



EMERGREEN

Report on Relevant Technologies, Methods and Systems

University of Helsinki

Ruralia Institute

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**Northern Periphery and
Arctic Programme**
2014–2020



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CONTENTS

1.	INTRODUCTION	4
1.1	<i>SCOPE AND AUDIENCE</i>	4
1.2	<i>STRUCTURE</i>	4
2.	POTENTIAL TECHNOLOGIES, METHODS AND SYSTEMS	5
2.1	<i>WASTE MANAGEMENT</i>	5
2.1.1	Recycling App “Bin-ovation”	5
2.1.2	e-Korren waste analytics dashboard	7
2.1.3	Karma App for rescuing unsold food	8
2.2	<i>RENEWABLE ENERGY AND ENERGY SAVING</i>	9
2.2.1	Solar map (SOLEY)	9
2.2.2	Uniride App for car pooling (under development)	11
2.3	<i>TECHNOLOGIES AND METHODS FOR SUSTAINABILITY EDUCATION</i>	12
2.3.1	Shaun the Sheep Game	12
2.3.2	Sustainable family sensitisation with Facebook	13
2.4	<i>TECHNOLOGIES AND METHODS FOR CITIZEN ENGAGEMENT</i>	15
2.4.1	Integrated Data Platform	15
2.4.2	Social virtual reality	17
2.4.3	Living lab as a co-production methodology	20
2.5	<i>TECHNOLOGIES AVAILABLE FOR DIGITAL PARTICIPATION IN PUBLIC SERVICES</i>	23
2.5.1	Introduction	23
2.5.2	e-Forms and feedback forms	24
2.5.3	On-line questionnaires	25
2.5.4	Maps and Gis-based technologies	26
2.5.5	Mobile apps and platforms	27
2.5.6	Hybrid digital platforms	28



2.5.7	Chatbots and digital recommendation technologies	29
2.5.8	Social media	30
2.5.9	Virtual reality	31
2.5.10	Virtual assistants	32
2.5.11	Hackathons	33
2.5.12	Games and 3D applications	34
2.5.13	Real time participation technologies	35
2.5.14	Participatory design and living labs	36
2.5.15	Crowdsourcing platforms	37
2.5.16	Blockchain technologies	38
2.5.17	Summary and potential application in the project	39
2.5.18	Remarks on the intelligent participation service future development	42
3	SUMMARY AND GAPS TO BE COVERED	43
4	CONCLUDING REMARKS	44
	ANNEX 1: Selection of participatory technologies. Potential GitHub profiles (2018)	45
	ANNEX 2: EMERGEEN services description	51



1. INTRODUCTION

1.1 SCOPE AND AUDIENCE

In accordance with the project document, the overall objective of WP1 is the co-development of the green growth type of public services that will be tested and refined in real life conditions and shared on a transnational platform later in the project.

As first, this report is set to take the stock of the existing experiences and to assess the relevant available technologies or methods in order to inform the partners in the choice of the most suitable ones for the planned services.

This report is the deliverable WP1T1 of WP1, coordinated by the UH. It summarises the inputs from five project partners. The report is work in progress for internal use between the EMERGREEN partners.

1.2 STRUCTURE

This WP report classifies the contributions received from the participating EMERGREEN partners according to the driving motive of technology or method development. The report first compiles inputs related to waste management (in Chapter 2.1) and related to renewable energy and energy saving (in Chapter 2.2). Next, it pulls together experiences related to sustainability education and learning (Chapter 2.3). This is followed by existing experiences pertaining to and driven by the citizen engagement with innovative methods (Chapter 2.4). Chapter 2.5 comprises a wide exploratory inventory of different technologies or methods with citizen participation in mind. Like the previous chapter with the citizen engagement and participation as the driving motive, this chapter is not referring to any specific public service sector. This account was carried out in view of the subsequent development of "Intelligent green participation service".

Different degrees of detail was provided on the reported technologies or methods, including varying levels of first hand experiences. Consequently, reporting along the suggested standard template is not followed strictly. Some template headings are either combined or left out.

Annex 1 is supplementary to chapter 2.5 and it includes a list of potential open source programmes and codes retrieved from Github –database.

Annex 2 contains EMERGREEN services description as per the project plan.

2. POTENTIAL TECHNOLOGIES, METHODS AND SYSTEMS

2.1 WASTE MANAGEMENT

2.1.1 RECYCLING APP- "BIN-OVATION"

2.1.1.1 DESCRIPTION / AN OVERVIEW

Recycling app – "Bin-ovation" is a mobile app technology that enables several functions:

- Push notifications to be sent to subscribers about any change to bin services;
- Recycling calendar, recycling centre opening times or any time bound messages;
- News and information function;
- A search tool (function) for recycling information – what material goes in what bin;
- Report function where people can take pictures of litter and send these to Council.

The enlisted key impacts of the service are:

- Accessibility to recycling information improved
- Digital credentials of organisation improved by offering local citizens app service
- Recycling rate increasing as downloads of app increase. NOTE: This is also due to a range of new operational measures.
- Awareness of recycling best practice increased

Council promotes this app to residents in the Derry City and Strabane District Council area. The app has currently 2000 users but the aim of DCSDC is to increase this significantly within the next 18 months through a range of tactics including:

- Competitions on social media e.g. chance of winning a tablet if you download the app
- Outdoor visibility – vinyl banners & signage at key Council events/Recycling Centres promoting the app
- Branding on all recycling marketing collateral; bin stickers, digital docs/ads, recycling guides,
- Targeted Facebook/Instagram ads promoting the app in areas of poor recycling to target demographic (18-35 year old males)
- PR: developing content for local media promoting app to local citizens



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2.1.1.2 POTENTIAL APPLICATION IN THE PROJECT

DCSDC's preliminary assessment:

<i>Services</i>	<i>How this experience can be used to deliver this service</i>
<i>Marine litter mapping and management service</i>	Report It function of Bin-ovation could really enhance this project empowering local people to gather marine litter intelligence. By promoting this app, it will also increase local awareness of the project. Open Litter Mapping may also be useful for this project. This involves litter being mapped using GPS technology.
<i>Zero Waste circular management service</i>	App currently used to improve this service by DCSDC.
<i>Green growth advisory services</i>	Push notifications element & news/info area of this app may be useful in providing advice to local community as per Green Growth Advisory Service project objective.
<i>Intelligent green participation service</i>	Digital participation element through Report It function of Bin-ovation could be used to enhance this project. People will feel empowered and like their contributing to the green journey.
<i>Data story telling of green energies service</i>	Bin-ovation enables the user to view local recycling services in a very accessible way using their smartphone or tablet. An app functionality for data story telling should also be explored for the green energies service.

2.1.1.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

App licensed and run by Bin-ovation Ltd. Organisation must apply to this company to use. Annual cost £2000.

2.1.1.4 SUPPORT AND OTHER USEFUL INFORMATION

The App can be downloaded from App Store or Google Play. User interface very straightforward and information can be specific to each area.

Open Litter Map also referenced: www.openlittermap.com

Key contact: Sean Lynch



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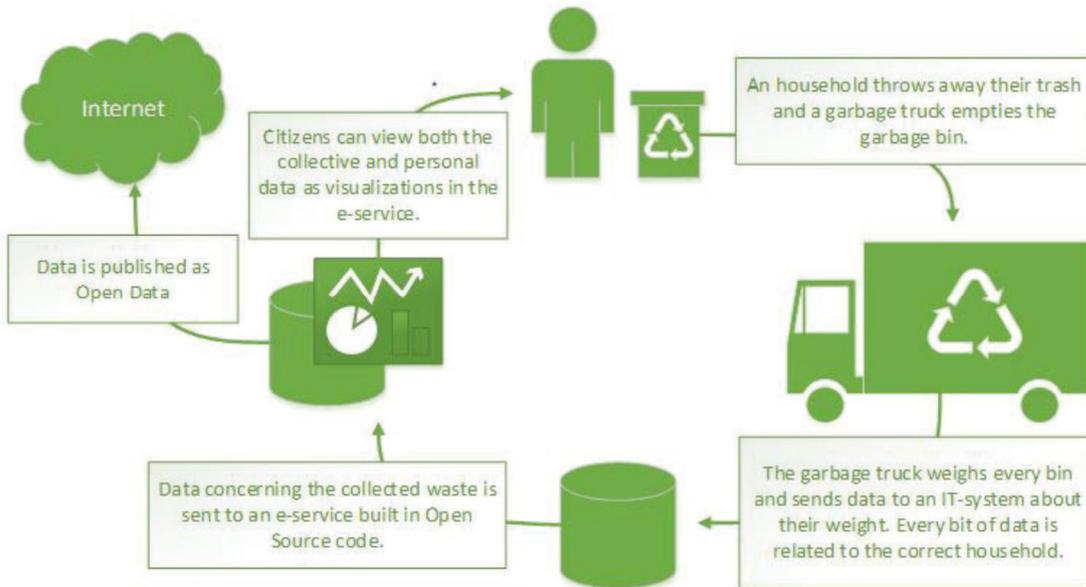


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2.1.2 E-KORREN WASTE ANALYTICS DASHBOARD

2.1.2.1 DESCRIPTION / AN OVERVIEW

A method including the whole cycle in waste handling, from the household throwing away their trash, to the household viewing their own data in the e-service.



2.1.2.2 POTENTIAL APPLICATION IN THE PROJECT

ALAV's preliminary assessment:

<i>Services</i>	<i>How this experience can be used to deliver this service</i>
<i>Marine litter mapping and management service</i>	--
<i>Zero Waste circular management service</i>	e-Korren can be used for both inspiration, technology and methods in forming the Personalised Waste Analytics Dashboard
<i>Green growth advisory services</i>	--
<i>Intelligent green participation service</i>	--
<i>Data story telling of green energies service</i>	--



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2.1.2.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

eKorren is a project that is exploring how Information Technology (IT) can be used to aid the development towards a sustainable society. How sensors (Internet of Things), Open Data, Visualizations and Gamification together can help the City of Sundsvall to become a smarter city.

The project has focused primarily on waste data, where the project has ensured the quality of the waste data in the City of Sundsvall, data that is generated by weight-sensors on the trucks that collect the waste. The data has then been published as Open data for re-use by the public (according to the Public Sector Information-directive in EU), to enable the creation of new services and open innovation. The data has been published in an open format both as a downloadable file and a REST API (Application Programming Interface).

