SiEUGreen
Sino-European innovative green and smart cities

Sino-European Innovative Green and Smart Cities

Deliverable 5.4

Sustainability & Exploitation plan

Lead Partner: DRAXIS
Lead Authors: DRAXIS
Due date: 30/06/2020
Version: 3.0

Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

The project has received funding from the European Union's Horizon 2020 Research, and Innovation Programme, under grant Agreement N° 774233

Disclaimer

SiEUGreen

The project has received funding from the European Union's Horizon 2020 Research, and Innovation programme, under grant Agreement N 774233 and from the Chinese Ministry of Science and Technology.

Throughout SiEUGreen's implementation, EU and China will share technologies and experiences, thus contributing to the future developments of urban agriculture and urban resilience in both continents.

The project SiEUGreen aspires to enhance the EU-China cooperation in promoting urban agriculture for food security, resource efficiency and smart, resilient cities.

The project contributes to the preparation, deployment and evaluation of showcases in 5 selected European and Chinese urban and peri-urban areas: a previous hospital site in Norway, community gardens in Denmark, previously unused municipal areas with dense refugee population in Turkey, big urban community farms in Beijing and new green urban development in Changsha Central China.

A sustainable business model allowing SiEUGreen to live beyond the project period is planned by joining forces of private investors, governmental policy makers, communities of citizens, academia and technology providers.

Technical References

Project Acronym:	SiEUGreen
Project Title:	Sino-European Innovative Green and Smart Cities
Project Coordinator:	Dr. Petter D. Jenssen, NMBU Phone: +4791377360 Email: petter.jenssen@nmbu.no
Project Duration:	January 2018 - December 2021

Deliverable N°:	D5.4
Dissemination level [1]:	CO (see explanation bellow)
Work Package:	WP 5 – Business Modelling and Sustainability
Task:	T 5.2 Development of exploitation and scaling plans for each of the 5 showcases
Lead partner:	20 - DRAXIS
Contributing partner(-s):	17 – SEECON, 6 – EMETRIS, 1 - NMBU, 2 - NIBIO, 3 - CAAS, 5 - NORDREGIO, 7 – AAKS, 8 - ViLabs, 9 - OKYS LTD, 10 – BAEISU, 11 – BGVS, 12 – ScanWater, 13 - Hatay, 14 - CASS, 15 - Sampas, 16 – HHEPSTI, 18 -IGZ, 19 – PHOTON.
Due date of deliverable:	30/06/2020
Actual submission date:	07/07/2020

[1] **PU** = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

Document History			
Version	**Date**	**Author - Partner**	**Summary of Changes**
1.0	17/07/2019	DRAXIS	Initial Draft
1.1	12/05/2020	NMBU/SEECON	Returned comments for integration
	27/05/2020	SEECON	Revision of chapter 3.3
2.0	26/06/2020	DRAXIS	Final version returned to NMBU for comments
2.0	07/07/2020	NMBU	Final version returned with corrections
2.0	07/07/2020	DRAXIS	Final draft submitted

3.0	26/05/2021	DRAXIS	Review comments incorporated and the entire document is revised.

Executive Summary

The current deliverable *D5.4 Sustainability and Exploitation plan* provides an overview of the SiEUGreen's sustainability beyond the lifetime of the project and the exploitation of its main results. Specifically, D5.4 aims at identifying project outcomes and elaborating SiEUGreen partners' considerations and investigations on the different approaches that will empower them to either individually or collectively sustain and expand the use and practice of SiEUGreen legacy outcomes, having considered scientific, commercial and non-commercial exploitation.

Particular focus is given to early conceived business ideas on an individual basis, as well as showcase exploitation plans, which will be the foundation of commercial exploitation and integrated into the respective Business Plans (*D5.5 Business Plans – M46*). The current deliverable also includes the preliminary outcomes of the study Urban Farming Scenarios 2030, which can be considered as complementary to the market analysis, and which showcase the potential for sustaining solutions, such as SiEUGreen.

Considering that the project is still under development and the showcase activities are still progressing, the business ideas and models elaborated in the current deliverable should not be considered as final ones and the document should be considered as a working document that can be later on adjusted on the basis of the needs, visions, political decisions and drivers for commercial exploitation. These will be directly linked to and further incorporated in the deliverable *D5.5 Business plans due M46*.

The overall approach for the development of the sustainability and exploitation plan relied on the identification, mapping, characterization and categorization of the exploitable results into commercial; non-commercial and scientific results; the definition of Intellectual Property Rights (IPRs); the identification of possible, most appropriate exploitation routes for the expected exploitable results corresponding to the nature of the different results and their target users; and the development of relevant business models.

The unexpected Covid-19 global pandemic did not affect the development of the current deliverable directly. Overall WP5 activities and partners' interactions and input have been

mainly desktop-based (desk research; online interviews; and online/email communications/exchanges with partners and stakeholders) and therefore no major disruption happened due to the confinement measures applied in the different partner countries.

The document is structured as follows. Section 1 is an introduction to the current deliverable. Section 2 presents briefly the SiEUGreen project and discusses the methodological approach followed for the identification, categorization and characterization of the project outcomes considered for exploitation. Section 3 presents the project sustainability pathway as it has been considered by SiEUGreen consortium partners. Section 4 describes commercial, non-commercial and scientific exploitation of SiEUGreen outputs. Section 5 presents potential SiEUGreen markets and customer segmentations. Finally, Section 6 briefly discusses the next steps.

List of Acronyms

Acronym	Description
3R	Reduce, Reuse, Recycle
AKOS	Smart City Automation System
API	Application Program Interface
BAEISU	Beijing Eco-Creative Agricultural Service Alliance (consortium partner)
BGVS	Beijing Green Valley Sprouts (consortium partner)
CA	Consortium Agreement
CAAS	Chinese Academy of Agricultural Sciences (consortium partner)
CEN	European Committee for Standardization
CO_2	Carbon Dioxide
DESCA	Development of a Simplified Consortium Agreement
DIN	Deutsches Institut für Normung
DIY	Do It Yourself
EC	European Commission
ECF	Efficiency Cycled System
EEA	European Economic Area
EU	European Union
H2020	European Union Framework Programme for Research and Innovation Horizon 2020
HHEPSTI	Hunan Hengkai Environmental Protection Science and Investment Group (consortium partner)
IBC	Intermediate Bulk Container
ICT	Information and Communication Technology
IGZ	Leibniz Institute of Vegetable and Ornamental Crops (consortium partner)
IoT	Internet of Things
IPR	Intellectual Property Rights
IRS	Innovation Radar Survey
ISO	International Organization for Standardization
MAA	Multi Actor Approach
MoU	Memorandum of Understanding
NCUA	National Center for Urban Agriculture
NGO	Non-Governmental Organization
NIBIO	Norwegian Institute of Bioeconomy Research (consortium partner)
NLH	Agricultural university of Norway
NMBU	Norwegian University of Life Sciences
NPK	Nitrogen – Phosphorus – Potassium
NUF	Nitrified Urine Fertilizers

OHW	Organic Household Waste
P	Phosphorus
R&D	Research and Development
SiEUGreen	Sino-European innovative green and smart cities
SMEs	Small-Medium Enterprises
SOA	Service Oriented Architecture
SSWM	Sustainable Sanitation and Water Management
TTO	Technology Transfer Office
UA	Urban Agriculture
UF	Urban Farming
UCD	User Centered Design
UI	User Interface
UX	User Experience
WP	Work Package

Table of Contents

List of Tables

List of Figures

1. Introduction

D5.4 Sustainability and Exploitation plan aims to provide an overview of the SiEUGreen exploitable outputs and the vision of all partners towards the development of successful exploitation of the project results. It also describes commercial, non-commercial and scientific exploitation for SiEUGreen outputs as well as showcases related exploitation. Business models of commercially exploited outputs will be the basis for the development of relevant Business Plans (*D5.5 Business Plans – M46*).

The present deliverable is submitted on M30 of the project and considering that the project further develops and the showcase activities are still progressing, the included business models are not considered finalized, but might be further developed or adjusted (or new ones to be developed) on the basis of the needs, visions and drivers for commercial exploitation. These will be directly linked to and further incorporated in the deliverable *D5.5 Business plans due M46.*

Within the period that the present deliverable was being developed, our world and society experienced the COVID-19 pandemic. The confinement measures that were applied in the different partner countries did not directly affect the development of WP5 activities and moreover the development of the current deliverable.

The necessary information and partners' input have been mainly desktop-based (desk research; online interviews; and online/email communications/exchanges with partners and stakeholders) minimizing the effects of disruptions due to the confinement measures. To avoid any possible delay and postponement of already planned activities, (in-person meetings with showcase partners and the implementation of a 2 days' seminar), online meetings and teleconferences took place. Minor issues were faced in interaction with partners that were not able to continue working remotely during the beginning of the confinement period.

2. The SiEUGreen project

SiEUGreen develops a suite of existing, as well as new innovative technological solutions and integrated concepts, within its showcases that aim to support resource-efficient production systems for Urban Agriculture (UA). To achieve that customized solutions will be provided to

end-users, with the integration of the different aforementioned technologies and solutions and they will be tested in larger environments in the showcases.

2.1 Innovation and Technologies

The overall innovation of the projects is the combination of existing and proven technologies and approaches, into an integrated and holistic concept that focuses on the principle to achieve the **3R**s - **R**educe, **R**euse and **R**ecycle to support food security and sustainable UA, and develop **resilient**, **socially coherent** and **smart future cities.** Within this concept, different waste streams are harnessed to be reused but also productively utilized to generate bio-products, such as organic fertilizers, and provide a source of the sustainable urban food supply with minimum transport, effective use of solar energy and carbon dioxide (CO_2). To achieve this, existing and unexploited technologies have been used under a collective approach and further developed (see relevant results described under WP2 deliverables) and the relevant outcomes of research and demonstration activities are in the focus of the SiEUGreen exploitation.

The technologies that are being used under the SiEUGreen project are currently being or have been developed during past and ongoing projects of the research teams affiliated to the Norwegian University of Life Sciences (NMBU), the Norwegian Institute of Bioeconomy Research (NIBIO) and the Chinese Academy of Agricultural Sciences (CAAS) and cover a wide range of water management, energy-saving and planting techniques. Within the technologies applied/used to harness different household/urban waste stream, the main focus has been given to achieving the greatest possible quality of the produced products (bio-products) and compliance to the existing hygiene rules and health and safety regulations (such as for human and household-based waste liquid, and solid fertilizer, compost). The regulatory mechanisms for the utilization of the waste bio-products for UA vary in the SiEUGreen partner countries. For instance, the regulatory mechanism differs from the European Union (EU) to China. The project will come up with general guidelines on how to recycle and reuse the waste by-products for UA that can potentially facilitate the development of regulatory guidelines.

Research activities that have been performed so far to demonstrate or further develop processes, production methods as well as technologies considered to be used within the project, are reported in the project relevant deliverables D2.1 Green Technology (T1) ready, D2.2 Evaluation of crop techniques, D2.3 Blue technology (T2) Ready – 1, and D2.4 Blue

Technology (T2) Ready 2. Similarly, Chinese partners have proceeded with relevant research on technological aspects as an activity performed under WP2 and WP3 and reported in the respective project deliverables.

