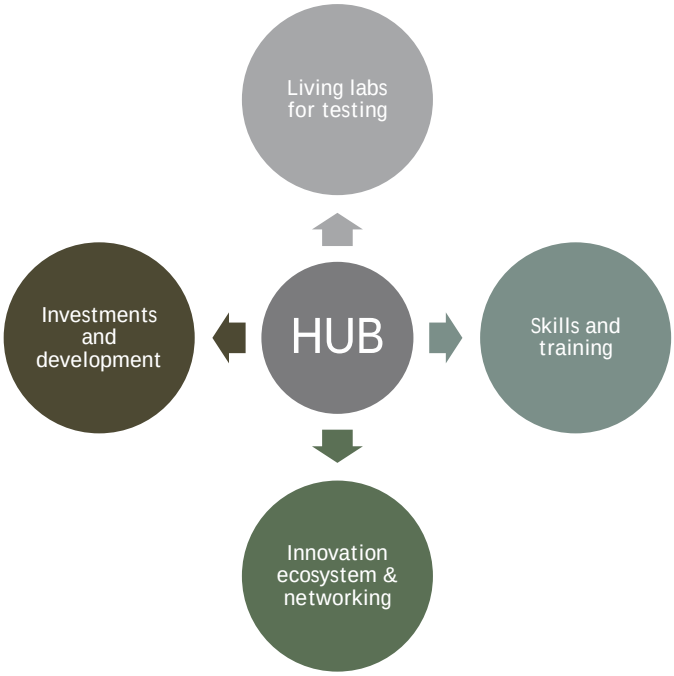
The mission of bioeconomy development in the City of Varaždin is based on the production and/or processing of renewable and natural resources and the conversion of these resources and waste materials into energy and/or value-added products. In accordance with the principles of bioeconomy, the use of natural resources should be sustainable and in accordance with the existing ecosystem while preventing negative effects on the environment.

Considering the specificity of the City of Varaždin and the recognized local bioeconomy priorities, the development of bioeconomy is based on the concept of sustainable waste management, which primarily refers to the use and recovery of biowaste, which is a raw material with high potential for energy and/or value-added products.

ACTION CENTRE PLAN

1. Overview

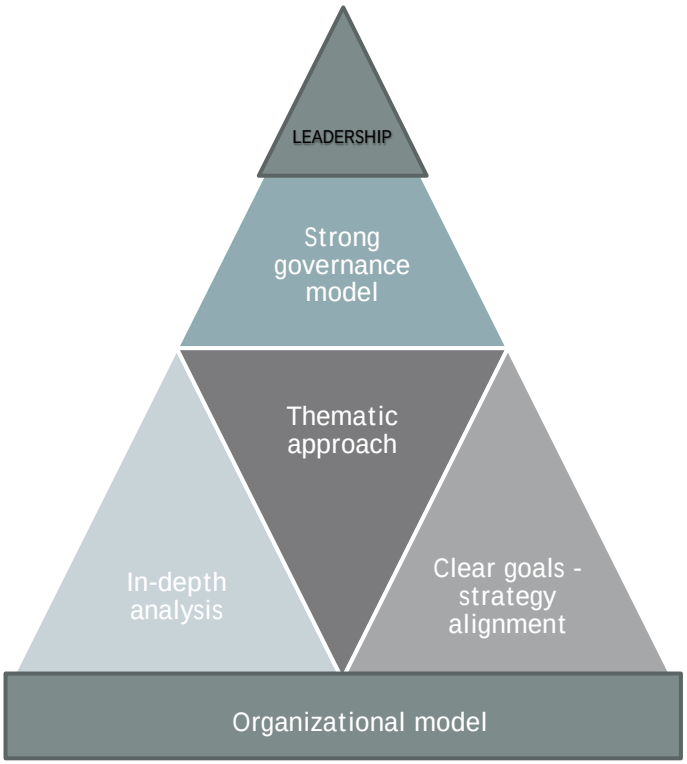
The driving wheel of the circular economy initiative will be a circular economy hub which is based on n-helix model and with actions like the concept of digital innovation hubs.



The challenges of circular economy are very broad and require deep changes of the business practice and social behaviour. This means that it will be approached systematically, by securing adequate skills and knowledge, development platform and investment and/or adequate business models.