The data has also been used to create an e-service for the citizens of Sundsvall where a citizen can log in and view visualized data specifically for their own home.

eKorren will deliver an Open Source e-service with dashboard functionality, with functions to gather data from other systems and display them both publicly and behind a login. The data stored in the e-service can also be published as an REST API for ease of re-use for the public (Open Data).

2.1.2.4 SUPPORT AND OTHER USEFUL INFORMATION

This platform opens several opportunities to gather more data in more areas of a city, like water usage or energy usage. And since the platform is open source it can be used anywhere by anyone without any licensing costs.

2.1.3 KARMA APP FOR RESCUING UNSOLD FOOD

2.1.3.1 DESCRIPTION / AN OVERVIEW

Karma is an app that helps a person rescue unsold food from being wasted. Instead of wasting food, businesses upload unsold food to Karma. Karma is available in 150+ cities across Sweden, and in London. Items are bought in-app and collected as takeaway. Retailers earn additional revenue, app users save on delicious food, and together they have a positive impact on the planet.



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2.1.3.2 POTENTIAL APPLICATION IN THE PROJECT

ALAV's preliminary assessment:

Services	How this experience can be used to deliver this service
<i>Marine litter mapping and management service</i>	--
<i>Zero Waste circular management service</i>	--
<i>Green growth advisory services</i>	--
<i>Intelligent green participation service</i>	Karma can serve as an external example of mapping and co-creation for a better environment.
<i>Data story telling of green energies service</i>	--

2.1.3.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

See <https://karma.life/> for more information.

2.1.3.4 SUPPORT AND OTHER USEFUL INFORMATION

See <https://karma.life/> for more information.

2.2 RENEWABLE ENERGY AND ENERGY SAVING

2.2.1 SOLAR MAP (SOLEY)

2.2.1.1 DESCRIPTION / AN OVERVIEW

The basic idea of the solar map Soley is a 3D map combined with data from SMHI (the Swedish Meteorological and Hydrological Institute). The project produces a Sun-map for Västernorrlands all seven municipalities, Västernorrland thus becoming the first county in Sweden with a county-sun-map. The sun-map provides a picture of how many kWh of solar power lands on a roof, and which part of the roof or wall is the best to mount solar panels on.

It is considered important to know how the existing installations and long-term access to solar radiation can be ensured, something called "solrätt". Using the Sun-map therefore is seen as a natural first step in the analysis of renewable energy for a building, a block or a whole city. The map will be

showing the solar insolation on roofs and facades on approximately 80 percent of the buildings in the seven municipalities

The map will be implemented at the homepages of seven municipalities of Västernorrlands and will be promoted toward the citizens during Q1 2019. The map is one of the first joint digital projects in Västernorrland aimed towards renewable energy. In the beginning the main purpose of the map is to raise interest in solar energy amongst the citizen.

In answer to the high citizen interest already, ALAV plans to launch the solar map full scale with a work schedule for 2019 including the following:

- An instructional film is being produced right now, planned to be implemented during on each municipality during (early) Q2 2019. It will contain each of the seven municipalities name, logo and pictures typical from the area (see example from Härnösand below). Each Energy- and Climate Advisor will be shown in the end with contact information.
- The map generated quite a lot of PR even before it was up-and-running, a new PR campaign is planned for Q2 2019.
- An ad with pictures/voice over/short film will be produced, to be placed in social media. Planned for Q2-3.
- The main target audience is house owners and facility managers, but also to raise awareness in the population as a whole.

The benefits from this project is to get citizens and SMEs in Västernorrland to install solar energy and thus reduce carbon emissions.

2.2.1.2 POTENTIAL APPLICATION IN THE PROJECT

ALAV's preliminary assessment:

Services	How this experience can be used to deliver this service
<i>Marine litter mapping and management service</i>	GIS-map knowledge could be of interest.
<i>Zero Waste circular management service</i>	--
<i>Green growth advisory services</i>	Will be one of the services provided by the new platform for the Energy and Climate Advisors.
<i>Intelligent green participation service</i>	--
<i>Data story telling of green energies service</i>	Sharing knowledge in communication regarding solar panels could be of interest.



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2.2.1.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Following ALAV, a lot of lessons have been learned over the (previous) time span of the project:

- Difference of digital maturity of the staff involved.
- It takes a lot longer than expected to merge new technologies. Both at the external consultants, also internally at the municipality in charge of operating and maintaining the map.
- High commitment level from all parts of the county is needed.

With the sun-map tool urban planners, architects and builders will be able to consider solar energy: 1) as a designing parameter in the urban development process, and 2) create a basis for decision making.

2.2.1.4 SUPPORT AND OTHER USEFUL INFORMATION

External link briefly explaining GIS maps: <https://www.youtube.com/watch?v=EpNeGMxefcQ>

This is a link to the Solar map webpage (will be updated during the project due to a new webpage):

<https://www.kfvn.se/solkarta.html>

An instructional movie has been produced in Härnösand to raise awareness of the solar map:

<https://www.youtube.com/watch?v=n8UrH-QiwIM>

Similar movies are being produced for the rest of the municipalities in the county of Västernorrland.

External link briefly explaining GIS maps:

<https://www.youtube.com/watch?v=EpNeGMxefcQ>

2.2.2 UNIRIDE APP FOR CAR POOLING (UNDER DEVELOPMENT)

2.2.2.1 DESCRIPTION / AN OVERVIEW

An app-based platform under development for carpooling of children to leisure time activities. At Uniride the parents can organize carpooling in for example the children's soccer team.



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2.2.2.2 POTENTIAL APPLICATION IN THE PROJECT

ALAV's preliminary assessment:

<i>Services</i>	<i>How this experience can be used to deliver this service</i>
<i>Marine litter mapping and management service</i>	Uniride can serve as an example of data crowdsourcing, mapping and co-creation.
<i>Zero Waste circular management service</i>	--
<i>Green growth advisory services</i>	--
<i>Intelligent green participation service</i>	Uniride can serve as an external example of co-creation.
<i>Data story telling of green energies service</i>	--

2.2.2.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

See <http://uniride.se/>.

2.2.2.4 SUPPORT AND OTHER USEFUL INFORMATION

See <http://uniride.se/>.

2.3 TECHNOLOGIES AND METHODS FOR SUSTAINABILITY EDUCATION

2.3.1 SHAUN THE SHEEP GAME

2.3.1.1 DESCRIPTION / AN OVERVIEW

This game, designed by the [Sustainable Learning](#) team in the UK and created by [Aardman](#), is free to play and challenges young people to build their own sustainable city by balancing five themes: food, nature, energy, transport and resources, whilst inspiring children to think about green issues. The game has now been translated into all EU languages and developed in 28 Member State versions.

2.3.1.2 POTENTIAL APPLICATION IN THE PROJECT

ALAV's preliminary assessment:

<i>Services</i>	<i>How this experience can be used to deliver this service</i>
<i>Marine litter mapping and management service</i>	--
<i>Zero Waste circular management service</i>	The game can serve as an example of gamification to impact behaviours
<i>Green growth advisory services</i>	--
<i>Intelligent green participation service</i>	--
<i>Data story telling of green energies service</i>	--

2.3.1.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Connecting teachers with free learning resources and expert knowledge to inspire children about sustainability through National Curriculum learning.

2.3.1.4 SUPPORT AND OTHER USEFUL INFORMATION

See <https://www.sustainablelearning.com/> for more information.

2.3.2 SUSTAINABLE FAMILY SENSITISATION WITH FACEBOOK

2.3.2.1 DESCRIPTION / AN OVERVIEW

Ten families in Sundsvall participated in the municipality's project "Sustainable family" to learn to live more sustainably for nine months. During the project, the families succeeded in, among other things, reducing their water use and the amount of household waste, but also cycling more and buying less.

2.3.2.2 POTENTIAL APPLICATION IN THE PROJECT

ALAV's preliminary assessment:

Services	How this experience can be used to deliver this service
<i>Marine litter mapping and management service</i>	--
<i>Zero Waste circular management service</i>	--
<i>Green growth advisory services</i>	--
<i>Intelligent green participation service</i>	--
<i>Data story telling of green energies service</i>	The method could be adapted to explain solar panels and heat pump solutions to a wider audience.

2.3.2.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

The families learned how to live more sustainably in the areas of Chemicals and Water, Electricity and Energy, Food and Consumption, Waste and Recycling, and Travel and Health. All contact with the families and information to them happened on Facebook to make it easy for everyone to participate and be active when it suited them. The municipality arranged lectures on, for example, renewable energy, endocrine disrupting chemicals and cultivation, as well as study visits to a sewage treatment plant and a waste incineration plant.

During the project, the spread of the posts on Facebook increased and they reached far beyond the municipality's borders and internationally.

The idea could be transferred to other environmental issues to increase knowledge and raise awareness.

2.3.2.4 SUPPORT AND OTHER USEFUL INFORMATION

More information regarding the resources required can be offered on demand.



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2.4 TECHNOLOGIES AND METHODS FOR CITIZEN ENGAGEMENT

2.4.1 INTEGRATED DATA PLATFORM

2.4.1.1 DESCRIPTION / AN OVERVIEW

In order to increase transparency, Public Administrations across Europe and other parts of the world have launched their own open data portals. These initiatives are targeted at driving more openness, reducing corruption and improving citizen services. However, despite the increasingly availability of open data, engagement of citizens have remained lower than expected. This raises the need to find other and new ways of increasing engagement.

The Integrated Data Platform (IDP) is the solution conceptualised, designed, implemented in the context of the ROUTE-TO-PA project to address this challenge. IDP comprises the integration of two different platforms: 1) an open data management platform with a set of features to simplify access and understandability of data; called Transparency Enhancing Toolset (TET) and 2) a social platform for data-driven engagement; known as Social Platform for Open Data (SPOD). The integrated platform enables the transition into the next generation of Open Data portals by creating tools that will *enable citizens to socially engage with open data users over Open Data resources* and also provide tools that could be integrated into existing Open Data platforms *to deliver greater data transparency and quality and, understandability.*

The SPOD component focuses on enhancing transparency by *promoting collaboration to support several kinds of activities* related to the use of Open Data. The general aim is to support groups who share a common goal by providing awareness of respective activities, and supporting the creation of relationships among people with common interest. The specific aim of SPOD is to engage users in forming groups to discuss topics of interest by using Open Data. Therefore, it facilitates data-driven discussions where citizens together with their public administrations discuss with arguments supported by data (evidence-based discussion). SPOD also includes other functionalities, such as, the creation and sharing of visualizations, and crowdsourcing of data along with discussions.