Beyond the technological developments and advances that are meant to support and enhance UA, the project is approaching and researching the socioeconomic aspects within existing or newly established communities. As being part of the SiEUGreen showcases research and support for demonstration activities (under WP1; WP3; WP6), relevant outcomes (either already developed/identified or expected throughout the project lifespan) are incorporated with the acceptance of technological ones to depict the integrated vision of SiEUGreen.

2.2 Identification of Exploitable Outputs

The overall procedure to identify and further elaborate the SiEUGreen exploitable outcomes has been a long process that demanded a continuous and dynamic exchange with all project partners. All project partners provided substantial input in all steps of the process playing important role in the development of the current deliverable. The following steps were considered in order to identify all the exploitable outputs of the project.

First, project deliverables mainly from WP2, but also from WP1 have been researched to list the already developed outputs/results, and furthermore explore their potential exploitation. **Second**, a structured questionnaire (see ANNEX I – SiEUGreen Outputs & Exploitation questionnaire) was developed and distributed to project partners, not only to collect information about the potentially exploitable outputs of the project but also to grasp the individual vision and intelligence of all project partners on how they intend to exploit those outputs, as well as the SiEUGreen showcases. **Third**, during a two-day project meeting (organized on M25) a list of identified exploitable outputs were produced with all participating partners providing their views on the basis of their research activities performed and results already achieved, but also their considerations on further/expected outputs that could be exploited. This first list was further adapted to include the input from the rest of the consortium partners. The overall activity as described above has resulted in the identification of the project exploitable outputs as listed in below Table 2.

To allow a better characterization of the project outputs, we have proceeded with the below-referred grouping into 5 distinct categories, within which subcategories of exploitable outputs have been considered, see Table 1 below.

Table 1 Categories of SiEUGreen Exploitable Outputs

Category	Sub-Category
Technology packages	- Waste and water treatment systems; - Appliances developed or further advanced; - Software applications developed/conceptualized.
Standards, Protocols and Operational Procedures	- Protocols and Operational procedures for hydroponic and crop-based production systems; - Standardization of production systems/product related standards.
Integrated Multiscale Analysis Frameworks	- Methodology and calculator of socio-economic and environmental impacts of Urban Farming (UF), - UA typologies for urban planning; - Policy recommendations; - Guidelines for the application of human waste-based fertilizers.
Data/Knowledge	- Information as primary and secondary data generated and collected within the project, leading to research, educational, training, policy-making and advisory services.
Showcase concepts	- Concepts and demonstration activities within each of the 5 project showcases.

Table 2. The SiEUGreen exploitable outputs

Category	Sub-category	Output	Description	Partner(s)	Target groups
Technology package	Integrated solid (organic) waste and waste water treatment system	The GREENergy concept	GREENergy is a circular decentralized treatment system with near-zero emissions to water and air through conversion of resources into fertilizers, bioenergy and soil amendment.	NMBU, NIBIO, ScanWater	- Public sector - Private sector - Researchers
	Software application	COMMURBAN	Citizen engagement application based on gamification features and DIY project of UA.	DRAXIS, Aarhus, Hatay, SAMPAS, OKYS,	- Public sector - Private sector - Researchers
	Software application	Biomass estimation app	Machine learning-based application for the evaluation of biomass development in lettuce production.	NIBIO	- Private sector - Researchers
	Software application	GREENergy monitoring system	An integrated monitoring system that will enable the GREENergy user to control the functions and system flows.	ScanWater	- Public sector - Private sector
	*Product/appliance	Garbage Processor	A garbage disposer that can transform kitchen waste into organic fertilizer.	PHOTON	- Private sector - Researchers - Residents
	*Product/appliance	Fruit and Vegetable Planter (mushroom and succulent)	Fruit, vegetables and succulent home growing devices, automatically adjusting humidity and brightness, and automatic water replenishment.	PHOTON	- Private sector - Researchers - Residents
	*Product/appliance	Paper-based microgreen production system and rack for Balcony Garden		BGVS	- Private sector - Residents

Standards, Protocols and Operational procedures	Operational procedures	Paper-based crop cultivation techniques using recycled paper	Use of recycled paper for microgreen production and development of production protocol.	NIBIO, BGVS	- Private sector - Researchers - Residents
	Operational procedures	Compost and waste-based cultivation	Household food and other types of waste (biochar, garden waste) used to deliver compost for balcony and greenhouse cultivation.	NIBIO, NMBU, IGZ	- Public sector - Private sector - Researchers - Residents
	Operational procedures	Nitrification of liquid waste	A system based on pH control is being developed to nitrify liquid waste rich in ammonium (e.g. urine, digestate) into a smell free and improved liquid fertilizer.	NIBIO, NMBU, IGZ	- Public sector - Private sector - Researchers - Residents
	Operational procedures	Hydroponic and aquaponic crop cultivation techniques	Evaluation of different cultivating techniques hydroponics, aquaponics to be applicable in the project showcases.	NIBIO, NMBU, Beijing Eco-Creative Agricultural Service Alliance (BAEISU)	- Public sector - Private sector - Researchers - Residents
	Operational procedures	Evaluation of the use of urine-based recycling fertilizers in soil-based and hydroponic horticultural production systems	Application of human urine-based fertilizers in soil-based and hydroponic production systems.	IGZ	- Public sector - Private sector - Researchers - Residents
Integrated multiscale analysis frameworks		Methodology and calculator of socio-economic and environmental impacts of UF	Analysis frameworks and tools as results of WP1 activities.	NORDREGIO, Aarhus Kommune, Hatay Municipality	- Public sector - Researchers
		Urban agriculture typologies for urban planning	Analysis frameworks and tools as results of WP1 activities.	NORDREGIO, Aarhus Kommune, Hatay Municipality	- Public sector - Private sector - Researchers
		Policy recommendations	Policy briefs and papers.	EMETRIS	- Public sector - Private sector - Researchers

		Scenarios for the future of Urban Agriculture	Publication of the results of the study performed under T5.4 Scenarios for the future of UA.	EMETRIS	- Public sector - Private sector - Researchers
		Guidelines for the application of human waste-based fertilizers	Easy to understand guidelines for UA practitioners for the use of human waste-based fertilizers.	IGZ	- Public sector - Private sector - Researchers - Residents
Data		Primary and secondary data selected within the project activities		NIBIO, NMBU, NORDREGIO, ViLabs, CAAS, IGZ, EMETRIS, SEECON, DRAXIS, OKYS	- Public sector - Private sector - Researchers
Showcases concepts		Showcase deployment concepts and results		NMBU, BAEISU, CAAS, Hengkai, ScanWater, Hatay Municipality, SAMPAS, ViLabs	- Public sector - Private sector - Researchers

2.3 SiEUGreen partners IPRs and Innovation management

The SiEUGreen project follows the IP relevant rules as set out by the project GA and have been embedded in the project partners' consortium agreement (CA). The SiEUGreen CA is set in line with the DESCA model (Development of a Simplified Consortium Agreement) for EC Horizon 2020 projects. With regards to the background, a declaration has been signed by all partners where they have agreed to *include in their individual obligation to grant Access Rights only Background generated by their respective research group directly involved in carrying out the Project and which is related to the work plan, aims and objectives of the Project, and only if the Party's ability to grant such Access Right is not restricted by existing or pending third party rights at the time Access Rights are requested*. Additionally, in the project CA, there have not been referenced any specific limitations and/or conditions for implementation nor for exploitation (as per the Articles 25.2 and 25.3 of the GA).

According to the project proposal, an IPR plan is to be developed to protect the SiEUGreen project intangible and tangible results from a legal point of view, in order to guarantee fair dissemination, exploitation and commercialization of the SiEUGreen outputs after the project completion. This activity falls under *WP4 – International knowledge transfer*, within which partner NIBIO developed the deliverable *D4.1 Partners agreement on IPR and MoU*, stipulating the terms and framework of an agreement between EU and China partners on the use and sharing of knowledge. NMBU and NIBIO as two of the main project research institutes and technology providers have associated their Technology Transfer Office (TTO) – Ard Innovation AS – with the identification and settling IPRs underlying promising innovations resulting from the project activity.

Additionally, NIBIO and NMBU have developed a process and form for the identification of innovative ideas/inventions towards a possible innovation whenever created in the SiEUGreen project, whether it is an early phase, after preliminary testing, or as a part of the project's active research process/results.

The project has also allocated the role of Innovation Manager to partner ScanWater. The Innovation Manager is responsible for the coordination of the innovation activities and understanding both market and technical problems, with a goal of successfully

implementing appropriate creative solutions. ScanWater has been in constant communication with both research and industrial partners establishing a dynamic exchange and transposing the research outcomes into potential concepts and products to be up-taken by the industrial partners. The activity as such, beyond its focus on the research uptake, has contributed to the knowledge sharing between the two regions and strengthened the communications between partners.

The following Table 3 presents the so far identified project innovations and partners involved in their development. The SiEUGreen innovative approaches and solutions have been reported by the project partners in the Innovation Radar Survey (IRS) by the end of the first reporting period (August 2019). The objectives upon which the development of those innovations based are the following:

- Contribute to more circular (urban) agriculture systems;
- Increase resource efficiency;
- Increase agricultural productivity;
- Facilitate the use of renewable energy sources;
- Develop new types of fertilizers;
- Treat waste to reduce pollution and ensure its reuse;
- Develop innovative business models.

Table 3 SiEUGreen Innovations

Innovation	SiEUGreen Partner leading	Partners participating	IPR	TRL Status M0	TRL Status M36	TRL Status M48
Apply Efficiency Cycled System (ECF) efficient planting circulatory system	BAEISU	N/A	Have not been claimed up to date	6	8	8
Urban circular agriculture based upon kitchen waste reduction and recycling	CAAS	N/A	Have not been claimed up to date	6	7	8
Struvite precipitation for soil conditioning	HHEPSTI	N/A	Have not been claimed up to date	4-6	6	6-7
The integrated treatment process for urban decentralized sewage	HHEPSTI	N/A	Have not been claimed up to date	5	7	7

Nitrification of liquid waste streams	NIBIO	NMBU	Have not been claimed up to date	4	6	6
Microgreen production using recycled paper	NIBIO	NMBU	Have not been claimed up to date	6	8	8
Tomato yield biomass estimation using machine learning	NIBIO	NMBU	Have not been claimed up to date	N/A	N/A	7/8
Hyperspectral imaging monitoring plant development under health and different pruning conditions	NIBIO	NMBU	Have not been claimed up to date	N/A	N/A	8/9
Compact greywater treatment	NIBIO	NMBU	Have not been claimed up to date	5	7	7
GREENergy	NMBU	NIBIO, ScanWater	Have not been claimed up to date	5	7	8
COMMURBAN application	DRAXIS	N/A	Have not been claimed up to date	1	6	8/9

The EC Innovation Radar services have communicated to the project coordinator that innovations regarding the GREENergy concept, the biomass estimation application, as well as the microgreen production using recycled paper, were mapped on the EC Innovation Radar platform.