Overall design will be driven by several principles:

- Clear set of goals determined by the strategy and action plan
- Activities will be based on an in-depth analysis of the ecosystem (business and societal)
- Strong governance model



2. Leadership/Governance and Organisation Model

Leadership/Governance Model

As the partner in the CITYCIRCLE project city of Varaždin corresponding department will lead the implementation of Circular Economy in Varaždin.

Currently the project partners are the main actors but with further development of the ecosystem and with new partners/participants the leadership team will need to change.

Therefore, governance model will accommodate these changes.

The HUB management model will transition from the initial form to more complex management structure as the number of partners increases and the project portfolio becomes more complex.

Initial model of governance will need to ensure that HUB can advance to the next level of its maturity which will involve more partners and number of projects.

In that sense the purpose of the governance model would be to ensure that:

- goals of the HUB are linked with circular economy strategy of City of Varaždin and other municipalities.
- set of actions and services are defined for the HUB to execute
- different agents with the capacity to contribute in an effective way are linked together
- a sustainability plan is prepared for the HUB based on public-private collaboration.

Governance model will need to ensure adherence to several principles:

- Immutable strategic goals to ensure continuity. This means that shareholders cannot change the basic principles of HUBs operation and its goals set out in the strategic documents.
- Clear guidelines on the rights and obligations of each member
- Rules on the value creation, assets management and its usage by all shareholders

This governance model, related to the first phase of HUB development, will need to transition into more complex model as the circular economy initiative gains regional awareness and participation. In the beginning mainly municipalities, utilities companies and agencies will be the new members alongside with several business and NGO organizations.

In this first phase more emphasis will be put on leadership model as the initiative at the beginning needs to get momentum and buy in from mayor stakeholders. The specifics and depths of the CE challenges will require support from municipalities and regional governments. Strong leadership and adequate model for other leaders from other municipalities will be crucial for the expansion of the initiative.

In this phase the governance model will ensure that strategic goals of all stakeholders are aligned with the EU and national policies and adequately solving regional challenges.

The purpose of governance model in this phase is to help build an environment of trust, transparency, and accountability necessary for fostering long-term investment, financial stability, and organisational integrity, thereby supporting stronger growth and more inclusive societies.

As the HUB develops and enters in the second phase of activities a modified and more complex governance model will be developed and put in place. This model will focus in more detail on:

- Institutional level – adherence to policies and shareholder's needs.
- Executive/Operational – including a governance board at the executive level and relevant working committees.

- Advisory – including a stakeholder forum

This governance model will need to ensure three things:

- engaging citizens and businesses
- measuring results
- execution (getting things done)

Governance model in this context will focus on putting in place systems of rules, practices, and processes by which organization will be governed. In this way distribution of rights and responsibilities by all participants will be implemented in the organization (HUB).

In addition to the initial set of principles expanded governance model would need to ensure implementation of another principle which relates to the ability to provide flexible decision making within the different working groups.

This means that HUB needs to avoid centralised decision making especially in matters that are not applicable or relevant to every working group.

Mission Contracts

Currently there are 13 stakeholder members committed to the project which are mainly public companies, academia, and local government. One member is from the SME segment. A larger list of potential stakeholders, which mainly includes entrepreneurs, was made during workshops and other project activities.

Preliminary research shows that from 24 companies 7 are already using some form of CE practices.

Organisation Model

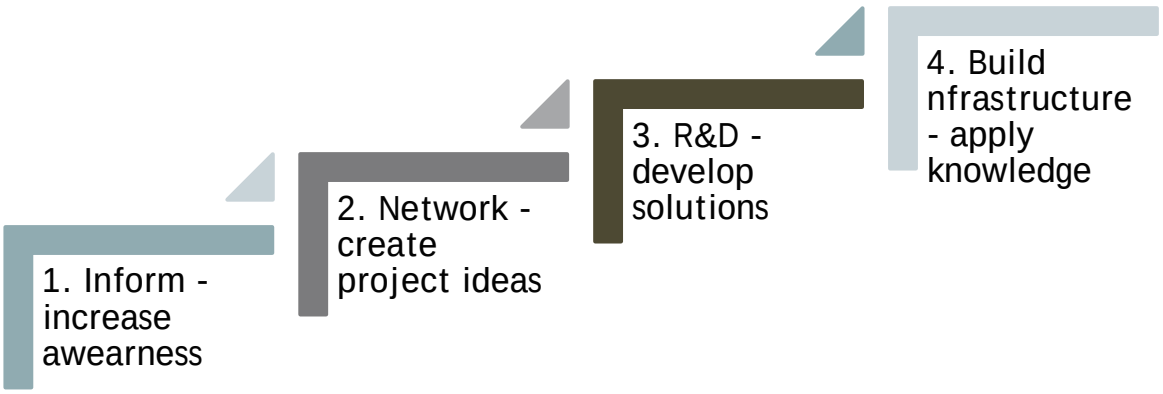
HUBs organizational model will have three levels.