The TET component extends popular and widely adopted Open Data platform such as CKAN, with a set of tools aimed at radically *improving end-user access* to relevant datasets as well as facilitating significantly better understanding of available datasets by “non-technical” end-users like citizens or the public at large through the provision of simple commonly used analytical tools and graphical representation of datasets in visualised manner. TET further facilitates storytelling driven visual analytics. CKAN is a free open source web-based open data platform and the de-facto standard for implementing open data portals. The underlying CKAN platform provides comprehensive data management and data discovery services as well as indexing and full text search. CKAN is designed to facilitate easy discovery of data and has a broad user base. Governments around the world including

US, UK, Ireland and Australia, use the platform for making open data accessible to citizens, businesses and other stakeholders. CKAN provides many essential features required to publish, share and visualize datasets and offers powerful cataloging, searching and storing capabilities.

When used together, the IDP seeks to pave a new road regarding applications and public services based on open data. It offers an integrated workflow from finding and analysing to visualising open data and publishing user's generated data-stories. Therefore, platform enables citizen/users, with their public administrations, to better explore datasets, discuss around open data, analyse and create visualizations to better understand issues them and possible co-create solutions with Public Administrations and local authorities.

Potential Impact: In order to improve public services and decisions by local authorities and regional entities, the platform supports the co-creation of information, knowledge and ideas by forming communities or groups around topics of interest or challenge.

2.4.1.2 POTENTIAL APPLICATION IN THE PROJECT

See the table under 3.4.2.2 where IDP and SVR are discussed together.

2.4.1.3 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

The benefit of the current technology/platform is that any additional functionality can be wrapped into a separate component and be added to the platform. TET includes a set of tools designed to extend the functionalities of popular open data platforms and in particular, CKAN with data accessibility and understandability features, describing User Interface Services and Storage layers. SPOD includes the Collaborative layer and the Presentation layer. The Collaboration layer includes SPOD Agora for public discussions, SPOD Knowledge Co-creation room, SPOD Data Co-creation room, SPOD Media Co-creation and Use and Reuse of the data. The Presentation layer represents how the stories can emerge through raw data. The Collaboration layer provides data visualization that can be embedded as an inline text within a story or this visualization can be shared on the social media for communicating information via the Internet.

The IDP (comprising SPOD and TET) is easily transferrable and easy to deploy at the target environment.

2.4.1.4 SUPPORT AND OTHER USEFUL INFORMATION

Installation Guide, Technical documentation, User Manual and Administrator guide for TET 3.0 is available on the GitHub repository at

<https://github.com/routetopa/tet/wiki>. <https://github.com/routetopa/tet/wiki>.

SPOD v.3.0 together with all documentation is available at

<https://github.com/routetopa/spod>

2.4.2 SOCIAL VIRTUAL REALITY

2.4.2.1 DESCRIPTION / AN OVERVIEW

Virtual reality (VR) creates realistic, immersive experiences for its users. It also allows for freedom of interaction that is unprecedented in previous communication modes. The effective tracking of movement combined with directional virtual-proximity-sensitive audio and simulated expressions enable very natural expressivity and intuitive interaction with the environment and other participants. These features combine to create extremely powerful experiences that not only allow users to interact in a realistic manner with virtual reality applications, but with other users as well.

In particular, the Social Virtual Reality Solution (SVRS) allows easy collaboration and collective simulation of almost limitless scenarios inside the VR environment. Therefore, VR technology effectively facilitates and improves useful engagement by the public in the planning processes, unlike the traditional consultation process. The SVRS builds upon well-established platform – AltspaceVR. The expandable WebVR-based core framework enables significant flexibility in terms of arranging immersive virtual environments and incorporating new logical elements. SVRS can host a City Hall meeting or public debate or consultation where citizens can participate remotely with interactivity level very close to face-to-face meeting while offering some experiences going beyond in-person meeting. For instance, inside the VR space a newly planned development can be projected and investigated (like new city developments, buildings, roads etc.) and explored, as they would be already implemented or developed. That enables the audience to have much better understanding and tangible overview of the government intentions in realizing the endeavors discussed.

Significant advantage of SVRS is that thanks to the increased immersion of the citizen into the interactive processes the overall trust is raised. Moreover, without the loss on expressivity and trust, users are behind avatars (which can be human, robotic or other), therefore their appearance, gender, ethnicity does not need to be revealed to other participants and it does not affect the communication. Therefore, unlike in any other mode of communication, SVRS enables the citizen to truly 'be closer' to the government through very natural and fair, bias free communication. Moreover, the handling and easy management and moderation of users or citizens across virtual environments can reduce

harassment and help improve service co-creation by involving service users in the development process.

Additionally, users or citizens can play a role in defining the allowable behavior and tasks within specific virtual environments. Giving users an option to select the environment they wish to enter and to change environments after entering one, will reduce the number of abuse incidents slightly because the user can exit or alter the discomfoting environment. This can be further accelerated and enforced by using designated community moderators such as the public sector who control the specific service environment, setting the rules the public administrator determines the best fitting and upholding them through use of their moderation abilities. Giving a single user control of the rules of the service environment also can help support a range of environment behaviors and reduce friction between users. Either users can generate and list their own service environments with specific rules or simply use moderation powers to enforce rules they wish to uphold. Using SVRS to engage service users or citizens in such a user defined social VR service environment can facilitate service co-creation and improve public value.

In addition, SVRS combined with social media can be used to develop positive culture towards direct citizens' engagement and interactions with their public administrators as well as the nature of co-creation process and its outcome. Moreover, public administrations should constantly foster the desired culture of a citizen's community, which is a key to creating an experience that users can enjoy without unwanted harassment.

One of the biggest advantages of SVRS as a remote participation enabler is the savings made on removal of physical presence requirement in the meetings. The savings are made on commuting (less pollution and money saved) as well as significant time-savings are made therefore increasing the potential productivity of the citizens who can devote the time to other matters.

Potential Impact: Current VR and Social VR environments combined with social media enable new innovative ways of citizens' engagement with their service providers and citizens' participation in the Emergreen project at planning phase.

2.4.2.2 POTENTIAL APPLICATION IN THE PROJECT

NUIG's preliminary assessment:

Services	How this experience can be used to deliver this service
<i>Marine litter mapping and management service</i>	Visual data story telling platform such as the one presented in this report (TET and SPOD) can be largely used to predict the hotspots where the litter will be accumulated in order to facilitate a more effective cleaning process.
<i>Zero Waste circular management service</i>	Virtual reality can help creating a computer-generated scenario capable of simulating a realistic experience through Virtual reality technology while employing games to nudge and orientate users towards the preferred recycling and use behaviours. In addition, TET and SPOD are potential platforms to enable waste analytics by using and visualizing data on the waste and recycling behaviour of users and the average behaviour of the immediate and comparable population.
<i>Green growth advisory services</i>	Social Virtual Reality Training Environment can be used to create an immersive collaborative learning environment for citizens and businesses to connect with the consultant and other learners. The social VR will allow direct participation of learners in demonstrations.
<i>Intelligent green participation service</i>	--
<i>Data story telling of green energies service</i>	The integrated use of TET and SPOD platforms as a tool to enable Visual Analytics and Data Story telling can be envisaged for this service. This technology goes beyond traditional visualisation to support data storytelling, in particular data stories related to explaining a phenomenon (solar panels & heatpump solutions) for deeper understanding. Some experiences such as the "Your Data story" (YDS) platform developed in the context of a project participated by NUIG could be adapted for use in this context.



2.4.2.3 IMPLEMENTATION AND TRANSFERABILITY

Citizens' engagement and participation through VR technology is still difficult outside designated places equipped with necessary technology, software, and hardware, meaning that citizens' participation may require extra efforts. The uptake of standalone VR headsets is increasing with the affordable headsets released in 2018 (such as 200 EUR Oculus GO), however it may take another couple of years to become mainstream technology.

Social VR platforms are transferrable and easy to install and use. However, this technology can be expensive and difficult to maintain. Special hardware and software are required.

2.4.2.4 SUPPORT AND OTHER USEFUL INFORMATION

Adopting this technology by users and service providers require certain level of expertise and familiarity with technology.

2.4.3 LIVING LAB AS A CO-PRODUCTION METHODOLOGY

2.4.3.1 DESCRIPTION / AN OVERVIEW

Methodology developed within the IMPROVE project to guide regions in the process of co-producing new services with their communities in a living lab environment helping them to:

- Establish the innovative living lab ecosystem formed by all the relevant stakeholders
- Effectively carry out the needed adaptation and organizational change in each stakeholder
- Provide the public services providers (civil servants, community managers, volunteers, social enterprises, etc.) with the necessary tools and skills to act as local champions leading the process of co-producing the new services
- Engage and involve the community
- Co-produce user-centred, inclusive, responsive and transparent services

The methodology includes a transnational dimension and provides guidance for the establishment of the IMPROVE transboundary living lab and how the participating regions can have access to other centres of knowledge.

This methodology provides a framework to guide those organisations that want to involve their communities in the definition and provision of the public services.

The framework has been defined flexible enough in order to be adapted to the different contexts and services areas.



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Arctic Programme**
2014–2020



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It presents a 5-step approach and stress on the importance of empowering intermediary facilitators (called local champions) as key actors in the process. These local champions can include civil servants, community managers, volunteers, social enterprises workers, planners and others depending on the service provided.

This methodology provides a framework to guide those organisations that want to involve their communities in the definition and provision of the public services. The methodology is aimed to establish a framework flexible enough to apply it in a different range of services. It mainly provide guidance on how to engage with your communities and establish an ecosystem to co-produce new services with the involvement of the final users as part of the solution.

Service	How this experience can be used to deliver this service
<i>Marine litter mapping and management service</i>	--
<i>Zero Waste circular management service</i>	--
<i>Green growth advisory services</i>	--
<i>Intelligent green participation service</i>	--
Data story telling of green energies service	--

2.4.3.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

The methodology is open and free of use for whoever is interested in the co-production of public services with their communities.