The Innovation Manager will encourage partners whose activity and results, individually or collectively, will yield patentable outcomes to apply for patents or other options to secure their results. At this stage of the project, most of the innovations are under development, and neither IPRs nor patents applications have been considered by the project partners. Specific confidentiality agreements will be signed among partners involved in tasks with sensitive IP and commercial issues, in the case they are required. The WPs have been planned and designed in such a way to allow optimizing the use of data and avoid conflicts of interest between partners. Whenever necessary, the project will capitalize on the expertise and experience of its latest Advisory Board member, Dr. Yu Ji who is specialized in IP law.

3. SiEUGreen Sustainability

In order to support the "*continuation of the delivery of benefits to the project beneficiaries and other constituencies for an extended period after the financial assistance has been terminated*"[1], SiEUGreen partners have elaborated different ways to ensure sustainability. Partners have considered the different approaches that will empower them either individually or collectively to sustain and expand the use of SiEUGreen outcomes, having considered commercial, non-commercial and scientific exploitation.

SiEUGreen sustainability plan contains actions to enrich and empower SiEUGreen sustainability among the existing end-users/beneficiaries across the showcases. This is mainly achieved through engaging activities such as educational workshops, training sessions, residents' participation in UA community gardens, women and refugee association meetings, as well as many other activities that take place throughout SiEUGreen showcases and strive to propagate and establish SiEUGreen practices, concepts and technologies beyond the end of the project.

Furthermore, partners have considered other actions that aim to ensure SiEUGreen sustainability through the dissemination of main results, knowledge gained and lessons learnt. The dissemination of SiEUGreen outcomes can take the form of scientific publications and policy recommendations. Moreover, the study of future UA scenarios (see 3.2) provides a solid basis upon which we can build innovative business models (see 3.3) to ensure the sustainability of SiEUGreen commercial outputs in the period beyond the end of the project.

Table 4 includes example of actions taken by SiEUGreen partners in order to contribute to the overall sustainability of the project.

[1] EU's definition of a project sustainability plan, European Commission (EC) Directorate-General Education and Culture (2006) "Sustainability of international cooperation projects in the field of higher education and vocational training - Handbook on Sustainability". Luxembourg: Office for Official Publications of the European Communities, ISBN: 92-9157-

Table 4 Sustainability Actions

Partner/showcase	Sustainability Action(s)
Hatay Metropolitan Municipality	Create training materials to reach to larger communities and further share the SiEUGreen outcomes for educational purposes. Learning/Education Center model that exhibits different technologies for food cultivation.
Hatay Showcase	Establish a UA manual for other municipalities with limited knowledge. Promote the SiEUGreen showcase deployment to newly developing Turkish UA market and government organizations through disseminating findings in local and international events and conferences.
CAAS	Capitalize through SiEUGreen on the common research outcomes and knowledge transfer between the EU and China regions, and to build a stronger basis for a continuous and sustainable international collaboration. Dissemination of project outcomes at local/national as well as international level strengthening the sustainability of the SiEUGreen outcomes around UA techniques and innovative production methods. Online training courses on how to plant sprouts (in 2020, more than 30,000 viewers)
Chinese showcases	
NMBU	Dissemination of SiEUGreen research outcomes on green and blue technology through scientific publications. Publications will sustain the ideas of SiEUGreen and can also lead to more future research activities aiming to improve/further develop SiEUGreen outcomes. Moreover, NMBU is planning for a new MSc program in UA from August 2021 as a continuation of its National Center for Urban Agriculture initiative that was inspired by the SiEUGreen project.
Norway showcase (Campus Ås)	
NORDREGIO	NORDREGIO will pursue opportunities to disseminate and deepen the knowledge acquired in SiEUGreen to other contexts through the Swedish Institute grant opportunity 'Third Country Participation in the Baltic Sea region'. This call offers the opportunity to apply for project funding for the inclusion of actors from Russia or the countries of the EU Eastern Partnership in a current EU project. If granted, this funding
Aarhus Showcase	

	will support the dialogue and exchange of knowledge between the SiEUGreen showcases and other UA initiatives from Russia and possibly Georgia. This can contribute directly to the sustainability of the project.
Aarhus Kommune & NORDREGIO	Word Gardens: workshop on building polytunnels. Brabrand: newsletters, videos, survey on the performance of urban garden.
Aarhus Showcase	
ViLabs	Exploit the SiEUGreen results related to the showcase deployment, including the public deliverables about the deployment instructions, concepts and results, aiming to: a) introduce the deployment methodology to several stakeholders; b) promote the SiEUGreen showcase deployment to its wide global network of experts c) promote the findings in international events and conferences.
All showcases	
ScanWater, HHEPSTI, NMBU	Based on the knowledge and ideas generated within the SiEUGreen, ScanWater is aiming to continue the research and development of the GREENergy concept beyond the termination of the project. This is considered to be formulated into a collaboration with HHEPSTI and research partner NMBU, supported via additional funds through the Norwegian exchange program (NOREC). Such collaboration will aim to further enhance the interlinks of research and technology and ensure the sustainability of SiEUGreen output such as the GREENergy concept.
Norway & Changsha showcase	
EMETRIS	All the dissemination activities including, scientific publications, policy briefs, studies on UA business models, SiEUGreen website, conferences, events, promotion videos, etc.
WP6	

3.1 Ensuring the SiEUGreen sustainability

To achieve sustainability partners have considered 3 interconnected pillars strongly developed within the project implementation. This tri-pillared approach focuses collectively on directing towards the strategic target of sustainability but also at successful commercial and non-commercial exploitation, maximizing the impact of the project beyond its implementation duration.

Engagement and increase of the end-users/beneficiaries of the SiEUGreen outcomes

Strengthening the engagement of showcase participants and of relevant stakeholders can enhance the visibility of the 5 project showcases, while also increasing the potential of activities continuation beyond the project end. Within each of the project showcases, engagement plans have been conceptualized (under WP1) and will be implemented within the showcases deployment. Through a continuous local (showcase level and partner's country) and global outreach approach, communication and dissemination activities are being performed by all project partners supporting the visibility of the project within different stakeholders.

More specifically, *D1.5-Engagement Strategies 1* of WP1 contributes significantly to project efforts in engaging local people in UA and facilitating the implementation of new technologies throughout the showcases, as well as fulfilling the visions and objectives of the latter. In turn, *D1.6-Engagement Strategies 2* will be an update of *D1.5* focusing on highlighting the best practices to engage people in the showcases, lessons learnt and the social acceptance of UA technologies.

Continuous development and evolution of the SiEUGreen tech outcomes, services and methodologies

Iteration cycles for the further development/adaptation of the technological advancements of the project will aim at ensuring that a continuous improvement is established and leads closer to tailored products and services towards targeted stakeholders. Since the project is still ongoing improvements and further advancements can be expected until the end of the project.

Targeted and continuous dissemination

To retain high interest and enhance the awareness of the SiEUGreen outcomes is of utmost importance to create the critical mass of end-users. Using the project and partners' dissemination tools and activities, to demonstrate the power of the project showcases, project partners will aim at attracting communities of users and potentially interested replicators.

As the project progresses and demonstration activities will come at full scale, dissemination activities will target key stakeholders/potential end-users, who can uptake project results, ensuring thus the project sustainability. At this stage of the project partners leading the deployment of the showcases have elaborated showcase exploitation plans that aspire to the long-term sustainability of the SiEUGreen outcomes. For example, showcases like Hatay and Aarhus that combine UA activities with socioeconomic concepts can pursue long-term sustainability of SiEUGreen results beyond the end of the project.

This task relies mostly on WP6 and more specifically on the forthcoming *D6.7* which will include the final dissemination plan for the SiEUGreen project. Moreover, the upcoming *D5.6-Handbook for SiEUGreen solutions replication* can potentially contribute to ensure the sustainability of the created knowledge and project outputs and foster their expansion and adoption by interested parties in the near future.

While research and scientific activities are still ongoing, some partners have identified further research opportunities. This is conceptualized on a number of Master and PhD thesis subjects that are going to be performed by NIBIO and NMBU students. The continuous research activity is expected to enhance the sustainability of the SiEUGreen research outcomes and further boost innovative research securing additional funding to research partners.

3.2 Future UA scenarios

Considering global trends such as climate change and resource scarcity, a major challenge for future cities will be to reduce negative environmental impacts. Moreover, cities must become or remain livable and attractive for their inhabitants and offer social and economic opportunities. Thus, reconnecting food production and cities offers promising potential, while the diffusion of UF reflects a rising awareness of how food and farming can shape our cities.

In this context, the project partner EMETRIS led the development of the Urban Farming Scenarios 2030 study that is performed under T5.4-*Elaborating Scenarios for the future of*

UA and it is included in the current deliverable as a supporting document.[2] The study elaborates at the present time different plausible scenarios for the future of UF. In such a way it has a twofold scope, from the one hand to stimulate and raise awareness among policy makers, researchers, investors, and societal actors on the opportunities ahead and on the other hand to provide input for the exploitation plans of the SiEUGreen outputs.

This section provides a summary of the main findings of the study which has triggered SiEUGreen partners to consider and elaborate future insights into the conceptualization of their exploitation plans.

UA business models and future scenarios

The study has examined the trends, driving forces, and uncertainties regarding the future of UA, in order to provide plausible narratives, scenarios for 2030 replying to the focal question: *"How will Urban Farming look like in 2030?"*. It is worth stating that the terms UA and UF have been used synonymously throughout this report.

During this process, the research team has utilized traditional and tested foresight methodologies for horizon scanning, weak signal identification, and scenario development, assisted in various steps by additional experts through participatory workshops and through a Delphi questionnaire.

On the basis of the research performed, ten different business models, varying in technology intensity and installations, commercial and non-commercial orientation but also across structures (indoor/outdoor etc.), were investigated and analyzed by experts (using a short Delphi exercise) and ranked on their potential to be the most expected towards 2030 (Figure 1).