First and top one would be the supervisory board which will represent in reciprocity the number of different types of stakeholders (municipalities, businesses, NGOs, utilities, research institutions,).

Second one will be the strategic level where working groups will be created for sub-thematic areas.

The third one is the operational level with the management board. Different experts and roles will be defined to ensure execution of strategic goals and actions.

As the HUB evolves and grows through its development phases organizational model will change and adjust.



3. Core Team

Core Team Model

The model of the core team will rely in the first phase on the HUB manager which will provide management support for the supervisory board and the leadership.

Other relevant core team members will come from the CITYCIRCLE project partners as they have the necessary knowledge, expertise, and experience. All these members know the community and local challenges. Considering the specifics of the region core team will in the first phase consist of portfolio developers for:

- biomanufacturing
- energy from biomass
- food chains
- utilities and waste management
- digitalization and information technologies
- clusters (HUB) developer

The principles of building the core team will be based on the analysis of priority challenges and needs of the ecosystem.

Based on the project results and findings the core principles would be to:

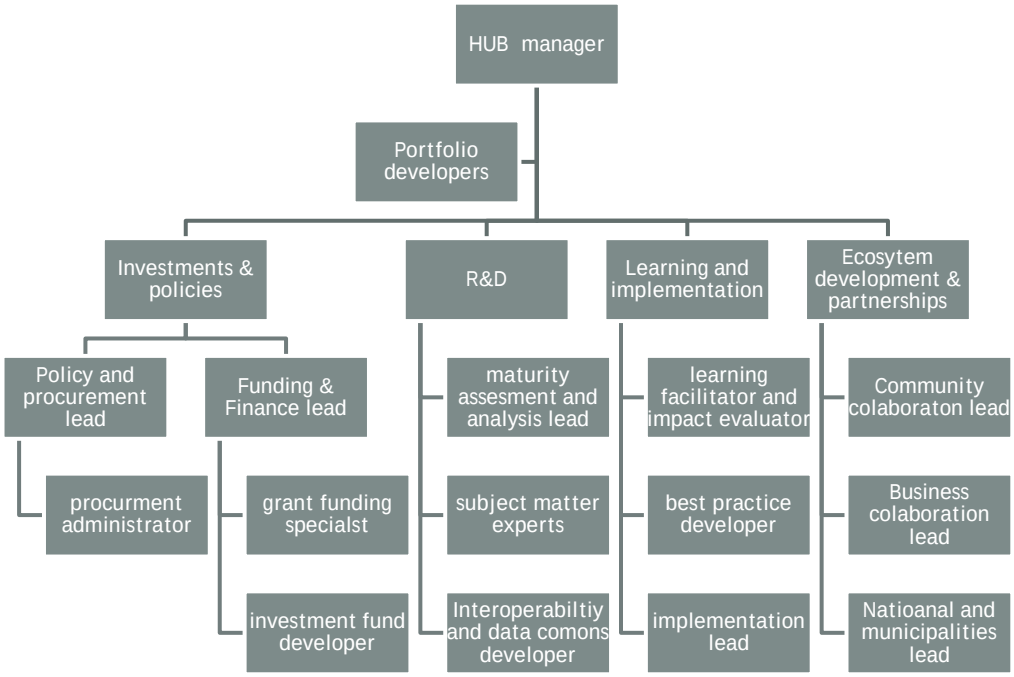
- provide relevant information about CE
- build portfolio which can have impact on local organizations and CE chains

Following these principles in the first phase emphasis is given on creating a team which consist of members who have direct experience in conducting CE related projects with proven outcomes and members who can facilitate in building the ecosystem.

Recruitment process for this phase will be based solely on the successful project references as the goal is to provide the wider community successful examples of CE best practice implementation.

For the HUB and cluster manager additional requirement will be necessary and they would mainly fall in the area of possessing necessary skills for building and managing partnerships, creating presentations and mapping various stakeholders needs and maturity levels.