The methodology can be accessed and downloaded in the IMPROVE website through the following link: [IMPROVE CO-PRODUCTION METHODOLOGY](#)

In the case of IMPROVE the methodology was applied engaging with almost 100 local champions for the delivery of the following services:

eCare/Health services

- *eCare/eHealth Communication service (North Karelia)*: a service to connect citizens, public sector actors, companies and associations making the process more inclusive, accessible and interactive moving from the current top-down approach to a new way of co-produce and organize the services.
- *Safer and secure telecare services (Vasternorrland)*: a service oriented to making use of new ICT technologies (i.e. cameras, sensors, etc.) to help carers feel safer and secure when supporting the growing number of elderly and disabled people, especially during the night or under bad weather conditions.
- *eHealth Messaging services (Sogn og Fjordane)*: a service that uses e-messaging to effectively communicate between the patient and different service providers.

Spatial planning services

- *Spatial Planning Service and Community Participation (Donegal)*: this is a step away from the traditional "Open for Public Consultation" time period, and into the realm of ongoing public contribution of local planning issues and the constant gathering of those issues in an online Spatial GIS application.
- *eParticipation Spatial Planning Service (Borgarbyggð)*: This service will be designed to promote citizen participation and collaborative problem solving in municipality governance. It will be based on a website that allows citizens to submit policy proposals to the municipal government. These ideas would be publicly accessible and can be debated by other participants and revised.
- *ePlanning Service (Derry and Strabane)*: A service to enhance the level and manner of public engagement at key stages of the Local Development Plan process in a format that will help to ensure that such engagement and feedback is actively utilized to steer and shape the progress of the plan preparation.

More info can be accessed [here](#).



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Arctic Programme**
2014–2020



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2.4.3.3 SUPPORT AND OTHER USEFUL INFORMATION



Figure: 5 step approach of the IMPROVE co-production methodology

2.5 TECHNOLOGIES AVAILABLE FOR DIGITAL PARTICIPATION IN PUBLIC SERVICES (FINLAND)

2.5.1 INTRODUCTION

This section is an inventory of participatory technologies with a digital dimension in Finland. Participation as a driving concept is understood very broadly here. It may refer to citizens' possibility to be involved in one way or the other in the public policy or service design process, no matter at which stage or to what intensity this might be. The inventory records examples of technologies in common use as well as those, which is just in the rising. The results show the first step in the implementation of the Emergreen co-operation in Finland. The inventory shared here repeats some of the technologies already mentioned in the earlier sections of the common report.

The technologies introduced in this section are divided into 15 classes: 1) E-forms and feedback forms, 2) online questionnaires, 3) maps and GIS-based technologies, 4) mobile apps and platforms, 5) hybrid digital platforms, 6) chatbots and digital recommendation systems, 7) social media, 8) virtual reality (VR) and augmented reality (AR), 9) virtual assistants, 10) hackathons, 11) games and 3D applications, 12) real time participation technologies, 13) participatory design/living labs, 14) crowdsourcing platforms, and 15) blockchain technologies.

The technologies were collected mainly from the official websites of Finnish municipalities, both bigger cities and smaller municipalities as well as the websites of the following projects touching upon

digitalisation: Suomidigi, Digisavo, Kokeilun paikka. In addition, Google search was used to look for more examples for technologies discovered elsewhere. The focus is on technologies used in Finland although some examples were drawn also from elsewhere.

As the report discusses a wide array of technologies (or methods) the presentation departs slightly from the template format. After a concise description of each technology the text moves on to implementation whereby it describes how each technology or method has been implemented within its previous or present context. Selected websites are also shown for further information. To control the length, the assessment of the technologies and their potential application for the other services under development within EMERGREEN is addressed collectively only at the end of the technology listing. The template is amended with a short consideration of participation after each presented technology or method. This means a brief reflection from citizen participation and user convenience point of view.

Finally, there are also some concluding remarks concerning the use and future development of these technologies. As an annex to the report, a short list of potential open source programmes and codes retrieved from Github -database is provided (keywords: participatory, participation, citizen participation, citizen, participatory design).

2.5.2 E-FORMS AND FEEDBACK FORMS

2.5.2.1 DESCRIPTION / AN OVERVIEW

Description: Passive feedback forms, participation relies on citizens' initiative (proactivity).

2.5.2.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Passive feedback forms are commonly implemented on a municipality's or city's website. They are generally open forms by which citizens can contact their local municipal office and offer feedback or ask questions of general nature.

The national "Kuntalaisaloite" ('Municipal Citizen Initiative') service has its own national website. The same site can usually be accessed also through municipalities' and cities' own websites. It offers municipal citizens a chance to propose initiatives related to one's municipality of residence and its' services.

Website (Kuntalaisaloite, in Finnish): <https://www.kuntalaisaloite.fi/fi> (also available in Swedish)

Easily transferable, minimal maintenance effort needed.

PARTICIPATION CONSIDERATIONS

As a method of participation, forms are somewhat passive and require initiative from the participants. Information flow is “one way”, and there is no dialogue or real interaction. Therefore, they offer a rather limited way for participation. Forms usually require the user to specifically look for them (for example on the municipality’s website).

2.5.2.3 AVAILABILITY TO THE PROJECT

Online form services available free or at low cost, minimal maintenance effort needed.

2.5.3 ON-LINE QUESTIONNAIRES

2.5.3.1 DESCRIPTION / AN OVERVIEW

Online questionnaires with set questions/themes, actively enquiring citizens’ opinions on certain topics.

2.5.3.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Numerous Finnish municipalities also have online questionnaires on their website. Such questionnaires are typically aimed at local citizens, and they may inquire views on a wide range of current municipal activities (e.g. the city of Hämeenlinna is currently interested in opinions related to the future medical centre and attitudes towards alcohol and drugs). Some municipalities, such as the city of Oulu, also publish the results after the questionnaire has closed. Public reporting is, however, no general rule.

At the national level, the Finnish Ministry of Education and Culture is currently using a “Verkkoavoriihi” (‘Online Brainstorming’) platform asking citizens about their views and experiences of cultural services maintained by the local municipalities, in order to revise a related law.

Website (Verkkoavoriihi, in Finnish): <https://www.strategydialog.com/2a4beda1-eb0c-41d0-a35a-aa9adff3657a>

Easily transferable, minimal maintenance effort needed.

PARTICIPATION CONSIDERATIONS

As a method of participation, questionnaires are more advanced than passive forms, as they do not solely rely on the proactiveness of the user. However, they also lack real interaction, and are best



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Arctic Programme**
2014–2020



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suitable for inquiring opinions on specific time-bound topics. Questionnaires can be distributed by on various platforms, such as traditional websites, social media, mobile apps etc.

Depending on the questionnaire's contents and distribution platform, the amount of participation effort needed from the user varies.

2.5.3.3 AVAILABILITY TO THE PROJECT

Online questionnaire services available for free or low cost, minimal maintenance effort needed.

2.5.4 MAPS AND GIS-BASED TECHNOLOGIES

2.5.4.1 DESCRIPTION / AN OVERVIEW

Technologies using maps or other GIS-based technology. Typically, the user is located automatically with the help of GPS or something can be pointed on the map.

2.5.4.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Kerro kartalla ('Tell it on the Map') is maintained by the city of Helsinki, and lets citizens answer areal questionnaires. Users can also pinpoint their opinions on the map and comment on the content generated by other users.

Palautteet kartalla ('Feedback on the Map') is a real-time, GIS-based feedback system tested by the city of Mikkeli with the help Maptionnaire tools (<https://maptionnaire.com/>)

Similar software (map/GIS-based questionnaires and/or feedback) are used by multiple municipalities and cities in Finland, for example by Helsinki.

Website (Kerro kartalla, in Finnish): <http://kerrokartalla.hel.fi>

Transferrable, some maintenance effort needed.

PARTICIPATION CONSIDERATIONS

As a method of participation, enables easy participation in areal themes. Most commonly used for collecting feedback or comments, but other uses might also be possible. Maps and GIS-based technologies can be incorporated into other technologies, such as mobile apps, hybrid platforms or VR/AR technologies.

2.5.4.3 AVAILABILITY TO THE PROJECT

Technologies available, user licences need to be bought from private companies. Maintenance depends on the level of use; some need to be done by the service provider.

2.5.5 MOBILE APPS AND PLATFORMS

2.5.5.1 DESCRIPTION / AN OVERVIEW

Mobiles applications and platforms enabling participation via mobile phones or tablets.

2.5.5.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Municipal mobile apps generally let the municipal citizens leave feedback and obtain information. The city of Helsinki's "Helsinki App" (Helsinki-sovellus) lets citizens leave feedback and follow how their feedback is being implemented. The app is currently in its beta phase, and users can also participate in the development.

The city of Mikkeli offers local businesses a participatory mobile app (Miksei). The city of Seinäjoki has a mobile app (Rinki) that allows users to access the Rinki platform (see below) on their phones. The city of Vantaa used a mobile app (Mun Myrtsi) to collect views and experiences related to a certain area of the city. The city of Pori is planning a mobile app that would motivate citizens to exercise more, and collect information about the use of exercising facilities, which would help budgeting.

The Sensei Research Project (carried out by Lappeenranta University of Technology) offers citizens of Lappeenranta a mobile app that is used to gather real-time information on garbage, smells, noise, introduced species and cyanobacterial blooms.

The city of Kauniainen has displayed QR-codes in its public facilities, allowing citizens to access customer satisfaction questionnaires on their phones.

Video (Helsinki-sovellus): <https://youtu.be/SSdbNuW8a-s>

Website (Miksei): <https://www.mikseimikkeli.fi/en>

Website (Electorate): <https://www.electorate.eu/?lang=en>

More information (Pori App, in Finnish): <https://www.pori.fi/hyvinvointiraha>

More information (Mun Myrtsi, in Finnish): <https://docplayer.fi/39357903-Mun-myrtsi-mobiilisovelluskokeilu.html>

More information (Sensei Research Project, in Finnish):

<https://www.lappeenranta.fi/fi/Palvelut/Ymparisto/Luonnonsuojelu/Sensei-tutkimushanke>

Transferable, maintenance effort needed.