[2] The current full version of the study on Urban Farming Scenarios 2030 is available in the following link: https://drive.google.com/file/d/1A02E8FD79dil0buW6nSSYfu-l6jkf1oT/view?usp=sharing

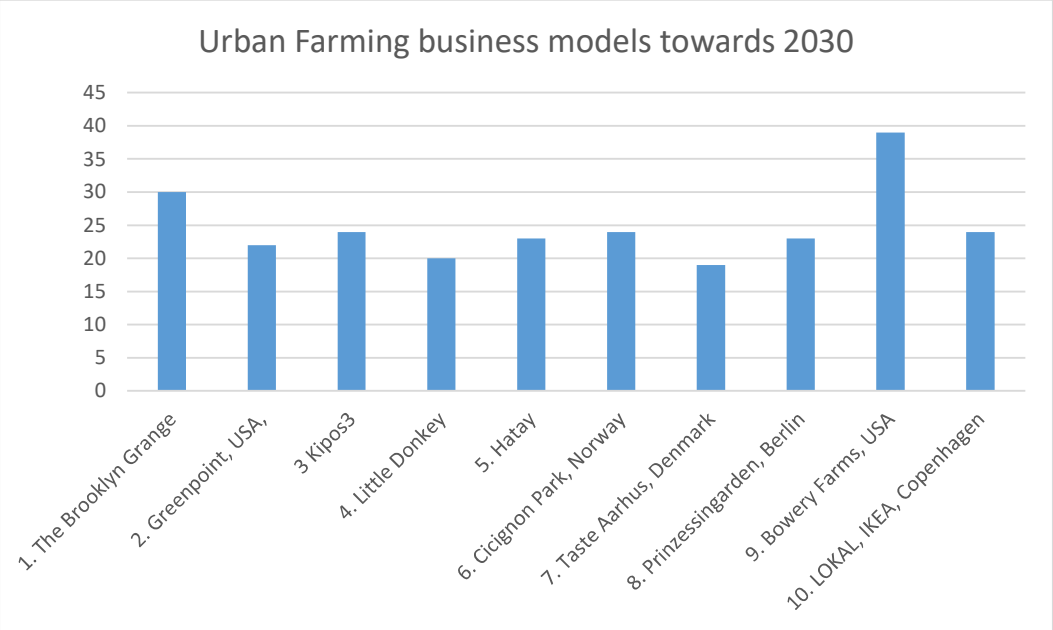


Figure 1 Urban Farming business models towards 2030

**Note: Business models in the above figure under n.4, 5, 6, 7 correspond to the SiEUGreen project showcases in Beijing, Hatay, Norway (and due to is similarity also in Changsha) and Aarhus.*

The analysis reveals higher expectations in indoor high-performance Hydroponic Vertical Farms, which exploit the synergies between the building environment and agriculture. High are also the prospects for smaller-scale Rooftop gardens or rooftop farms that have the longest tradition, but the range of products would be limited to tolerant species. This model combines other business activities like education, restaurant, etc. As regards community UF, the expectations to become a broadly popular model are less and is expected to remain a limited scale action for various forms of community engagement.

Considering the analysis of the driving forces, the uncertainties, the various weak signals, and the prospects of the various UF models, four, equally plausible, alternative scenarios for the future of UF are have been conceived. The scenarios were constructed using the information received through the horizon scanning and the following analysis of the driving forces that revealed the certainty and importance of several drivers (such as climate

change), but also underlined the importance of others like the future stance of society towards the new technologies, and the environmental challenges, but also towards a healthier way of living (see Figure 2).

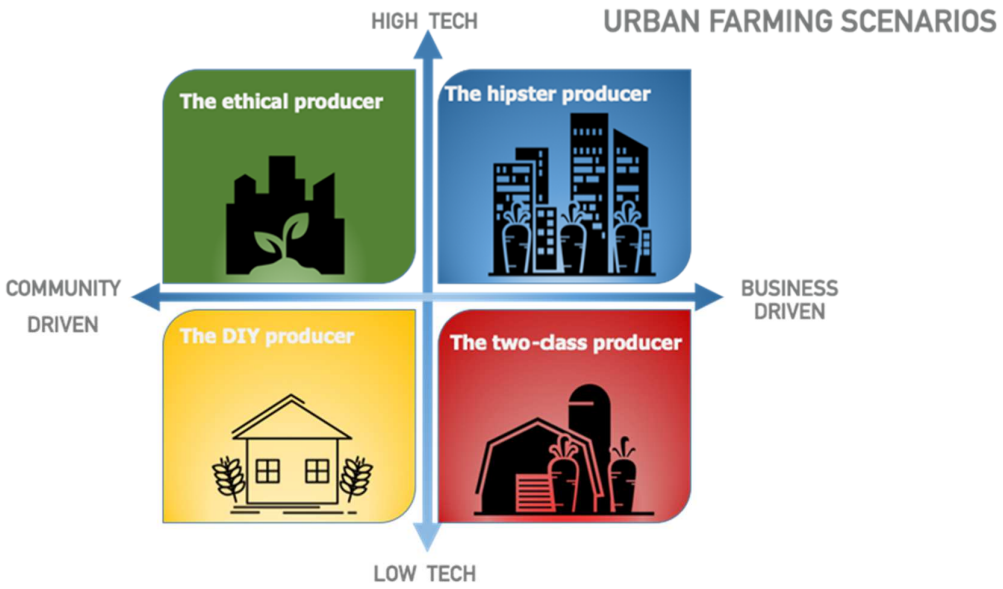


Figure 2 Urban Farming Scenarios towards 2030

In addition, the study team took into account the alternative identified UF business models, from high tech industrialized production to a more primitive organic community farming and we introduced this information to the final scenarios' narrative.

These scenarios may help us to think about the various possible directions for UF, but also help us to think about ways to support different developments. In the case of the SiEUGreen project, these scenarios are being considered by the project partners, fueling their exploitation plans of the different models and technologies tested and verified in the context of the project. It might be the case that one of these scenarios will be the reality of UF in 2030, or more of these scenarios might become a reality in different urban settings in Europe and Asia.

3.3 Supporting the elaboration of business models

As part of the overall approach followed for the development of the current deliverable, the project team, seized upon the long-term perspective of the partners to ensure the sustainability of the SiEUGreen legacy, and organized capacity development and coaching activities for project partners from Europe and China in the development of business models.

SiEUGreen strives to support EU-Chinese cooperation through scientific and technological exchange and the exchange of business models. This will be achieved by creating new value chains and developing innovative and sustainable business models for project results targeting economic and social benefits and potential replicability across regions and countries.

To support the exploitation of project results for scientific, commercial and non-commercial purposes or in public policymaking to maximize impact, the SiEUGreen project organized, implemented and followed up a number of business modelling activities.

In response to the global COVID-19 pandemic, all activities were held online, including coaching sessions aiming to support partners in the further development of business models. The overall goal of these activities was to initiate a change in the ability of consortium partners to substantially ideate, describe, evaluate and discuss business models using the Business Model Canvas (see Figure 3 below). This approach has been in line with the vision to further support the sustainability of the SiEUGreen, by any of the project partners that will be in a position to conceptualize and elaborate additional business models they can conceive within or beyond the project term.

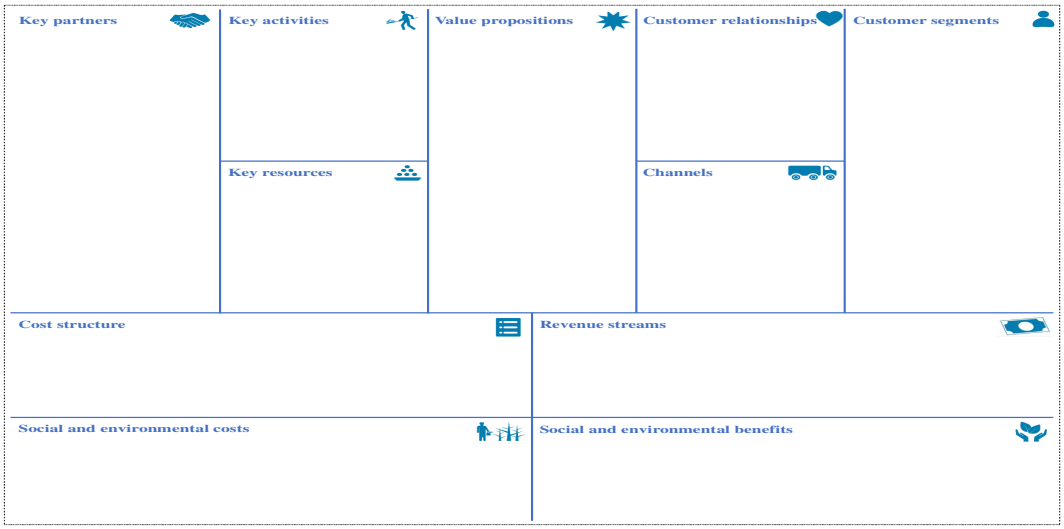


Figure 3 Business Model Canvas

Note: *The Business Model Canvas is a visual template for identifying, describing, designing, challenging, pivoting and organizing different elements of a business model. It is a great strategic management tool to help quickly and easily understand, define and communicate a business model in a straightforward, structured way.*

The results from the webinar and related activities have supported the development of innovative business models that partners have considered for the SiEUGreen exploitation and will be the basis for the development of relevant business plans (*D5.5 Business plan, M46*). Participants have benefited from the Business Modelling Webinar & Coaching (see Figure 4), gaining knowledge and getting familiar with tools readily applicable for the development of their potential business models.

Additionally, the followed approach with the use of Business Canvas is supporting the partners in the identification of all the crucial aspects that will need to be considered within the further development of the new service or product they aim to exploit. Furthermore, this allows partners to identify potential investors and alternative sources of funding and thereby contribute to the sustainable development and continuation of SiEUGreen beyond the project term. On the basis of this, a pitching session was organized within the webinar as an introduction for participants into the insights and scope of pitching, supporting them to realize approaches for further budget/support to develop their ideas and paving the way for potential commercialization and investment strategies development.

The conceptualized business models are considered living documents. Due to the different stage of their technology development and/or readiness, some of the business models are more developed and elaborated than others. As the project progresses, partners might further develop or adjust them. New business models that may be identified will also be elaborated and incorporated with the relevant business plans in the deliverable *D5.5 Business Plan* (M46)

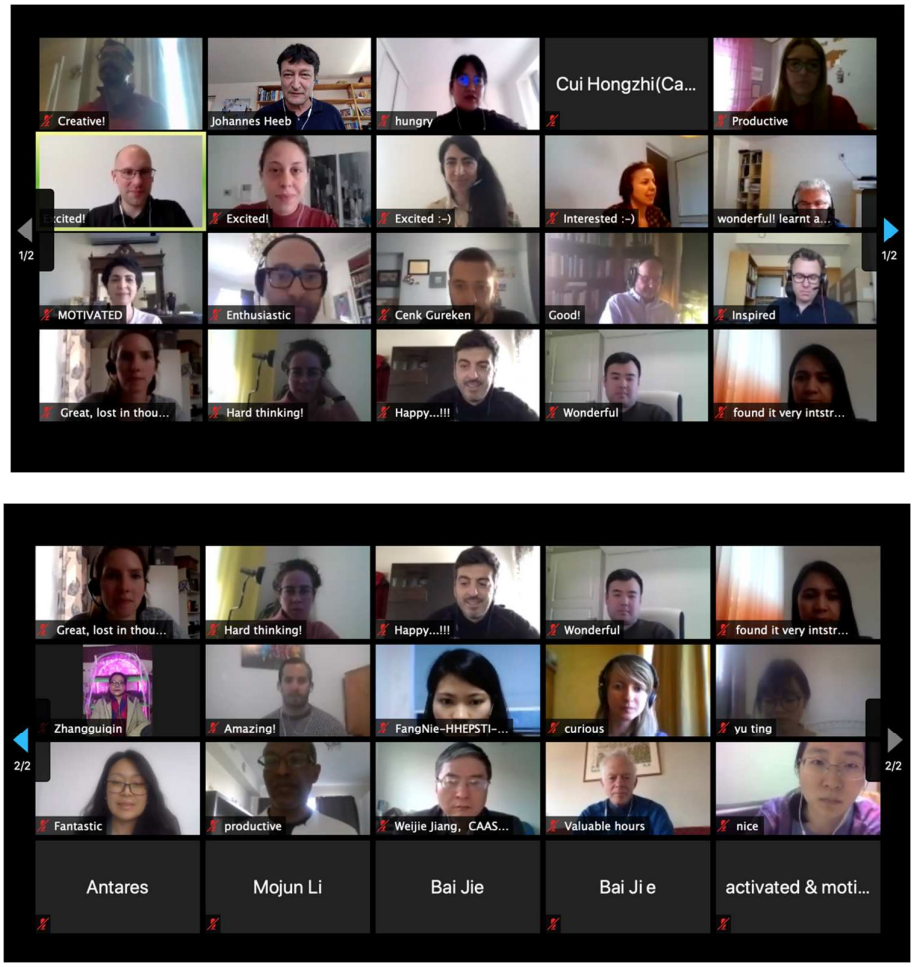


Figure 4 SiEUGreen Business Modelling Webinar

The so far considered and elaborated business models vary between commercially and socially driven ones which reflect the way partners consider exploiting project outcomes. Elaborated (initial) business canvases, as developed by project partners within the business modelling seminar, are included in ANNEX II – Draft Business Canvases.