In the next phase of the HUB additional core team members will cover the following roles:



For the expanded core team roles are defined based on the evolutionary stages of the HUB.

Roles are grouped in four most important areas:

- investment and policies
- Research and development
- Learning and implementation
- Ecosystem development and partnerships.

Core Team Funding/Resourcing Plan

The main starting point for Hub's operations will be the DAN development agency as it is the main partner in the CITYCIRCLE and has the necessary experience and knowledge about the CE.

In general funding scheme of the core team will change with the development stages of the HUB.

Initial financing of the HUB will come from the regional and local authorities involved. The pre-seed funding for the HUB manager will come from the DAN development agency. The municipalities and regional governments would finance the initial core team members which would consist of the before mentioned HUB manager and portfolio developers and one or two administrators/specialists. The portfolio managers, administrators and specialist would be mainly resourced from current partners on the project and its members/supporters.

Portfolio managers will be engaged via partnership agreements based on their institution type. If the portfolio manager is from a local government institution and intra-agreement would be made that regulated involvement of experts for specific bioeconomy sub-thematic area. If the expert is from a private, NGO or other type of organization than appropriate contract would be defined.

Financing gap for the initial core team will exist after the CITYCIRCLE project is finished and this gap would mainly be filled by a mix of local governments support and new national and EU funded initiatives/projects

The second stage of HUBs development which will include involvement of industry players, NGOs, RTOs will adopt characteristics of a cluster organization, which means that finance will come from all members.

As an extension to the second stage of HUBs development third and fourth stage of development would provide project base financing for additional staff.

4. Community allies

Development of the network and the whole ecosystem will mainly depend on the relevance of projects and initiatives conducted. In this sense the initial core team and subsequent core team staff needs to conduct a thorough analysis of the regional CE ecosystem and define two things:

- Which are the appropriate business models which are applicable to the region
- What best practices can be applied to the various stakeholders and what are the benefits they bring.

By applying this approach number of organizations, experts and community members will continuously increase which will give relevance to the initiative. Governance model and framework would be crucial for steering the HUB as a whole and individual activities/projects.

Of course, the usual activities which include awareness, citizen participation models and forums will be conducted as establishment of working groups for specific areas, processes and themes to provide diversity of approach and to cater to everybody's challenges, needs and issues.

5. Capacity Development Plan

We assume that capacity development would be mainly individualised with few topics relevant to all core team members.

As can been seen from the organizational chart every team member has a specific role, ranging to technical expertise, financing which is further divided to areas like investments, grants, procurement, policies etc. Another area is the ecosystem development and information/knowledge sharing.

All core team members would need to get at least medium level training on the specific challenges CE brings. This training would need to be conducted on two levels, one for managers and other for specialists/administrators.

Second type of training would need to be a mix of education and consulting as every team member would need to gain specific knowledge regarding application of CE to its area of work/interest. For example, investment specialist would need to be educated on how to create CE eligible investment studies but also would need to get consulting support on how to apply its knowledge to the regional specifics. Bioeconomy specialists would need to get specific engineering and/or technical training on how specific CE solutions work and on-filed consulting support on how they can be implemented.

ENABLERS

Overall defining the actions which will give insight on what enablers will have the most appropriate impact will depend on the awareness of the stakeholders and by stakeholders we mean, citizens, government, entrepreneurs, etc.

As will be more presented in detail in the Process and portfolio chapter by the proposed activities we can se that the regional lacks some basic infrastructure and facilities for managing waste. These facilities represent the key enabler from the infrastructure point of view for implementing a working circular economy plan. One of the obstacles the region faces is the lack of financing for developing this basic infrastructure and processing facilities. This brings us to two conclusions:

1. There is a lack of public awareness about the environmental issues and how they affect or will affect the quality of life.
2. Adequate business model is not developed that would ensure the sustainability of the infrastructure needed to establish a circular economy practice in the region, thus it is hard to secure adequate financing.

Croatia in general has a low level of waste recycling, although to a lesser extent Varaždin region is no exempt for that. With these introductory remarks and conclusion, we can devise a plan for enabling a path to circular economy.

1. Collaborative Communities

Community Communication

As is previously stated the circular economy hub will be the central knowledge and action point for implementing the circular strategy of the region. For that to happen a content communicated to the community member's needs to be simple, straightforward, continuous and with a much degree of practicality.