PARTICIPATION CONSIDERATIONS

As a method of participation, mobile applications offer users a convenient and fast way of participation. They are highly customisable, and can be used for a wide range of different topics. Mobile applications and platforms can also incorporate and combine features from other technologies, such as map and GIS-based technologies or games.

Mobile apps and platforms offer a very low-threshold participation method. Especially younger generations are used to taking care of things on their phones, so minimum extra effort is needed for participation via mobile apps.

2.5.5.3 AVAILABILITY TO THE PROJECT

Technology available, but must be bought from the private service providers. Maintenance needs to be done by the service provider.

2.5.6 HYBRID DIGITAL PLATFORMS

2.5.6.1 DESCRIPTION / AN OVERVIEW

Digital platforms combining multiple functions, for example feedback and participatory budgeting.

2.5.6.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Many municipalities and cities in Finland are using hybrid digital platforms for citizen participation. The city of Helsinki's platform (OmaStadi) is a platform for participatory budgeting, and allows citizens to not only make their own suggestions, but also to comment and like other people's suggestions. Helsinki also has another platform (Kerro kantasi) for citizens to share their opinions on the city's ongoing or upcoming projects, and to read and comment other users' posts. A third Helsinki platform (Ruuti) is aimed especially at young people, and lets them make initiatives and comment on them.

The city of Tuusula also uses a hybrid platform (Tuusulan avoin osallistumisalusta) for participatory budgeting, polls and citizen opinions. The city of Vantaa has a platform (Vantaa-kanava) which allows citizens to watch municipal meetings in real time, and participate in current discussions by, for example, uploading their own videos. The city of Seinäjoki's participatory platform (Rinki) has a feature, which utilises the user's location for better-targeted information.

The national "Ota kantaa" platform allows citizens from all around the country to voice their opinions on different projects. The platform also allows both organisations and private citizens to introduce their own projects for commenting.

Website (OmaStadi, in Finnish): <https://omastadi.hel.fi>

Website (Rinki, in Finnish): <https://rinki.futuredialog.co>

Website (Tuusulan avoin osallistumisalusta, in Finnish): <https://osallistu.tuusula.fi>

Website (Ruuti, in Finnish): <http://ruuti.munstadi.fi>

Website (Kerro kantasi, in Finnish): <https://kerrokantasi.hel.fi/>

Website (Vantaa-kanava, in Finnish): <https://vantaakanava.fi/>

Website (Ota kantaa, in Finnish): <https://www.otakantaa.fi/fi/>

Transferrable, maintenance effort needed.

PARTICIPATION CONSIDERATIONS

As a method of participation, hybrid digital platforms enables a wide range of different kinds of participation methods on various themes. They can also incorporate and combine features from other technologies. A versatile hybrid platform could offer public sector projects a good starting point for citizen/user participation, as their scope can be broadened or reduced according to the current needs.

A web-based hybrid platform does require some participation effort from the user. However, a platform combining multiple participation approaches makes versatile participation easier. Making the platform accessible by mobile phones could make it feel more approachable to users.

2.5.6.3 AVAILABILITY TO THE PROJECT

Technology available, but needs to be bought from the private sector. Maintenance might need to be done by the service provider.

2.5.7 CHATBOTS AND DIGITAL RECOMMENDATION TECHNOLOGIES

2.5.7.1 DESCRIPTION / AN OVERVIEW

Chatbots or digital recommendation systems, such as automatic pop-up windows, based on artificial intelligence and data collected from the users.

2.5.7.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

The city of Helsinki is testing a parking chatbot that can answer questions related parking.

Löytö ('find') is an in-development artificial intelligence that can recommend culture-related services based on information related to the user's interests, location and prior use of the application.

QA2 is an in-development artificial intelligence that can forward feedback received by a city or municipality to the correct person in charge of the items discussed in them.

Kamu ('buddy') is a chatbot used by the Finnish Immigration Service, helping with questions related to immigration and citizenship.

Trebotti is the city of Tampere's customer service bot, answering questions on town planning, parks, streets and construction work.

Website (Parking chatbot, in Finnish): <https://www.hel.fi/helsinki/fi/kartat-ja-liikenne/pysakointi/asukas-ja-yrittajapysakointi/>

Video (Parking chatbot, in Finnish): <https://www.helsinkikanava.fi/kanava/fi/videot/video?id=3906>

More information (Löytö, in Finnish): <https://digi.hel.fi/blogikirjoitukset/tekoaly-ja-me-kokeilut-toimiva-helsinki/>

Video (Löytö, in Finnish): <https://www.helsinkikanava.fi/kanava/fi/videot/video?id=3803>

More information (QA2, in Finnish): <https://digi.hel.fi/blogikirjoitukset/tekoaly-ja-me-kokeilut-toimiva-helsinki/>

Website (Trebotti, in Finnish): <https://trebotti.tampere.fi/>

Transferability: Possibly transferrable, maintenance effort needed.

PARTICIPATION CONSIDERATIONS

As a method of participation, chatbots enables a more interactive way of collecting feedback, answering questions and giving recommendations. At the moment usage is rather limited, but as artificial intelligence continues to develop, more complicated and versatile uses are possible.

Website-integrated chatbots require the user to access the website in order to use them, but they offer a relative simple way of participation, as they can typically be accessed through the main page and therefore do not require further search.

2.5.7.3 AVAILABILITY TO THE PROJECT

Technology available, but needs to be bought from the private sector. Maintenance needs to be done by the service provider.

2.5.8 SOCIAL MEDIA

2.5.8.1 DESCRIPTION / AN OVERVIEW

Popular social media applications can also be used for citizen participation by municipalities. Usage varies from rather passive information dissemination and news feeds to active and facilitated interaction.



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Arctic Programme**
2014–2020



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2.5.8.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Social media platforms seem to be rather popular amongst Finnish municipalities. The most popular choice seems to be Facebook.

The city of Tuusula has a Facebook account under the name “#fiksaatuusulaa” (‘fix Tuusula’), encouraging locals to inform the city of any needs for repair in their vicinity.

The city of Vantaa and the municipality of Kemiönsaari both use a wide range of different social media sites for different purposes: Kemiönsaari even has 28 different social media sites on four different platforms (Facebook, LinkedIn, Instagram & Twitter), each of them focusing on different municipal operators and themes.

Website (#fiksaatuusulaa, in Finnish): <https://www.facebook.com/fiksaatuusulaa>

Video (“Vantaa in social media”): <https://www.youtube.com/watch?v=uk3le6kb4MM>

Website (links to Kemiönsaari’s social media accounts, in Finnish):

http://kemionsaari.fi/fi/kemionsaaren_kunta/lehdisto_media

Easily transferrable, maintenance effort needed but is relatively simple.

PARTICIPATION CONSIDERATIONS

As a method of participation, social media enables strong interaction with users. Offers a convenient and very low-threshold way of participation. Depending on the type of social media platform used, various implementation options are possible. In some cases, also works as a real time participation platform.

2.5.8.3 AVAILABILITY TO THE PROJECT

Social media technologies are easily available for free. Requires active maintenance effort by a designated person (persons) in the public service. Usually no outside help is needed.

2.5.9 VIRTUAL REALITY (VR)

2.5.9.1 DESCRIPTION / AN OVERVIEW

Virtual and augmented reality technology used in citizen participation. The concept of “social virtual reality” (SVR), VR combined with social media, also exists.



**Northern Periphery and
Arctic Programme**
2014–2020



EUROPEAN UNION

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2.5.9.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Digital City Adventure is an augmented reality game taking place in Mikkeli. The game is carried out in co-operation with businesses and other local operators.

Cave is a virtual environment, which enables users to explore buildings and public spaces that are yet to be actually constructed. Local citizens can give feedback already in a construction project's planning phase, and therefore be able to participate in city planning.

The Smart City Guidance is a guidance application using AR technology. It is especially planned to be used in big mass events.

'Virtual planning table' is a virtual environment used by the city of Vantaa for engaging local citizens in city planning.

Video (Digital City Adventure): <https://www.youtube.com/watch?v=djXFH4euwk4>

More information (Cave, in Finnish): <https://www.sweco.fi/palvelumme/kayttajalahtoinen-suunnitteluprosessi/>

Website (Smart City Guidance): <https://itsasign.fi/en/frontpage/>

Video (Virtual planning table, in Finnish):

<https://www.facebook.com/vantaankaupunki/videos/10156669230213311/>

Might be hard to transfer and maintain, most likely very expensive.

PARTICIPATION CONSIDERATIONS

As a method of participation, both VR and AR technology offer unique opportunities, which are surely not all yet explored. Current virtual reality environments especially enable new ways of participating in projects already at planning phase.

Currently participation through VR technology is mostly not possible outside designated places equipped with necessary technology, meaning that participation requires quite a lot of effort from the user. AR technology on the other hand works on private mobile phones, and can be used in daily life.

2.5.9.3 AVAILABILITY TO THE PROJECT

Requires expertise and in-depth study of the technology.

2.5.10 VIRTUAL ASSISTANTS

2.5.10.1 DESCRIPTION / AN OVERVIEW

Virtual assistants (such as Siri, Echo and Home Assistant) used for citizen participation.



**Northern Periphery and
Arctic Programme**
2014–2020



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2.5.10.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

“Kunta-Kati” is an example of a virtual assistant in-development. She can answer municipal citizen’s questions and receive feedback. (Note that ‘Kunta’ means municipality and ‘Kati’ is a female name in Finnish)

“Pepper” is a robot “working” at a public medical centre in Helsinki’s Kalasatama. Pepper robot understands and can speak two languages, answers questions, receives customer feedback, helps customers find the place they are looking for with the help of a tablet screen, and entertains the customers by dancing.

Video (Pepper): https://youtu.be/4urDOxd1_wg

Video (Pepper, in Finnish): <https://www.youtube.com/watch?v=ov4Fapy1kYg>

Might be hard to transfer and maintain, most likely very expensive.

PARTICIPATION CONSIDERATIONS

As a method of participation, virtual assistants can offer both “face-to-face” as well as remote guidance, and could in some ways be considered as modern, real time equivalents of e-forms and questionnaires. However, they can also incorporate various other technologies such as maps and GIS-based techs.