4 SiEUGreen Exploitation

The focus of SiEUGreen exploitation is steered towards the market, the policy as well as research around the efficient and circular use (and re-use) of local resources to support UA concepts. Starting from a complementary consortium consisting of experienced multi-sector partners (research/academic, SMEs and technical/industrial) across the two geographical regions in the EU and China, SiEUGreen is aiming to early adoption by various end/users and further demonstration of its legacy outputs. Such an approach is laid on the principle of the SiEUGreen to utilize and create knowledge, perform and develop research on existing and new technologies and pave the way for successful uptake of innovative solutions.

This section presents a coherent exploitation plan for SiEUGreen outputs as identified in Table 2. SiEUGreen outputs, on the basis of the intention of the project partners, are envisioned to be exploited:

- Commercially (business models for commercial activity);
- Non-commercially (policy advice; educational purposes; socially driven business models; etc.);
- Research/Scientific exploitation (journal publications; further research activities; new projects; etc.).

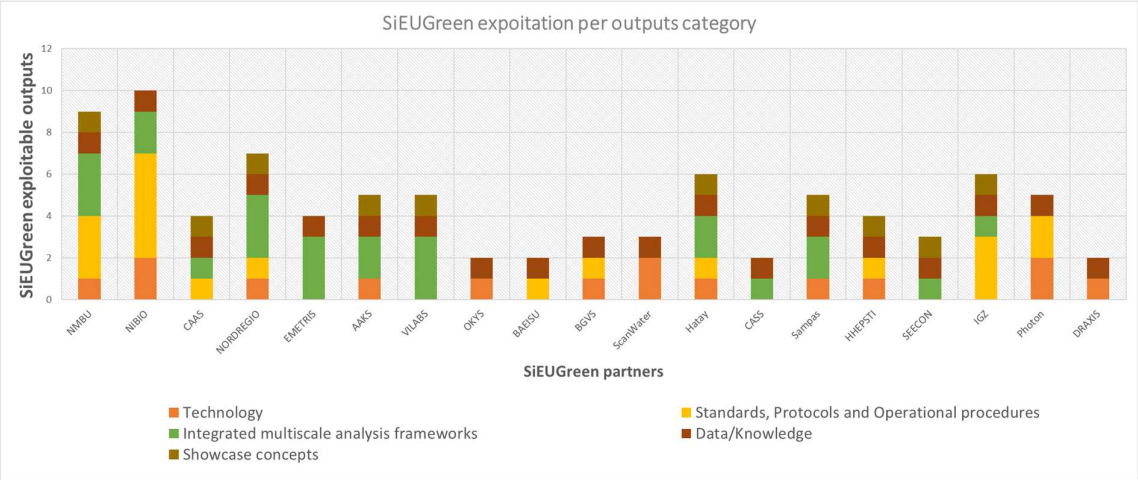


Figure 5 SiEUGreen exploitation per output category

The above Figure 5 provides an overview of the number of exploitable outputs, per category and per SiEUGreen partner.

4.1 Commercial Exploitation

The commercial exploitation could be both collective (project consortium) and individual. More specifically, in the collective exploitation, all the involved partners can offer SiEUGreen commercial and potentially commercial outputs (included in Table 5) as an integrated suite of outcomes (i.e., services, solutions and appliances/products). For the individual exploitation outputs can be offered as standalone components.[3] In the case of the first option the distribution of revenues will be governed by internal agreements among partners. Alternatively, in the case of the individual offer, owners can make an individual sale of their service, solution, appliance or product and earn all the profit for themselves. In the specific case, where a single component is owned by two or more partners, once again the revenues will be distributed according to the internal agreements among partners.

By offering the integrated suite of SiEUGreen outputs we can achieve not only to promote the market interests of the consortium, but also to enhance individual partner positioning in the market. Potential customers will be able to purchase the entire suite of outputs, some of them, or even a single output offered under the SiEUGreen commercial package of services/solutions/products.

Table 5 below includes all the commercial and potentially commercial SiEUGreen outputs until the current stage of the project.

[3] Further details on individual exploitation and partners can be found in the ANNEX III – SiEUGreen Partners & Individual Exploitation .

Table 5 SiEUGreen commercial & potentially commercial outputs

Output	Short description	Partner leading	Partners participating	Potential Customers	Exploitation
GREENERGY	The GREENERGY concept (including GREENergy monitoring system) builds upon the development and demonstration of the integrated waste and waste water treatment system applied within the Norway and (partially) Changsha case.	NMBU	NIBIO, HHEPSTI, ScanWater	• Green building developers • Public authorities/city planners • UF companies & practitioners • SMEs	Commercial
Aquaponic system (Beijing showcase)	The business model is for the promotion of a high-efficiency aquaponic system for the integrated ecological fish-vegetable production with zero pollution and zero emissions in water shortage area or around the big city.	BAEISU	CAAS	• Researchers/students • Citizens/Residents • SMEs • Local restaurants	Potentially commercial
UA model to empower disadvantaged communities (Hatay showcase)	Business model for empowering disadvantaged communities towards continuous production of fresh, local, pesticide free, organic food by using innovative UA systems and renewable energy sources.	Hatay municipality	SAMPAS	• Citizens/Residents • Refugees • Hatay women cooperative • Researchers/students • SMEs • Farmers • Public authorities	Potentially commercial
Integrated multiscale analysis framework on UA typologies	Address the needs of policymakers who lack instruments to assess benefits and drawbacks of UA for the development of cities and integrated urban planning.	NORDREGIO		• Policy makers • Public administration (municipal/regional authorities) • City planners • Researchers/students	Potentially commercial

Operational procedures – Organic composting – Urban Composting Hub	The business model values households' organic wastes to green the circular city in a sustainable way by promoting the production of organic fertilizer from anaerobic digestion of organic household waste streams. It focuses at creating a composting hub, where residents can provide their organic waste and obtain locally produced compost.	IGZ		• Citizens/Residents • Home gardeners • UA practitioners	Potentially commercial

Operational procedures – Nitrification of liquid waste streams	The business model involves the treatment of source-separate urine and further processing to liquid fertilizer product for commercial applications. A traditional but modern, local, high quality, hygienic, quick-release recycling fertilizer from yellow waste water.	IGZ/NIBIO/NMBU		• Small/home food producers
				  ○ Home gardeners
				  ○ UA practitioners (individuals; community & allotment gardens)
				  ○ Citizens/Residents
				• Large/non-food producers
				• Flower companies
				• Public authorities/ Municipality (urban green space, Landscape and park maintenance)
				• Local/ /Rural Farmers & Gardeners
					Commercial

Product/Appliance - Fruit & Vegetable Planter	The business model is tailored to the continued development of balcony vegetable /mushroom /succulent planting equipment that allows urban residents to eat their own organic vegetables and reduce - in part - the demand for market supply.	PHOTON		• Citizens/Residents	Commercial
Product/appliance - Garbage Processor	The business model describes reduction of household kitchen waste and production of organic fertilizer, which can be used by urban	PHOTON		• Citizens/Residents • SMEs	Commercial

	residents to grow healthy, green organic vegetables.				
Product/appliance – Paper based microgreen production	The business model is for Beijing Green Valley Sprouts that involves residents in growing vegetables at home and selling them to the company, which processes these vegetables into soap, nutritious food and other products and sells them to the market.	BGVS		• Citizens/Residents • SMEs	Commercial
Software/Biomass estimation app	Machine learning based application for the evaluation of biomass development in lettuce (tomato) production.	NIBIO		• Private sector • Researchers	Potentially commercial
Software/COMMURBAN	Mobile application aiming to promote urban and peri-urban eco-friendly farming techniques and strengthen EU-China collaboration.	DRAXIS	OKYS	• Public Authorities • UA practitioners • Citizens/Residents • SMEs	Commercial
Policy Recommendation and Scenarios for the future of Urban Agriculture	Consulting public entities mainly local and regional authorities to develop or expand an UF policy and support companies to initiate or develop products, services for this market i.e. hydroponics, aeroponics in urban areas.	EMETRIS		• Public authorities • Private developers	Potentially commercial
Showcase deployment concepts and results	Consulting service for smart cities to apply the SiEUGreen Sino European deployment methodology of the showcases.	ViLabs	NMBU, AAKS, HATAY, HHEPSTI, CAAS	• Public authorities • SMEs	Potentially commercial

Note: *Please note that for the outputs with * there is also α non-commercial or scientific exploitation plan (see* Table 6*).*

SiEUGreen commercially exploitable components/outputs

On the basis of partners' interest in exploiting commercially outcomes of the SiEUGreen project, the current section presents the initial innovative business ideas that have been so far conceived and being incorporated into potential business models. These ideas are an outcome of the dedicated Business Models workshop (see Section 3.3), organized to support and mentor partners in to the conceptualization and elaboration of their ideas in to business models, aiming at both commercial and noncommercial exploitation.

As mentioned in Section 3.3, some of the business ideas have been more elaborated than others and below we present the ones that are the most incorporated. However, the business models developed currently and any additional can be further elaborated in the upcoming period of the project and will be the basis for the development of the relevant business plan (*D5.5 Business plans* – M46).

The GREENergy concept

GREENergy is a smart, green concept for integrated water and sanitation, storm water management, energy supply and nutrient management in cities based on the principle of resource recovery and safe reuse. It aims to increase resilience of cities, make urban development more climate, environment and human-friendly with near zero emissions, circular economy, low climate and water footprints.

Elaborated in building infrastructures, GREENergy (see Figure 6) will reduce water consumption, by using water saving fixtures as vacuum toilets, and reuse greywater sources, facilitating recycling of nutrients to urban and peri UA and thus, almost eliminate pollution of surface water. Integrated with biogas reactor, will allow biogas production from toilet waste (blackwater) and organic household waste, delivering heat and power but also nutrient retentate to support greenhouse food production.

The innovative element of GREENergy is the well balanced combination of technical and social innovations that facilitates 1) reduced water consumption, 2) the minimization of greenhouse gas emissions, 3) the promotion of reusing CO_2 and waste-based nutrients in local greenhouses, 4) the production of biogas/energy from domestic organic waste, 5) the

production of fertilizers from domestic organic waste and 6) the promotion of ecological sanitation.