This means we will use two main directions:

- First will be to build on the existing pilot. The local market has already provided visible benefits throughout the pilot. It will serve as a good communication tool for the community on how circular economy can work in practice. Various means of communications can be employed, from workshops to learning content.
- Second direction will be to further an in a more insightful present the challenges of circular economy and environmental issues we are facing.

In general, there are not enough understanding of the environmental issues we are currently facing and what we will face in the future. These challenges will translate into many direct economic and environmental issues which will incur additional costs. These costs would need to cover by taxpayers' money. Circular economy is one of the most important tools to lower that cost, but it will require large upfront investment.

This message needs to be conveyed to all community members in a clear way with a proposition of several practical solutions with which community members can relate to.

Citizen Co-creation

If we assert the traditional practices and activities of the regions inhabitant's bioeconomy circular economy practices are embed into their day-to-day life, especially if we relate to famers and people who live outside or near urban areas.

We can build on these traditional practices to find new ways on how to use them within circular economy concept. This would best be done by conducting numerous workshops while implementing design thinking concepts. The modern way

of life has greatly made traditional practices obsolete from various reasons, many things have become a commodity, lack of free time, etc. We would need to set up small innovation labs to transform old practices into relevant circular economy practice.

2. Enabling Economies

Business Models

Entrepreneurs are obviously critical for enabling circular economy. But there will be a continuous challenge in ensuring their participation. One of the main barriers is the lack of valuable resources for achieving an economy of scale. For some processes there would simple be no economic justification for setting up processing facilities.

By using the results from detailed analysis about the waste cycle in the region, the circular economy maturity level a suitable action plan can be devised. Combing the results from the analysis and finding from citizen co-creation and NGOs actions can helps as to develop a realistic plan for stimulating working business models.

At this moment it is very difficult to propose concrete actions since we do not have enough data about the waste cycle in the region.

Transformative Investment

The most transformative investment will need to be for the basic infrastructure. Nevertheless, significant portion of the available investment funds which would need to be secured from various EU funded initiative would need to allocate to community lead projects. The circular hub will provide support and screening on available EU funds to strengthen the co-operation within the community and to increase awareness and understating of the environmental issues and how circular economy can solve it.

These parallel efforts along with investing in analysis of the current ecosystem would lead to development of innovative business models which could benefit from the new recycling infrastructure and processing facilities.

3. Smarter Systems

Data Commons

Circular economy hubs digital platform will have a marketplace for publishing needs for various types of raw materials, waste types they produce. This platform will in future phases grow to a central repository of all data related to waste management and circular economy related statistics in the region and serve as an open data portal

Interoperability

Building upon the digital platform and data commons role digital platform will incorporate various interoperability standards and information model. It will not seek to create it's on standard as this would be beyond its resource capacity. It will focus more on providing detailed guidelines on how to use available data (which are not part of the standards) in

other systems by providing interfaces and documentation. Hopefully this would help further develop or upgrade existing standards on national od EU level.

Smart Applications

The space for smart applications in circular economy is ever growing. Based on the citizen co-creation, community involvement and ecosystem analysis possible smart aplication will be identified.

Based on the finding of city circle project for city of Varaždin first smart application could cover two areas. First is the awareness part, where citizens could get more information on CE in an interactive way. Second would be to create extend the digital platforms marketplace to a full sized smart app for trading various goods in the bioeconomy space.

4. Municipal Momentum

Procurement

There are several areas where procurement can be beneficial. Municipalities can stimulate short food chains and mandated all public institutions and beneficiaries to participate in it. Additionally, they can mandate that biowaste is properly collected and recycled.

Public procurement process can be developed which incentives participants to use circular economy practices in fulfilling their contractual obligations.

Green procurement system must be developed and put in effect in coordination with the building of necessary infrastructure and processing facilities otherwise they will create unnecessary difficulties for organizations and entrepreneurs.

Therefore, first cause of action would be to create a feasibility study of the impact of green procurement in the region and a future foresight regarding bioeconomy development.

Policy

Most of the policy instrument relevant to the bioeconomy, waste management and circular economy are determined by the regulations on government level. There are larger projects which involves several regions which also dictates the framework for waste management of a single region and its municipalities. In that sense a proper analysis which has been outlined several times in the document is needed. Based on the analysis results City of Varaždin and participating municipalities will be able to determine what adequate policies can be created on local level. These local would need to provide meaningful impact while being aligned with national regulations, projects and initiatives in order to be able to benefit from available funding and resources from EU and national funds.