The line between virtual assistants and chatbots or recommendation systems is not always clear. Virtual assistants typically recognise speech and are able to talk. In addition, virtual assistants do not rely solely on their cumulated knowledge, but are able to use Internet search machines when answering questions.

“Material” virtual assistants such as Pepper introduced above offers, in addition, a means of “face-to-face” interaction enabled by digital technology. Pepper’s example shows that virtual assistants can offer a way for users of public spaces and institutes to engage in (digital) feedback and questions on the spot.

2.5.10.3 AVAILABILITY TO THE PROJECT

Requires expertise and in-depth study of the technology.

2.5.11 HACKATHONS

2.5.11.1 DESCRIPTION / AN OVERVIEW

Hackathon is an event in which participants intensively try to come up with solutions and implementations in a short period of time. Originally related to programming.



**Northern Periphery and
Arctic Programme**
2014–2020



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2.5.11.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

CityHack Tuusula was a hackathon event during which participants came up with solutions related to educational services in the city of Tuusula.

Turku Future Hackathon was hosted by the city of Turku. The participants were tasked with coming up with ideas related to the development of the Turku campus and science park area.

Open4Citizens is a project taking place in five European cities (Copenhagen, Karlstad, Rotterdam, Milano, Barcelona). The project hosts hackathon events for citizens in co-operations with IT experts, public administrations, interest groups and start-up companies. The aim is to raise citizens' awareness on open data and create innovation in public spaces.

Video (CityHack Tuusula): <https://www.youtube.com/watch?v=xOamoARwsfI>

Website (Turku Future Hackathon): <http://www.turku.fi/en/hackathon>

Website (Open4Citizens): <http://open4citizens.eu/>

Relatively easily transferred, does not require active maintenance outside of events and event planning.

PARTICIPATION CONSIDERATIONS

As a method of participation, hackathons offers citizens a way to not only make initiatives or suggestions, but also the opportunity to provide solutions to them. Hackathons could be considered a participation methodology that can easily incorporate different kinds of participatory technologies, and perhaps even coming up with new ones.

2.5.11.3 AVAILABILITY TO THE PROJECT

Depending on the type of hackathon and the technologies planned to be available to the participants, events could be carried out relatively easily. No maintenance required per se, but commitment needed in pre-event planning, during the event, and when publishing the results after the event.

2.5.12 GAMES AND 3D APPLICATIONS

2.5.12.1 DESCRIPTION / AN OVERVIEW

Games and 3D applications used in citizen participation.



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2014–2020



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2.5.12.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

The City Planning Game and the 3D Environment for Oulu's City Centre Vision are both 3D applications used by the city of Oulu. The City Planning Game allowed local citizens to participate in the planning and design of a new residential area. The 3D environment allows citizens to explore the proposed designs and projects made for the development of Oulu's city centre, and enables users to vote for their favourites.

Altogame is a participatory environment built on game technology. According to the developers, it allows anonymous, non-hierarchical discussion on various local themes.

Empaville is a participation simulation using role-playing in both digital and "non-digital" environments. It allows, for example, schoolchildren to familiarise themselves with participatory budgeting and other citizen participation.

Website (Altogame): <https://www.altogame.com>

Video (Empaville): <https://www.youtube.com/watch?v=hfjFrWgdiP8>

Website (City planning game, in Finnish): <http://hiukkavaara3d.ouka.fi/vanhahiukkavaara/>

Website (Oulu 3D environment, in Finnish): <http://oulu.playsign.net>

Possibly transferrable, maintenance effort depends on the contents.

PARTICIPATION CONSIDERATIONS

As a method of participation, games and related applications typically offer a fun and relaxed way of participation. Participation via games or "gamified" platforms and applications can make the participation process itself worthwhile. The concept of "gamification" refers to game-elements in non-game contexts, and is typically used for engaging users. For example, a city planning experience in a virtual reality environment can easily be made game-like.

2.5.12.3 AVAILABILITY TO THE PROJECT

Technology available, but needs to be bought from the private sector. Maintenance needs to be done by the service provider.

2.5.13 REAL TIME PARTICIPATION TECHNOLOGIES

2.5.13.1 DESCRIPTION / AN OVERVIEW

Technologies allowing real time participation. A popular example is Skype, but there are also other software and applications developed especially for participatory use. Participation is taking place simultaneously with the participated event.



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2014–2020



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2.5.13.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

e-Raati (e-panel) is an example of an online panel, allowing citizen to participate in local decision making in real time.

“Nuoret muutosvoimana” (Youngsters as change agents) is a project proposal by the municipality of Kuhmo, exploring the use of Skype as a way for getting disabled or marginalised young people to participate in the local youth council meetings.

More information (eRaati, in Finnish): <http://www.digisavo.fi/palvelu/eraati/>

More information (Nuoret muutosvoimana, in Finnish):

<https://www.kokeilunpaikka.fi/fi/experiment/772/>

Transferrable, maintenance effort depends on the kind of application used.

PARTICIPATION CONSIDERATIONS

As a method of participation, real time participation technologies could literally enable users to take part in decision making when it is done. As the example of the municipality of Kuhmo shows, it can also be used to encourage participation from those who might otherwise find it challenging.

However, due to the nature of the technology, participation is only possible on a set time. This differs from many other digital participation solutions, which typically allow the user to participate when it best suits them.

2.5.13.3 AVAILABILITY TO THE PROJECT

Technology available, but more advanced ones need to be bought from the private sector. Free applications and software such as Skype can also be used.

2.5.14 PARTICIPATORY DESIGN AND LIVING LABS

2.5.14.1 DESCRIPTION / AN OVERVIEW

Technology-assisted participatory methods such as living labs. Living lab refers to a participatory method, which combines research and innovation, and typically brings together public and private sector actors.

2.5.14.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

For example, The Satakunta region in Finland has used the living lab methodology for developing health-care and wellbeing technologies in co-operation with local elderly people and their relatives.



**Northern Periphery and
Arctic Programme**
2014–2020



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The city of Lahti is hosting a living lab with the Lappeenranta University of Technology. The projects are focused on innovations and productivity development in the public sector. Previous projects include, for example, studies on robotics and elderly care, robotics and welfare services, and a co-creation of oral health care services.

Video (Satakunta living lab):

https://www.youtube.com/watch?time_continue=543&v=DYqflhHLAGM

Website (Lahti living lab): <http://www.lahtilivinglab.fi/>

The city of Helsinki has also run several experiments on urban planning applying the living lab – approach over the years (general overview).

<https://www.helsinkikanava.fi/kanava/fi/videot/video?id=2703>

Possibly transferrable.

PARTICIPATION CONSIDERATIONS

As a method of participation, the living lab methodology offers users the chance to participate in the planning and production phase of, for example, public services. Like hackathons, living labs could be considered a methodology for using and developing different technologies.

2.5.14.3 AVAILABILITY TO THE PROJECT

Requires some expertise on the topic. Services can be bought from the private sector.

2.5.15 CROWDSOURCING PLATFORMS

2.5.15.1 DESCRIPTION / AN OVERVIEW

The use of crowdsourcing platforms for funding and other sharing (knowledge, ideas, skills etc.).

2.5.15.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

The city of Tampere is experimenting with crowdfunding, using the Finnish mesenaatti.me platform. Associations, communities and working committees from Tampere can participate by coming up with projects and trying to get them funded. The city of Tampere will then take part in further funding and implementing the projects that were able to raise most crowdfunding.

TaskRabbit and UpWork are not public sector examples, but offer a different kind of approach to crowdsourcing. TaskRabbit brings together people with skills and people who need help and UpWork helps connect employers and freelancers.

Website (Tampere crowdfunding experiment, in Finnish): <https://www.tampere.fi/tampereen-kaupunki/paatoksenteko/osallistu-ja-vaikuta/joukkorahoituskokeilu.html>

Website (TaskRabbit): <https://www.taskrabbit.com/>

Website (UpWork): <https://www.upwork.com/>

Relatively easily transferrable, maintenance simple.

PARTICIPATION CONSIDERATIONS

As a method of participation, crowdsourcing platforms enable participation of those with needed skills, knowledge or some other shareable capital goods. From a public sector perspective, this kind of technology could help enforce participation of local citizens in local projects, instead of hiring outside professionals.

From a user perspective, crowdsourcing offers a concrete way of supporting and participating in public projects. However, it is worth considering the possible inequality that lies within any private funding systems (such as crowdfunding) – can public participation of any kind be tied to the participants' ability to contribute financially?

2.5.15.3 AVAILABILITY TO THE PROJECT

Various crowdsourcing platforms are available for use.

2.5.16 BLOCKCHAIN TECHNOLOGIES

2.5.16.1 DESCRIPTION / AN OVERVIEW

The use of blockchain technology for citizen participation. Blockchain technology is used for record keeping, and is said to be resistant to any data modification. It is also used for keeping track of cryptocurrencies such as Bitcoin.

2.5.16.2 IMPLEMENTATION DESCRIPTION AND TRANSFERABILITY

Mudamos is a Brazilian example of a mobile application using blockchain technology to enable citizens to vote for popular law initiatives.

e-Vox is an open e-democracy platform based on blockchain technology.

Website (Mudamos): <https://www.mudamos.org/>

Website (e-Vox): <http://e-vox.org/>



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2014–2020



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Hard to transfer and maintain, most likely very expensive.

PARTICIPATION CONSIDERATIONS

Blockchain technology helps eliminate possible frauds in voting systems, and can also be used for user identification, thus strengthening democracy and citizen participation. As the technology is still developing, the possible range of uses could broaden in the future.

For users, blockchain technology makes user identification simple and reliable. For example, the Mudamos project introduced above has stated that until now bills of popular initiative could not be effectively processed in Brazil, because of voter verification issues.

2.5.16.3 AVAILABILITY TO THE PROJECT

Requires expertise and in-depth study of the technology.

2.5.17 SUMMARY AND POTENTIAL APPLICATION IN THE PROJECT

Below follows a summary of the 15 identified categories against a brief description of the kind of participation they enable or may enable.