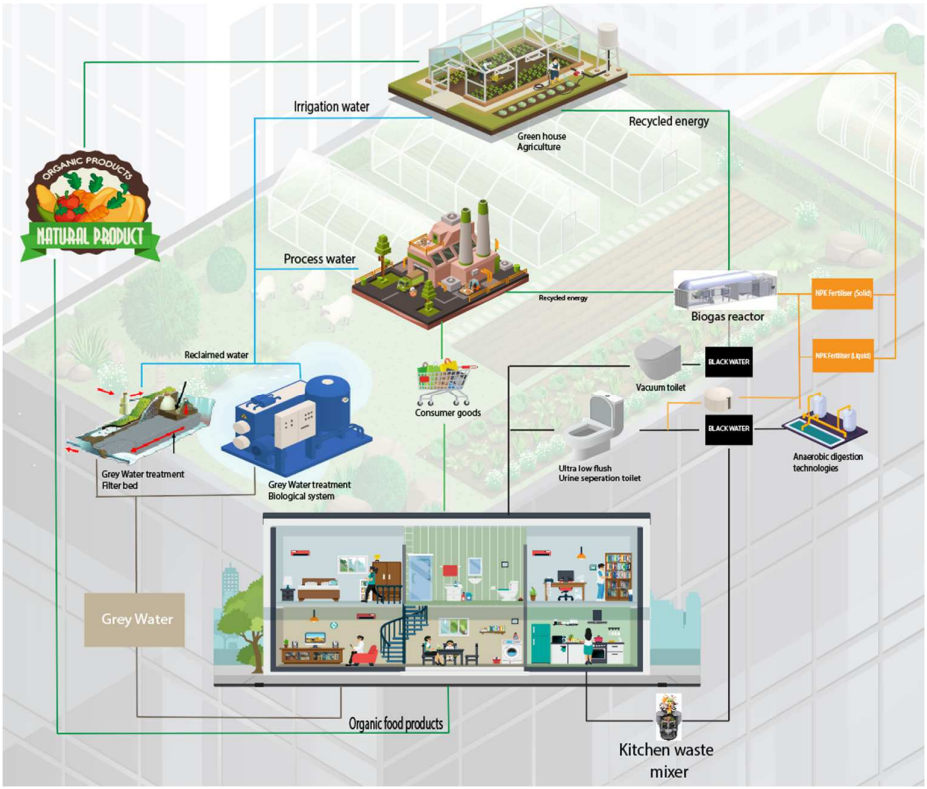


Figure 6 The GREENERGY concept

The business idea for GREENergy is primarily the provision of services for the development of fully operated waste and waste water decentralized systems for green, sustainable residential urban areas. The GREENergy concept is elaborated by ScanWater, HHPESTI, NIBIO, NMBU on the basis of the project showcases in Norway and Changsha.

The services include the processing engineering design and components sourcing, as well as consulting services to municipalities, city planners/developers, architects and engineers, real estate agencies. Moreover, the GREENergy system will be supported by an integrated monitoring application (developed by ScanWater), a user friendly interface that will allow for constant and overall monitoring of the system operations. The modular approach of the GREENergy supports and further new business ideas related to the reuse of waste and waste water resources for the development of fertilizers (idea elaborated under below-Nitrification of liquid streams).

The development in of GREENergy in Norway has already caught the interest of several developers and consultants, and they have approached NMBU for discussion of new potential projects using the GREENergy concept. This indicates that the innovative GREENergy concept has a commercialization potential in Norway and beyond.

Moreover, in rural China centralized wastewater treatment systems are rare. At the same time China's regulations demand any wastewater to be treated before disposal. This is seen as a great opportunity for HHEPSTI to commercially exploit the GREENergy concept as an integrated decentralized waste and wastewater treatment system in China. The R&D team of the company will capitalize on the knowledge and experience gained within the research performed regarding the GREENergy concept, and will further continue the development of the wastewater system.

Aquaponic system (Beijing showcase)

The high-efficiency aquaponic system is developed in the Beijing showcase at Sanyuan common Farm. This showcase is led by Chinese Academy of Agricultural Sciences (CAAS) and Beijing Eco-Creative Agricultural Service Alliance (BAEISU).

BAEISU aims to exploit the aquaponics system of the Beijing showcase as:

- Attraction sight for visitors as the system is quite new for most people in China. The farm already offers the opportunity for tourists to "pick" the food cultivated in the site.
- Industry production plant which primarily provide fresh vegetables and fish to the local restaurants. Due to the regional regulations against river and lakes pollution, fish farming is not allowed in the region, and aquaponics could be considered for commercial fish production. For this partners have launched new efficient aquaponics system for mass production of fish and vegetables (Pinggu showcase).

The full business idea, model and plan will be part of the *D5.5 Business plan.*

UA model to empower disadvantaged communities (Hatay showcase)

Most of UA systems/practices throughout Turkey are still quite new and at very early stage or being developed only for research purposes. Thus there are not yet largely conceived business models for such system commercialization in Turkey. Hatay Municipality and

SAMPAS leading the Hatay showcase aim to make use of innovative UA systems, coupled with renewable energy sources, to empower the disadvantaged communities towards continuous production of local organic food and support continuous training and knowledge structures for UA. This will be achieved by building on the current and local conditions related to the employment, social integration and the potential of UA innovations:

- Refugees are mostly unemployed and in the need of a job and require an opportunity to receive training on how to operate a greenhouse and receive investment;
- Women are excluded from the workforce and look for an opportunity to become part of it;
- Farmers and investors are looking for new agricultural systems and technologies to adopt. They need a space for practicing opportunities and access to technical information;
- The local community needs fresh, local, pesticide free, organic food;
- University researchers and students need access and practice into innovative UA systems.

The above realizations are setting the basis of the Hatay showcase infrastructure to be a production, training, knowledge and demonstration center that will allow different target groups and stakeholders consider and incorporate innovative and socially inclusive UA solutions and practices. Therefore, the main objective/values are to:

- Empower the community (including disadvantaged groups) in engaging UA activities supporting ecological methods;
- Be a center of continuous production of local organic food;
- Use and demonstrate clean renewable energy to minimize the use of resources in the progress of the agricultural production

To facilitate the objectives, Hatay plans to work together with different key partners such as local NGOs (Woman Cooperation, Syrian Social Groups Association), Universities, Local Communities (Including Refugees), SMEs, investors, the Chamber of Agriculture and other SiEUGreen partners.

Capitalizing on the showcase infrastructure the municipality will create trainings on greenhouse production methods primarily focusing on refugees and women of the local community, to empower their potential in to the local and regional workforce. The produce will be provided at local store creating a local and short supply chain for fresh, local, pesticide free, organic food.

Additionally, the infrastructure and technological equipment regarding the aquaponic and hydroponic production lines, will be used as demonstration sites for investors and SMEs that would be interested in new UA oriented production methods. Moreover, the greenhouse infrastructure will provide access and enable to university students and researchers.

Integrated multiscale analysis framework on UA typologies

Policy makers lack instruments to assess the benefits and drawbacks of UA for the development of cities. NORDREGIO leading WP1 has developed a typology based on the variety of UA initiatives implemented in Aarhus that can help to address this issue. More than 250 UA initiatives flourish across the urban landscape of Aarhus. These initiatives are assembled by different groups of people, for different purposes and have different impacts in the city.

Through the mapping and classification into six types of UA initiatives the typology analysis framework offers an alternative on how UA can be acknowledged as a strategy for long-term planning rather than a transitory activity that takes place in urban environments.

UA is multifunctional (e.g. social, ecological) and multi-purpose (e.g. recreation, self-supply, profit) practice that involves different actors and implies on a variety of development options. UA can have a great impact on other domains of the urban system such as urban food supply system and sustainable urban development. Typologies have been found to be a useful tool to deal with this complexity. They provide a means to unpack the different dimensions of UA, reducing the complexity and diversity of cases into a smaller number of more intelligible types. This is appreciated by policymakers as it reduces the variety of empirical evidence and facilitates the design of policy recommendations.

The typology enables planners and policy makers to understand the different types of UA in terms of location (intra-urban and peri-urban); governance (the different actors that

manage the UA initiatives); land ownership (private or public) and the technology that is employed to grow food (e.g. pallets, greenhouses). The way in which these elements are combined turns out into different outcomes that can help to achieve particular planning goals such as strengthen the green infrastructure and increase the biodiversity of the city, improve people' health, contribute to social inclusion, lessen costs with the maintenance of public areas, boost the local economy through the consumption of local products, providing recreational services.

Up to know (and to our knowledge) there is no instrument that allows neither discussing what are the benefits of UA for urban planning, nor the impacts of urban planning in UA. This typology is the first step to systematize this knowledge and can turn out into a useful tool for decision making, urban planning and development as well as to consulting public authorities and private developers.

Urban Composting Hub

Currently, urban citizens and the community of urban gardeners lack access to affordable, locally produced, high-quality compost or soil amendment, which are needed to accomplish a sustainable form of UA, based on regional nutrient and carbon cycling. In addition, urban gardeners who have access to organic waste, like green cuttings from their gardens or balconies and kitchen waste, often lack appropriate skills, tools, time, space or mix of materials to produce high quality compost as soil amendments and fertilizers. Thus, there is a need to locally produce substrates for urban gardening and for closing urban cycles.

The Urban Composting Hub can address this problem as it creates a collective local nutrient cycling system for valorizing urban organic wastes as precious and locally available source of plant nutrition for urban gardeners engaged in modern food & flower cultivation.

The business model is based on a non-commercial community-based approach and involves the local de-centralized collection of source-separated organic waste for professional composting. Designed as a product-service-system, the "urban composting hub" offers composting as a service and compost as a product: urban green waste and organic household waste is collected from its place of origin, transformed into high quality compost by thermophilic composting operated in a professional mode, and ultimately returned to the gardeners or community. A locally produced, sustainable, hygienically safe, high-quality

always available and affordable compost or soil amendment will be produced and can be applied in urban food production and local nutrient cycling.

The idea is being elaborated by IGZ for a community garden in the area of Frohnau in Berlin, where local farming for residents and nearby schools, kindergarten and retirement homes is supposed to take place. The aim is to transform a former mono-culture maize field into a green urban space for community gardening, education, meeting and gathering. It is currently under discussion, to implement such composting hub at this place. The local community can then bring their organic wastes from kitchens, balconies or gardens to the composting hub; likewise, pick-up service can be used. We turn the waste into value and then offer quality-assured compost as a fertilizer for the community garden and potentially as a commercialized product.

The potential for replicability of this structure is being considered for the showcase of Aarhus and as a business model will be investigated within other municipalities too.

Nitrification of liquid streams

Today's pressing environmental problems are associated with linear nutrient flows from rural agri-food production sites to human settlements. These open loops can be closed by using innovative, safe and resource-efficient technologies to recover essential plant nutrients from urban waste water promoting a circular economy. Therefore, urine is an important resource for "urban mining", containing 80% of the nutrients in urban waste water, in a volumetric share of only 1%. Source-separation of human urine thus provides direct access to a sustainable nutrient resource and can effectively capture nutrients. After processing, urine-based recycling fertilizers can be used as an alternative to synthetically produced mineral fertilizer in plant production.