Organisational Readiness

Local municipalities and their public institutions and companies have very limited resources to create a systematic change in the area of circular economy. The circular economy hubs first mission would be to provide necessary insights, knowledge and best practices which would lead to better knowledge and resource sharing thus enabling them to free

human resources. This will result in better support of the innovation process and more community involvement in the area of circular economy spiralling new gains and value creation.

PROCESS AND PORTFOLIO MANAGEMENT

1. Near-term Portfolio

Three projects oriented towards biowaste are under development.

Plan is to provide enough adequate bins for waste separation, by which we mean underground tanks in settlements with buildings where it is necessary to preserve adequate living space. The plan has not been fully implemented because there are insufficient sources of funding. We plan to speed up this activity by preparing documentation which will create the preconditions for applying for EU funds.

In the field of anaerobic treatment of biodegradable waste, it is planned to use all produced biogas and digestate in the City of Varaždin. Biogas will be used as a fuel for public transport, while digestate is used as a valuable fertilizer on agricultural land. The measure has not been fully implemented because there are insufficient sources of funding.

We can speed up the activity by further educating the public about the importance of using biowaste, and by preparing documentation for the development of appropriate infrastructure - biogas filling stations.

For sludge disposal it was planned that more than 40% of the treated sludge be used on agricultural land.

So far this has been partially solved by carrying out activities for the disposal of 600 T of sludge per year through allocation of compost in bags to the public. Compost is obtained from waste sludge from wastewater treatment plants and enriched with wood chips, but for now it can only be used for lawns, flowers and ornamental shrubs until a solution will be developed for disposing it on food growing areas.

2. Strategic Actions & Experiments

Strategic Portfolio Overview

Action/Experiment Name	Brief Description (max 50 words)
Construction and equipping of a plant for sorting separately collected wastepaper, cardboard, metal, plastic and other materials – SORTING PLANT	The project of building and equipping the sorting plant is defined in the Joint Circular Economic Strategy of Varaždin as one of the strategic projects crucial for the transition to a circular economy. The treatment of useful waste components in the sorting plant will increase their quality and the possibility of their reuse as raw materials. This will contribute to increasing the recovery rate of waste.
Establishment of recycling yard Varaždin	Construction and equipping of a second recycling yard in Varaždin with a capacity of 7.000 tons per year.

Construction and equipping of a plant for biological treatment of separately collected biowaste – composting plant	The subject of the project is the construction and equipping of a plant for biological treatment of separately collected biowaste - composting plant in Varaždin, with a capacity of 2,500 tons per year, in which separately collected biowaste will be recycled by composting.

Replicate following sections to describe each planned action/experiment, create as many as necessary

Action/Experiment 1

Construction and equipping of a plant for sorting separately collected waste paper, cardboard, metal, plastic and other materials – SORTING PLANT

The subject of the project is the construction and equipping of a plant for sorting separately collected waste in Varaždin, with a capacity of up to 7,000 tons per year, which will separately collect wastepaper, glass, plastic, metal, textiles, and prepare materials for reuse and recycling.

Sorting plants are an important segment of the waste management system, as recyclable waste collected separately is sorted, selected, and cleaned from undesirable segments, which will increase its quality and value to become a secondary raw material offered on the market. The implementation of the project will contribute the increase of recovery and recycling rate of separately collected waste and reduce the amount of waste disposed of in landfills in the project application area, the City of Varaždin, and 19 other local governments in Varaždin County which will jointly use the sorting plant.

After the implementation of procurement procedures, construction works began in February and the deadline for completion of the entire project is 31.10.2022.

The key stakeholders of the project are companies authorized to recycle and process certain types of waste. The treated waste will be offered as a secondary raw material and it will available from the sorting economic operator at a market price. The expected results of the project are:

- sorting plant built and usage permit obtained
- 5.795 tons of sorted waste suitable for recycling will be processed in the first full calendar year of the sorting plant operation.

Project implementation period: 12.02.2021. - 31.10.2022.

The project is co-financed by a grant awarded through the Public Call "Construction and / or equipping of a plant for sorting separately collected wastepaper, cardboard, metals, plastics and other materials" (reference code: KK.06.3.1.12) which is financed by Cohesion Fund.