1. E-forms and feedback forms: Enables participation but requires initiative from the users. From a user perspective could be considered “stiff” to use.
2. Online questionnaires: Enables inquiring opinions on specific topics, and can be distributed on various platforms. Users’ participation motivation might depend on the type of platform that is being used.
3. Maps and GIS-based technologies: Enables easy participation in areal themes, and can incorporate other technologies to further make participation simpler from the user perspective.
4. Mobile apps and platforms: Enables convenient and fast participation for the “mobile generation”. Numerous features from other technologies can be incorporated.
5. Hybrid digital platforms: Enables a wide range of different kind of participation technologies and methods collected on a single-access platform. Participation effort needed, but versatile participation is easy.
6. Chatbots and digital recommendation systems: Enables a more interactive way for collecting feedback or opinions (compared to categories 1 & 2). The development of artificial intelligence



will most likely broaden the possible uses. Offers users a relative low threshold for participation.

7. Social media: Enables strong interaction with the users, but requires active maintenance. In some cases can work as a real time participation platform. For users already familiar with social media platforms, participation requires minimal effort.
8. Virtual reality (VR) and augmented reality (AR): Enables unique approaches to participation in the early stages of project planning. Technology requirements restrict usage, and currently virtual environment participation is only possible in designated locations. In this aspect, AR technology allows a more versatile means for participation.
9. Virtual assistants: Enables a more “face-to-face” participation experience, and can incorporate various other technologies.
10. Hackathons: Provides a method of participation by incorporating typically various new technologies. From a user perspective, offers a chance to participate not only by means of making initiatives, but also by contributing to concrete solutions.
11. Games and 3D applications: Enables a fun and relaxed way of participation. From a user perspective, participation through games offers an engaging medium. Other technologies and platforms can also be “gamified” for better user engagement.
12. Real time participation technologies: Enables literal participation in decision-making. In contrast to most other participatory technologies, participation must happen at the certain time.
13. Participatory design/living labs: Provides a method of participation typically incorporating various new technologies. Enables citizens/users to participate in the planning and production of public services.
14. Crowdsourcing platforms: Enables participation of those with needed skills, knowledge or other assets. Could help in participating local people in projects, instead of outside specialists. From a user perspective, allows concrete participation.
15. Blockchain technologies: Enables safe and modification-resistant record keeping, and can therefore help strengthen citizen participation in democratic decision-making. From user perspective brings a feeling a security. Possible uses could broaden in the future as the technology develops.

Some of the 15 categories of technologies identified above are more frequently used than others, and they cater to slightly different methods of participation. Many of these technologies can also be

incorporated and combined and indeed, some of them could fit into more than just one of the categories.

Here we also propose to further divide the introduced categories into three different groups, based on their current or hypothetical future usage and popularity.

These groups are 1) "The Cold Techs", which are very basic online technologies that could also be seen as somewhat outdated, even though they are still commonly used, 2) "The Hot Techs", which are technologies that are used, tested or developed actively at the moment, and 3) "The Warm Techs", which could make a breakthrough in the future, but are currently still not in wide-spread use.

1. "The Cold Techs": online forms (1) and questionnaires (2).
2. "The Hot Techs": maps and GIS-based technologies (3), mobile apps and platforms (4), hybrid digital platforms (5), chatbots and digital recommendation systems (6), social media (7), hackathons (10), participatory design/living labs (13).
3. "The Warm Techs": virtual reality (VR) and augmented reality (AR) (8), virtual assistants (9), games and 3D applications (11), real time participation technologies (12), crowdsourcing platforms (14), blockchain technologies (15).

To wrap up this chapter we list some ideas on how the technologies introduced so far could, at least in theory, be incorporated into the other partners' services in the making (in addition to the ones already mentioned in the individual services' descriptions). These are just to illustrate the idea how numerous technologies and methods could further enrich each other.

Services	How these experiences/technologies can be used to deliver this service
<i>Marine litter mapping and management service</i>	The technologies already envisioned in the marine litter mapping and management services include data crowdsourcing and mapping tools, drone technology for documentation, and visual data story telling tools. These could all be combined on a single (mobile-based) hybrid platform, allowing users to map their findings, watch drone footage (and maybe send their own visual footage as well), and follow the project's progression.
<i>Zero Waste circular management service</i>	The zero waste circular management services are planning to use VR/gamification and a personalised analytics dashboard to encourage users into preferred recycling behaviour. In addition, an artificial intelligence (chatbot/recommendation service, virtual assistant) could be incorporated as a part of the dashboard, helping users with any questions related to recycling or waste management.

<i>Green growth advisory services</i>	The green growth advisory services are envisioning using social virtual reality (SVR) as well as a chatbot with artificial intelligence accessible through social media platforms. Additional, supportive options could include hackathons and living labs, aiming to engage the community to providing possible solutions, and further giving the project more visibility.
<i>Intelligent green participation service</i>	To be determined by UH and the stakeholders in the next phase of implementation.
<i>Data story telling of green energies service</i>	The technologies envisaged to be used in the data story telling of green energies service include visual analytics and data story telling tools. In order to engage user participation, other visual methods such as virtual or augmented reality, 3D applications or games could also be incorporated.

2.5.18 REMARKS ON THE FUTURE DEVELOPMENT OF INTELLIGENT PARTICIPATION SERVICE

In addition to the current and potential usage of these technologies to advance participation there are issues related to licenses, open data and open code that should be taken into consideration when further approaching the topic. The question of open data and open code has come up in discussions with regard to the public sector technologies. It appears that especially the municipal stakeholders would like to avoid a situation whereby they might end up being dependent on a single private sector operator. The use of open code software is thus seen as preferable, whenever possible.

Finally, one should notice that the concept of (citizen) participation as such is very loose. How one perceives participation thus directs what kind of technologies and/or methods are seen as appropriate or contributing to participatory local governance.

Much of the academic research done on public sector participatory technologies seem to concentrate on technology development. Research focusing on the user experience is scarce. When utilising and further developing the participatory technologies for public services, the user perspective should be one of the central considerations. Participation should be available on a low threshold, and if possible, the method of participation or technology used should feel rewarding or motivating in itself.

Whereas older technologies such as online forms and questionnaires have often aimed to use citizen participation for identifying possible problems, the future of citizen participation technologies may increasingly be in technologies that enable users to also contribute to problem solving and solutions.

The possible ethical problems related to participatory technologies should also be identified and addressed. These are related, for example, to the division of power, privacy, safety, and citizens' autonomy.

3. SUMMARY AND GAPS TO BE COVERED

This report has pulled together more than twenty existing experiences on relevant technologies and methods potentially relevant for the future steps of the implementation of EMERGREEN. The inputs received from the partners can be summarised as shown in the matrix below.

Contributing partner	Waste management	Renewable energy and energy saving
DCSDC	<ul style="list-style-type: none"> Recycling app – “Bin-ovation” 	
ALAV	<ul style="list-style-type: none"> e-korren Waste analytics dashboard Karma app for rescuing unsold food 	<ul style="list-style-type: none"> Solar Map (Soley) Uniride app for car pooling (under development)
<div style="border: 1px solid black; padding: 5px; display: inline-block;">Sustainable learning games FB facilitated sustainable family –experiment</div>		
Citizen engagement/participation		
NUIG	<ul style="list-style-type: none"> Integrated Data Platform for enhanced citizen engagement (IDP) Social Virtual Reality (SRV) 	
ERNACT	<ul style="list-style-type: none"> Living lab environment as co-production methodology 	
UH	<ul style="list-style-type: none"> 1) E-forms and feedback forms, 2) online questionnaires, 3) maps and GIS-based technologies, 4) mobile apps and platforms, 5) hybrid digital platforms, 6) chatbots and digital recommendation systems, 7) social media, 8) virtual reality (VR) and augmented reality (AR), 9) virtual assistants, 10) hackathons, 11) games and 3D applications, 12) real time participation technologies, 13) participatory design/living labs, 14) crowdsourcing platforms, and 15) blockchain technologies 	

Figure: Summary matrix of inputs

The experiences are classified along different and overlapping driving motives. The suggested sustainability education, as described in the contribution from ALAV, cuts across the fields of waste and energy saving. Co-production by means of living lab environments is one of the methods of user involvement applicable to different range of services. Citizen engagement and participation is added as the crosscutting notion: definition of engagement and participation thus directs what kind of technologies or methods are seen as appropriate to participatory public governance.

4. CONCLUDING REMARKS

- Two specific substance fields of public service were identified: waste and energy while the notion of sustainability education touched upon both.
- Many of the technologies captured in the report can also be combined and indeed, some of them could fit into more than just one of the categories.
- The cross cutting thrust for the digital citizen engagement can be mixed and matched in the fields mentioned above, and many more, in many different ways.
- The reported experiences and technologies offer clearly potential for inspiration and cross-fertilisation.
- The actual potential for mixing and matching is in the end best evaluated by each of the partner.

ANNEX 1: Section on participatory technologies (UH).

Potential GitHub profiles (2018)

City of Helsinki

<https://github.com/City-of-Helsinki>

Participatory Orgs Project

<https://github.com/ParticipatoryOrgs>

Citizens Foundation

<https://github.com/CitizensFoundation>

Open Budgets EU

<https://github.com/openbudgets>

Social Apps Lab

<https://github.com/socialappslab>

Potential GitHub projects

Consul

"Citizen participation and open government application"

<https://github.com/consul/consul>

<http://consulproject.org/en/>

Consul merit

"CONSULMerit adds reputation behavior to CONSUL citizen participation software in the form of Badges and Points/Social coins"

https://github.com/ortegacmanuel/consul_merit

<https://consul.abclink.info/>

Demofony2

"Demofony is a Symfony 2.x application to enable citizen participation in government decisions"

<https://github.com/tecliure/demofony2>

Hyperlocal citizen participation

"Hyperlocal website for citizen participation and open data"

<https://github.com/crisscrossed/citizen-participation>

Decidim

"The participatory democracy framework"

<https://github.com/decidim/decidim>

<https://decidim.org/>



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2014–2020



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DecidimMataro

"Citizen participation platform based on Decidim framework"

<https://github.com/AjuntamentDeMataro/decidimmataro.cat>

PFC

"Web platform for citizen participation"

<https://github.com/jeronimok/pfc>

CitizenApp

"An app that encourages citizen participation"

<https://github.com/AdrienSavo/CitizenApp>

Active Citizen Dashboard

"Active Citizen AI Dashboard to explore how deep learning social media listening can foster young people's empowerment and active participation in democratic life"