The nitrification of liquid streams is developed by SiEUGreen partners (IGZ/NIBIO/NMBU) in order to recycle and upgrade nutrients from urban waste water for green cities and modern plant production. The business model involves the collection and treatment of source-separate urine to process this resource to a commercial liquid recycling fertilizer product. The processing unit operates at small and medium scale alike, which allows for decentralized production of fertilizers wherever needed and adapted to the prosumers need. For small food producer, e.g. home gardeners, urban community gardens or

community supported agriculture, “a traditional but modern, local, hygienic, high quality recycling fertilizer from urine, available in 1 l bottles to 20 l containers” is considered to be provided. For large food & non-food producers, such as farmers, gardeners, park & green maintenance, or flower companies, “a novel, locally produced, high quality, hygienic, adaptable, quick-release Nitrogen – Phosphorus – Potassium (NPK) recycling fertilizer from urine, available from 25litres containers to 1000litres Intermediate Bulk Containers (IBC)” is considered to be offered.

Under this business idea, SiEUGreen partners have considered 3 different approaches, applying to the necessary infrastructure for the processing of the waste streams. The GREENergy concept is one of these structures, offering a modular waste and wastewater treatment/processing system is considered to be used for the necessary infrastructure of the processing unit, while IGZ has considered the use of other existing infrastructure available in the market. Additionally, NIBIO is investigating on a smaller scale infrastructure that can be used locally (household scale). All three are being considered for its potential to be commercially exploited and updated business models and plans will be structured. Draft business canvases are provided for the first two approaches in ANNEX II – Draft Business Canvases.

Fruit and Vegetable Planter

The Fruit & Vegetable planter business idea is conceived by PHOTON. The product has been developed and the company aims to the commercially exploit. Within the SiEUGreen the product is provided to the Chinese showcases supporting the infrastructure of home/balcony vegetables production.

PHOTON aims to leverage participation in the SiEUGreen and the outcomes of the Chinese showcases to enhance its research and development department but also expand its presence in the Chinese market. The full business idea, model and plan will be part of the *D5.5 Business plan.*

Garbage Processor

The Garbage Processor business idea is conceived by PHOTON. The product has been developed and the company aims to the commercially exploit. Within the SiEUGreen is

provided to the Chinese showcases supporting the composting processes household organic waste and produce compost. The full business idea, model and plan will be part of the *D5.5 Business plan.*

Biomass Estimation app

The land resources for agriculture has been decreasing, as more rural areas are urbanized to accommodate industrial needs. UA is one of the growing food security solutions as the global population and urbanization rapidly increase. UA is defined as the production, process and distribution of food produced in cities for local needs. However, for successful yield crops intensive monitoring, control and automation are necessary. An efficient way of implementing this is the utilization of vision systems and machine learning algorithms to optimize the capabilities of farming techniques.

As crop growth monitoring are heavily dependent on subjective human judgment the monitoring and control are prone to inaccuracy. A machine vision system implemented helps "see" the crops and analyze numerous essential elements in crop growth effectively. The use of machine visions to acquire data from a smart agricultural setup is evidently capable of increasing the efficiency of food production. This method can extract all the features that the human eye hardly visualizes. The extracted features from the image processed are then used for developing models from the processed dataset through an algorithm. The developed models are utilized for further monitoring, analysis, and control. Such an app is developed by SiEUGreen partner NIBIO.

Although the Biomass Estimation app has been identified by partners as potentially commercial output of the project, there has been yet no commercial plan for this outcome.

Paper based microgreens production

The paper based microgreens business idea is conceived by Beijing Green Valley Sprouts (BGVS). BGVS is the inventor of the paper-based plant growing technique and within SiEUGreen is the provider of knowledge and material for the research activities performed under WP2 (resulted in improvement of the technique and use of recycled paper instead of regular).

Utilizing the successful product validation as performed within WP2 and the SiEUGreen showcases (in China and Norway) BGVS wants to capitalize on its partnership by exploiting the outcomes of the showcase demonstration in order to further expand its presence in the Chinese market but also to explore and evaluate a market entry in Europe for the cultivation devices and paper-based sprouting microgreens production.

The full business idea, model and plan will be part of the *D5.5 Business plan.*

COMMURBAN

Even though the idea of COMMURBAN is to act as a tool for the engagement of citizens, in the framework of the research and the interaction with the stakeholders and the users, DRAXIS identified a number of opportunities and ideas that are considered to be further explored and exploited.

A clear cut commercial exploitation strategy for COMMURBAN application is to attract the interest of public authorities since they could customize the application and use it to engage citizens in various UF projects, create a sense of community in their region and promote various eco-friendly UA activities. But there are also other exploitation pathways:

- Due to the extended self-quarantine periods of COVID-19 population is experiencing stress and anguish to some extent. UF is a domain that can offer a powerful response to the effects of COVID-19 on the economy and social depression. The COVID-19 lockdown gave many citizens the incentive to grow their own fruits and vegetables leading to a boom in UF and new opportunities for COMMURBAN, such as the care farming and for improving citizens' mental health.[4] COMMURBAN as a unique tool for health organizations, and other public and private initiatives.

[4] Care farming is a method that uses agricultural practices to provide social, or educational care services to socially excluded people, people with disabilities and vulnerable groups of people. Care farming facilitates public interaction with the natural environment. It can also be therapeutic because it can address a range of public health and service provision issues by engaging people in farming activities and improving their health, social and educational circumstances (Hemingway et al., 2016).

- In the Hatay showcase the municipality plans to promote the use of COMMURBAN app as the main platform for the communication and knowledge sharing of UA enthusiasts and communities.
- COMMURBAN can become an UF Incubator and create value for all its stakeholders, providing users with access to a number of UF techniques, resources, tools, training material and consultancy on urban cultivation methods. In order to do that, a well-structured marketplace that will serve as a meeting point for urban farmers, companies that sell farming tools, seeds, raw material, etc. and local groceries is the main feature that should be added to the application.

Additionally, the whole process of designing and developing the COMMURBAN application was a valuable experience for DRAXIS. DRAXIS team put a lot of effort into the design of the User Experience and User Interface (UX/UI) and gained important knowledge from the procedure. COMMURBAN was designed based on a User Centered Design (UCD) approach; an interactive design process that focuses on the users and their needs in each phase of the design. DRAXIS will further capitalize on the experience gained by COMMURBAN and in collaboration with an independent, non-profit educational institution located in Greece will design an interactive platform aiming to raise children's awareness on the benefits of healthy food choices. The platform will promote the experiential learning and encourage groups of children from schools, environmental groups, neighborhoods, even individual children, to develop a small-scale farming projects in school yards, home yards, or other urban areas and upload them on the platform in the form of Do It Yourself (DIY) projects.

Along with DRAXIS, OKYS is interested in continuing to maintain the COMMURBAN app and the services offered. Moreover, OKYS will promote the app and the overall SiEUGreen IT services to urban agriculture initiatives that currently do not have digital environment for their processes.

Finally, SAMPAS aims to support and encourage the capitalization of the COMMURBAN App by promoting it through existing and new stakeholders in order to reach a wider local following throughout Turkey and extend its use by promoting its capabilities as a tool for the engagement of citizens, a revenue generator and an urban farming incubator etc. among different organizations and other public and private initiatives.

Scenarios for the future of Urban Agriculture and policy recommendations[5]

Scenarios for future of UA and policy recommendations developed by EMETRIS in the context of SiEUGreen can be commercially exploited as consulting services to private companies and public authorities. For example, EMETRIS plans to capitalize on the development of policy briefs to support policy structuring for their public customers as well as to develop tools and training material for both private and public institutions. EMETRIS will also add in its service portfolio several new planning and policies aspects like UF, new business models etc. and increase its ability to understand and support private and public investments in this quite new and risky field.

Showcase deployment concepts and results[5]

Showcase deployment concepts and results developed by SiEUGreen partners (NMBU, BAEISU, CAAS, Hengkai, ScanWater, Hatay Municipality, SAMPAS, ViLabs) can be commercially exploited by introducing the deployment methodology to several stakeholders (i.e., municipalities, cities, public authorities, private developers) as consulting services. For example, ViLabs is willing to exploit the SiEUGreen results related to the showcase deployment, including the public deliverables about the deployment instructions, concepts and results, aiming to:

- commercialize the new consulting services to offer in future European funded projects. Such competitive services will support communities to effectively adopt Si-EU technologies for urban agriculture, offering them a successful mature methodology and training;
- make use of the findings in future projects, and use the SiEUGreen reports as a basis when working on new approaches and energy efficiency offerings.
- prepare promotional material and fact sheet applicable to ViLab's role in the project and indicating expertise in the field;

[5] Please note that these outputs have also a non-commercial and/or scientific exploitation plan (see Table 6).

The methodology and best practices related to the showcase deployment are part of the public deliverables of WP3 on the deployment instructions, showcase concepts and assessment results. Such project results have joined ownership with the Agency Research Executive Agency (REA) as it is defined in the Article 26, Ownership of results of the Grand Agreement with number 774233.

4.2 Non-Commercial Exploitation

The non-commercial exploitation can take the form of public policy consulting and advise to policymakers regarding UA and its socioeconomic impacts (see Table 6). Similarly, to the commercial exploitation, outputs can be exploited both on individual and/or consortium level. Lessons learnt from the deployment of the showcase and the knowledge gained within the project, can be used to advice public authorities on issues related to UA and resilient-green cities. For instance, policy recommendations concerning how to achieve social engagement through UA activities or advises on how to design an optimal urban planning in order to activate the unused spaces of municipalities/cities for urban farming and encourage the community-based UA initiatives. SiEUGreen demonstrations in Hatay and Aarhus constitute good example of how UA can be used by policymakers in order to empower disadvantaged members of society and transform the urban planning of a municipality to facilitate UA activities.

Moreover, non-commercial exploitation can be directed to establish and complement SiEUGreen's commercial exploitation. For example, consulting activities in a form of policy recommendations and advise to public authorities (urban planning departments, municipalities, etc.) can be planned with the aim to refine the current SiEUGreen ecosystem and accelerate its commercial acceptance.

4.3 Scientific Exploitation

As derived by Table 2 some of the SiEUGreen outputs are research-oriented, meaning that partners do not envision to exploit these outputs in any other way than scientific (see Table 6). Publishing the project results in scientific journals and making the created knowledge publically accessible can foster further scientific research and potentially enable future

innovation in UA. Therefore, the research exploitation will aim to promote the growth of a vital community which can use, enhance and further develop the SiEUGreen outcomes. Empowering such a community can be also seen as an investment into sustainable use of SiEUGreen achievements in the future.

Moreover, research exploitation and dissemination of scientific results can play a complementary role to the commercial exploitation of SiEUGreen outputs. For example, by providing scientific evidence and enabling other researchers to examine the benefits of UA in terms of social engagement, resource-saving, public health, and circular economy in general, we wider the range of people interested in implementing the suggested solutions, technologies, social methods, etc., proposed by SiEUGreen.

The different knowledge outcomes of the project will be disseminated through various scientific publications in peer-reviewed international high-impact journals, conference presentations, workshops, videos and through the press. Publication and dissemination of research results is expected to be delivered under the WP6.

In Table 6 below we include both on-commercial and scientific exploitation for outputs derived within the SiEUGreen project.