Total value of eligible project costs: 35.753.806,01 HRK

Grant amount: 30.390.735,10 HRK

Aid intensity: 85% of eligible costs

The City of Varaždin has already provided additional funds for the implementation of the project through the Public Call for co-financing the implementation of EU projects at the regional and local level for 2020 in the amount of 2.681.535,46 HRK.

The key enabler of the project is City of Varaždin as an investor and project applicant and the Development Agency North - DAN Ltd, which manages the project.

Action/Experiment 2

Establishment of recycling yard Varaždin.

The main goal of the project "Establishment of recycling yard in Varaždin" is to increase the rate of separately collected municipal waste that can be used as a secondary raw material or used for producing energy, in order to reduce the amount of mixed municipal waste and the amount of waste disposed of in the landfills.

The Varaždin Recycling Yard will collect all categories of waste listed in Annex IV of the Ordinance on Waste Management (OG 117/2017) (problematic waste, waste paper, metal, glass, plastic, textiles, bulky waste, edible oils and fats, detergents, paints, medicines, EE waste, batteries and accumulators, construction waste from minor household repairs) and waste prescribed by a special regulation governing the management of a special category of waste. The plan is to process 7.000 tons of separately collected waste per year. An important segment of the project is the implementation of educational and information activities that will cover at least 80% of the population in the project area, and whose purpose is to inform citizens about the importance of waste sorting, disposal options through the recycling yard and the possibility recycling waste and its environmental benefits. The delivery of the public service of collecting mixed municipal waste was assigned to the company Čistoća Ltd Varaždin, which is majority owned by the City of Varaždin, and will also be entrusted with the management of the recycling yard Varaždin, since in accordance with the Law on Waste Management, the provider of public service of mixed municipal waste collection is obliged to provide a recycling yard. The project is co-financed by grants awarded through the Public Call "Establishment of recycling yards" (reference code: KK.06.3.1.16) which is financed by Cohesion fund. The expected results of the project are:

- recycling yard Varaždin established
- conducted educational and informative activities within the project.

Total value of the project is: 7.547.177,50 HRK

Amount of the grant: 3.413.008,29 HRK

Project implementation period: 11.06.2021. - 11.06.2023. (24 months)

Action/Experiment 3

Construction and equipping of a plant for biological treatment of separately collected biowaste – composting plant

The subject of the project is the construction and equipping of a plant for biological treatment of separately collected biowaste - composting plant in Črncec Biškupečki in Varaždin, with a capacity of 2.500 tons per year, in which separately collected biowaste will be recycled by composting. This will contribute to the improvement of the waste management system in the area of 17 local self-government units of Varaždin County, from whose areas the separately collected biowaste will be recycled, and thus increasing the recycling rate, reducing the amount of waste disposed of in landfills while providing education to the citizens on bioeconomy thematic.

By using compost in agriculture, it is possible to reduce the use of artificial fertilizers, improve soil quality and enable plants to develop faster and healthier. Recycling of biowaste in composting does not create any harmful effects on the environment (soil and air), while the disposal of biowaste in municipal landfills has significant negative impacts on soil and air caused by decay of biowaste. It is one of the indicators of the benefits of this investment.

The project will have a positive impact on a number of groups in the project scope:

- producers and owners of municipal waste who are also end users because the construction of the composting plant will have the infrastructure for quality disposal of biowaste-
- population (households) from 17 local governments that are in the project area that will be educated on the importance and effects of sorting and separate waste collection, the role of compost in the waste management system and the importance of recycling and recovery of useful waste components. They will be able to get a visible confirmation that the waste is sorted for a reason and that it will not end up in one pile as it is often presented in public. They wail be able to use the resulting compost from the compost plant to fertilize the soil in their gardens, flower beds, orchards, etc.
- producers of vegetables, fruits, plants, restaurants. Plant will process their biowaste which than can be used within their production process, for example to farmers as compost and natural fertilizer and thus reduce the use of fertilizers which will lead to improved quality of their products, which is increasingly important to customers. Also, the project will contribute to reducing unemployment by creating 3 new jobs.

The expected result of the project is:

- Recycling plant built and equipped for the purpose of establishing new capacities for biowaste recovery.

Total value of the project is: 5.904.658,70 HRK

Amount of the grant: 4.133.261,09 HRK

Project implementation period: 01.10.2020. – 31.07.2022.