<https://github.com/CitizensFoundation/active-citizen-dashboard>

<https://deep-y.yrpri.org/>

Takepart

"A platform for citizen participation in urban development green areas"

<https://github.com/jucajuca/takepart>

CitizenApp (mobile)

"A mobile application for citizens' participation"

<https://github.com/AdrienSavo/CitizenAppMob>

Citizenline

"Open source project for citizen participation tools"

<https://github.com/citizenline/citizenline>

Open Source Citizen

"Economic citizenship experiment aiming to increase economic participation in open source software"

<https://github.com/motdotla/osc>

Citizen Participation for Crime Prevention and Investigation

<https://github.com/mhamzas/Citizen-Participation-for-Crime-Prevention-and-Investigation>

<https://www.crimereporting.tk/en/>

StreetChecker

"Street Checker application for participation of citizen"

<https://github.com/axilla/street-checker-php>

Virtuagora

"Digital platform, open source, for citizen participation"

<https://github.com/virtuagora/virtuagora-core>



**Northern Periphery and
Arctic Programme**
2014–2020



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<https://www.virtuagora.org/>

Smart Cities App

"Android application for citizen participation in smart cities management"

<https://github.com/Ca-my/Smart-Cities-App>

Sim project

"Applied project to improve citizen's participation - platform development"

https://github.com/EstelleBarnoud/sim_project

SwellRT Pad

"Jetpad fork providing new features for citizen participation & collective intelligence"

<https://github.com/llopv/jetpad-ic>

Politikei

"Interface between citizen and legislative power promoting access, control and participation"

<https://github.com/CodeForBrazil/politikei>

The Ugly Indian (TUI)

"The Ugly Indian is a community striving to make India cleaner, by active citizen participation"

<https://github.com/rajeefmk/tui-app>

Community Connect

"Idea in development for open source platform for local agencies wishing to spur citizen participation"

<https://github.com/gregkeidan/Community-Connect>

Mi Congreso

"Initiative to present the mexican congress initiatives in a easy to understand format and engage citizen participation"

<https://github.com/fedegl/mi-congreso>

BlackCloud

"BlackCloud is an open-source technology for citizens political participation in smarter cities to encourage personal and community pollution monitoring"

<https://github.com/ChaitanyaBaweja/BlackCloud>

Agora 2.0

"Civic participation oriented tool for polling citizens' opinions regarding local public interest issues in a synchronized on-line and on-site setting"

<https://github.com/joausaga/agora20>

Sufragia

"Sufragia is an intelligent and open platform promoting accesible citizen participation where every user from any community, state or even nation can broadcast a unique vote in a referendum, election or opinion"

<https://github.com/juanpabloprado/sufragia>

Ballot Box

"React Native App to show the potential of how a mobile application would improve civil participation in the general public. BB is aimed at increasing overall voter turnout in the United States to improve voter outcomes for all citizens."

<https://github.com/tyslas/Ballot-Box>

A Nova Voz

"The first chatbot to provide accessibility to open government data, enabling citizens to follow their politicians and know what they are doing, making the exercise of political participation friendly."

<https://github.com/jeanmdias/anovavoz>

<http://www.anovavoz.com.br/>

Smart City Forum

"The Smart City Forum project helps local governments be transparent and get feedback from citizens about their public works. It is based on the principle of open data and citizen participation in local government."

<https://github.com/hoominchu/smartcityforum>

<https://hdworks.org/smartcity/browse.jsp>

Public Spaces X

"Reclaiming and activating public spaces through participatory design for community uplift"

<https://github.com/codeforpakistan/PublicSpacesX>

Participatory Design Studio

"Open education resources for a participatory design studio"

<https://github.com/baharmon/participatory-design-studio>

OpenGovernment

"OpenGovernment -- a project of the Participatory Politics Foundation"

<https://github.com/opengovernment/opengovernment>

Participatory Budgeting Platform

<https://github.com/StanfordCDT/pb>

<https://pbstanford.org/>

Mapeo Desktop

"Offline participatory map editor for indigenous territory mapping and environmental monitoring in remote environments"

<https://github.com/digidem/mapeo-desktop>

<https://www.digital-democracy.org/mapeo/>

Participatory Budgeting

"Participatory budgeting app for municipal corporations in India"

https://github.com/vishwajeetv/participatory_budgeting

<https://www.youtube.com/watch?v=7B-IBEWYnvk>

Marine Map

"MarineMap is an open-source tool for participatory marine planning"

<https://github.com/underbluewaters/marinemap>

Your Priorities

"Your Priorities is a digital democracy platform, a progressive web app, and a participatory social network that empowers groups of any size to speak with one voice and organize around ideas"

<https://github.com/CitizensFoundation/your-priorities-app>

<https://yrpri.org/domain/3>

ThisCausesThat

"A Rails application offering a participatory platform to identify Environmental, Social, Political issues and generate a comprehensive causal network encompassing them"

https://github.com/rgoraya/wc_master

Collective Development

"A participatory system where citizens are not the library's audience, they are the makers"

<https://github.com/codeforanchorage/collective-development>

Participatory GIS

"A home for the American Red Cross's materials relating to participatory GIS and community mapping"

<https://github.com/AmericanRedCross/ParticipatoryGIS>

Our Story

"Documentation for Our Story participatory media platform"

<https://github.com/digitalinteraction/ourstory-guide>

<https://guide.ourstory.video/>

Rhizome

"Participatory democracy and place-based deliberation"

<https://github.com/sobingt/rhizome>

Ecclesia

"Ecclesia is a tool for participatory democracy"

<https://github.com/earelin/ecclesia>

SimCopiapo

"Participatory modelling to support water governance in the Copiapo Basin"

<https://github.com/juancastilla/SimCopiapo>

WeBudget

"WeBudget is a platform for participatory and transparent budgeting"

<https://github.com/Ale-/webudget>

Stirling and Forth Valley Participatory Neighbourhoods (SFVPN)

"Stirling and Forth Valley Participatory Neighbourhoods website template"

<https://github.com/SFVPN/neighbourhoods2018>



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Arctic Programme**
2014–2020



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We the People

"We the people write the laws - a full participatory framework"

<https://github.com/KevinTriplett/WeThePeople>

Geranium

"Energy consumption simulator for participatory modelling and decision making, taking into account: urban, social and micro-climate data."

<https://github.com/npapoylias/Geranium>

Mobisense

"Mobisense: A participatory platform for data collection and dissemination in public transportation"

<https://github.com/emarkou/mobi-sense>

Majority

"A platform for participatory budgeting developed for the University of Kent as a part of MSc Computer Science."

<https://github.com/AndrewJPhillips/Majority>



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2014–2020



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ANNEX 2: EMERGREEN SERVICES DESCRIPTION

Marine litter mapping and management service

Service to reduce the impact that marine litter is having on the marine and coastal environment. The community will be engaged to report marine litter and change their behaviour towards it. This includes citizens, fishermen, recreational boats, etc.) that are seen as part of the solution. It will be a technology-led public service where several emerging technologies are envisaged as follows:

- Data Crowdsourcing and Mapping tools map are foreseen as a useful mobile phone-based tools for co-creating datasets and mapping marine litters.
- Drone technology to record and report the marine litter as well as to show the before and after cleaning process.
- Visual data story telling tools will be used to predict the hotspots where the litter will be accumulated in order to facilitate a more effective cleaning process (i.e. beaches.etc).

This service will be tested in Donegal and made available to other regions through the transnational platform.

Zero Waste circular management service

Service to change behaviour towards a zero waste circular district. DCSDC's Recycling Rate is 40.5% while the current infrastructure is prepared to achieve a 73 % of recycling rate so behavioural change is a key factor to increase and meet the EU and council's targets. Several emerging technologies could be trialled as follows:

- Virtual reality & Gamification - Creating a computer-generated scenario capable of simulating a realistic experience through Virtual Reality technology while employing games to nudge and orientate users towards the preferred recycling and use behaviours.
- Personalised Waste Analytics Dashboard - This comprises a dashboard which uses data on the waste and recycling behaviour of users and the average behaviour of the immediate and comparable population. Existing experience from Vasternorrland will input on this.

This service will be tested in Derry and Strabane and made available to other regions through the transnational platform.

Green growth advisory services

A service to assist advisors in their task of providing advice to the community to be more energy efficient and solve the issue they have to reach a wider audience. The use of the following technologies is envisaged:



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Arctic Programme**
2014-2020



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- Social Virtual Reality Training Environment: use of VR technology to create an *immersive collaborative learning environment* for citizens and businesses to connect with the consultant and other learners. The social VR will allow direct participation of learners in demonstrations.
- Artificial Intelligence-driven Conversational Chatbot: a conversational chatbot agent developed by NUIG could be *trained* with expert information and knowledge base provided by the advisor to drive natural conversations the learners. The chatbot technology here could serve as virtual assistant accessible through communication platforms such as Facebook.

This service will be tested in Vasternorrland and made available to other regions through the transnational platform.

Intelligent green participation service

A service that collects together good practices from various participatory projects. The results and experiences are scaled into an intelligent participation system that can be applied in other geographical contexts sharing similarities. The technologies envisaged are:

Digital participation and co-creation platform: these platforms affords both traditional engagement and participation while also enabling participants to engage in more sophisticated activities including agenda setting, co-design and co-development of artifacts by exploiting resources available on the platform and external ones. Behavioral change on the participatory platforms could be achieved through active exchange and deliberations based on concrete evidence.

This service will be tested in South-Savo (Finland) and will serve as a basis to develop the transnational platform and provide means of hosting the other services described in terms of behavioural changes and sustainability.

Data story telling of green energies service

A service displaying real time data on green energies presented in an user-friendly and interactive way to encourage citizens and businesses to invest in solar panels and various heatpump solutions leading in a reduction of the dependence on imported fossil fuel.

The use of Visual Analytics and Data Story telling tools is envisaged. This technology goes beyond traditional visualisation to support data storytelling, in particular data stories related to "explaining a phenomenon (solar panels & heatpump solutions) for deeper understanding. Some experiences such as the "Your Data story" (YDS) platform developed in the context of a project participated by NUIG could be adapted for use in this context.

This service will be tested in Faroe Islands and made available to other regions through the transnational platform.



**Northern Periphery and
Arctic Programme**
2014–2020



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