Table 6 Non-Commercial and Scientific Exploitation

Output	Partner(s)	Non-Commercial & Scientific Exploitation
Primary and secondary data selected within the project activities	NIBIO, NMBU, Nordregio, ViLabs, CAAS, IGZ, Emetris, SEECON, DRAXIS, OKYS	- Use data to improve software applications used in showcases (i.e., COMMURBAN, Biomass estimation app). - Use data for research purposes and further development of technologies and concepts tested in the showcases. - Publish findings in a form of data to generate further scientific research. - Use data to draft reports and generate policy advises as well as consulting concepts for policymakers, public authorities, etc.
Showcase deployment concepts and results	NMBU, BAEISU, CAAS, HHEPSTI, ScanWater, Hatay, SAMPAS, ViLabs.	- Scientific exploitation through publication of results and knowledge created regarding showcase deployment for future research activities and apply the findings in studies and projects related to UA. - CAAS aims at exploiting scientifically the research and technology related outcomes to further support its scientific and educational activities within the sectors of crop production, composting and innovative production technologies, as well as capitalizing on the SiEUGreen outcomes to initiate further research (via national and international funds and collaborations). - SAMPAS foresee to establish a long-term management organization together with the Hatay Metropolitan Municipality. Consequently, SAMPAS aims to exploit the created management model through other stakeholders working on similar projects. - HHEPSTI is aiming to exploit the knowledge and outcomes of the research and demonstration activity regarding the deployment of the Changsha showcase. The R&D team of HHEPSTI will continue its research activity on the struvite precipitation and its conversion to products for soil conditioning and slow release ecological fertilizer.

Guidelines for the application of human waste based fertilizers	IGZ	- Scientific and policy exploitation of guidelines for UA practitioners for the use of human waste based fertilizers. This can potentially generate policy or regulation change or change in the perception of people regarding fertilizers that are derived from human waste.
Scenarios for the future of Urban Agriculture	EMETRIS	- Scientific exploitation through publication of the results of the study performed under *T5.4-Scenarios for the future of UA*. Consortium can use this study for future research and to consult public authorities and private entities.
Methodology and calculator of socio-economic and environmental impacts of urban farming	NORDREGIO, Aarhus Kommune, Hatay Municipality	- Contribution to the academic debate on the role of UA for resilient cities through publication of a few scientific articles and scientific exploitation of the results from the integrated multiscale analysis framework and methodologies developed under WP1. NORDREGIO has already published an article and it is expected to publish at least one more scientific paper.[6] - Develop frameworks that can help estimate the pros and cons of UA. *D1.2-Baseline study including key indicators and development of a typology* and *D1.3-Guidelines for a new interactive impact assessment approaches* are likely to provide a robust basis for further development of tools that can be used by planners and decision-makers in different urban contexts.
Policy recommendations	EMETRIS	- Public policy exploitation of the results derived from the implementation of integrated multiscale analysis framework used in the showcases of Hatay and Aarhus. Exploitation of the results in a form of policy-oriented publications or policy reports.
Evaluation of the use of urine-based recycling	IGZ	- Research exploitation of the operational procedure to use fertilizer that is based on human waste (i.e. urine) in soil-based or hydroponic production system.

[6] Borges, L. A.; Hammami, F.; Wangel, J. (2020): Reviewing Neighborhood Sustainability Assessment Tools through Critical Heritage Studies. Sustainability, 2020, 12(4), 1605; https://doi.org/10.3390/su12041605.

fertilizers in soil-based and hydroponic horticultural production systems		- The results of the experiments with recycling fertilizers, including a urine-based liquid fertilizer and fecal compost, are going to be published in three scientific articles (one already accepted and in revision process; the other two to be submitted in 2020). - Relevant data from IGZ and other SiEUGreen partners on the various plant experiments dealing with recycling fertilizers can be compiled to a publication in "Nature Food". The article is expected to focus on comparing and systematically evaluating different approaches to utilize urban producing urban fertilizers.
Paper based crop cultivation techniques using recycled paper	NIBIO, BGVS	- Exploit the scientific outcomes from the bilateral collaboration with China through publication and development of production protocol for the innovative use of recycled paper in microgreen production.
Blue and Green Technologies	NMBU, NIBIO	- Partners plan to exploit the research outcomes regarding the blue technology e.g. waste water management and purification, in to further research activities and to continue the research activity on the social science aspects. This links to the results regarding *T2.3 Cultural adaptation of technology in circular economy*, that will be used to understand the user acceptance of utilizing human waste based fertilizers in to food production. - Moreover, with a focus on the hydroponics based vegetable production, NIBIO is planning to capitalize on the current research activity and continue the scientific investigation on the use of plant nutrients derived from organic wastes e.g. kitchen waste and agriculture waste. This is formulated in to a new research proposal that will allow further the investigation of the potential, advantages and hurdles of organic waste based plant nutrients in to hydroponic production systems.

4.4 Showcase exploitation plan

The exploitation plan for the showcases is quite straightforward. Showcases will be exploited to promote and disseminate SiEUGreen's exploitable outputs (i.e., commercial, non-commercial and scientific). The five showcases of the SiEUGreen project, i.e. Norway, Aarhus, Hatay, Beijing and Changsha, are being developed as different use cases in terms of technology and concepts implemented, and therefore consider different exploitation plans as described in the Table 7 below.

Table 7 Showcase Exploitation

Showcase (Leading Partner-s)	Description	Exploitation
Norway (NMBU, NIBIO)	The showcase focuses on demonstrating a proof of concept for a smart and green retrofitted building-GREENergy concept. The latter and further infrastructure will be installed and implemented in a student residence on Campus Ås.	Use this case as a living example to draw political attention to the use and re-use of household waste and water resources as well as the support for innovative concepts, including UA. Implementation of the GREENergy concept to raise awareness about circular solutions and sustainable development not only in the local dwellers and municipality but also in other municipalities and potentially at the national level. Dissemination of showcase's knowledge outcomes through scientific publications conference presentations, workshops in order to contribute to further socio-economic and environmental research on UA, smart and green.

Aarhus (Aarhus Kommune, NORDREGIO)	Showcase activities in World Garden and Brabrand Common Garden, allow practitioners to consider alternative crop production systems (polytunnels, mobile gardens) and solar driven toilet (to demonstrate the potential benefits of composting) around the city. This is aimed to enhance the citizens' involvement in UA activities and to promote consumption of food produced within the city.	Capitalizing on the SiEUGreen outcomes (i.e., multiscale analysis framework), the Municipality of Aarhus aims to: • Mediate the dialogue between different municipal departments and UA initiatives and practitioners in order to enhance the role of UA in the city. • Integrate different components in to the municipality's urban planning, allowing for better assessment of inactive and under-utilized public spaces in applying UA. • Change people's perceptions and potentially also local regulations (allowing the use of composted human waste for food production).
Hatay (Hatay Municipality)	The Hatay municipality aims to use the innovative technologies in order to increase local productivity via traditional and innovative greenhouse production, including aquaponic. Further they aim to educate local vulnerable communities and refugees in food production techniques. The showcase develops a business model on the basis of which the existing infrastructure of the project will be used as a hands on training center for local UA practitioners, students, and local communities with particular focus to unemployed women and refuges.	Develop a comprehensive system which will not only widen the usage of UA technologies but will also maintain its potential for replicability throughout Turkey and will further guide local authorities in to adopting and developing similar systems. Create added-value for social-economic development of local authorities and communities focusing on the involvement of various economic level citizens and disadvantaged groups. Describe a re-applicable model for local food production by UA which provides social-economic added value for different groups including refugees. Initiate a policy framework that enables disadvantaged social groups to join to the agricultural workforce by participating in urban agricultural food production.

Beijing (CAAS and BAIESU)	This showcase is taking place at Sanyuan common where urban dwellers can cultivate their plots and SiEUGreen partners practice aquaponics techniques for crop cultivation. Sanyuan farm's vision is to demonstrate resource-efficient UA and a healthy-happy life style.	Partners aim to continue their research and investigations on the technical specificities of the aquaponics system in order to explore the untapped potential of the aquaponics system and identify the most efficient and market aligned combination of vegetable and fish species production. Partners aim to capitalize on the knowledge developed within the showcase activities and continue its research and education at the Sanyuan farm. For example, the Sanyuan Farm aquaponics system (and the farm at large) will continue being used as an educational and research facility for CAAS.
Changsha (HHEPSTI)	This showcase aims at demonstrating a partial GREENergy concept, as an integrated waste and wastewater treatment system. This showcase operates as the "first of its kind" circular building and it is a demonstration site for potential clients, strategic partners and governmental bodies.	The showcase infrastructure is aimed to increase the attention of potential clients to the company's commercial activity and on also support the recognition and use of innovative decentralized wastewater treatment systems by the relevant public institutions. The building structure and the functionality of the integrated system will be used by the resear4ch and development (R&D) team of the company to continue research on circular systems, as a concept that can realize the recycling of sewage resources as well as minimizing pollution.

Note: *More detailed description of showcase exploitation is given in ANNEX IV – Showcase Exploitation.*

5 Market insights

The *D5.1-Market Analysis I* has already revealed a substantial growth for UA technologies and productions methods, led not only by the disruptive drivers of increased food demand due to urbanisation and growing population, climate change and the need for more climate adapted and low footprint production methods and supply chain, but also heavily driven by the development of new technologies. Considering also the growing public and private investment in UA, these factors appear to establish a favourable environment for the SiEUGreen outputs, given their commercialisation potential.

In addition, the recent COVID-19 pandemic put the whole agri-food sector under a high pressure clamp affecting both long and short supply chains (IPES, 2020). Production and supply chains slowed down and created shortages in the market, with growing concerns in food availability and pricing (Agritecture, 2020). The COVID-19 lockdown measures, with respect to self-quarantine and social distancing in some cases led to increased activity of home/garden food growing but also gardening (World Economic Forum, 2020), with experts considering a potentially further and lasting boost to UF. At the same time, various limitations have been identified, regarding high operational and initial investment costs, acceptance of technologies and final products but also the current institutional and regulatory framework. Public health aspects under national, European and international regulations for the use of human and other waste as input for fertilisers for food production pose limits to the commercialisation of such products.

The SiEUGreen project apart of assessing and demonstrating the quality of such final products to ensure its safe use for food production (in line with existing regulations and norms), aims at supporting policy change and investigate the perception of users and consumers, untapping the potential of human and other waste streams in to food production fertilisation products. This is considered to create a strong positioning of the relevant SiEUGreen outputs and strengthen its exploitation potential.

6 Next steps

The present *D5.4-Sustainability and Exploitation Plan* provides an overview of the so far identified project outputs and how project partners aim to exploit them, and ensure the SiEUGreen sustainability after the project termination.

Concerning sustainability partners have taken the appropriate actions in order to engage showcase participants and make the use of SiEUGreen technologies, concepts, solutions sustainable beyond the end of the project. This work continues under WP1 and *D1.6-Engagement Strategies 2* as well as through individual showcase deployment. Moreover, the publication of created knowledge within SiEUGreen constitutes another major step towards project sustainability and preservation of its results/outcomes. The reporting and dissemination of the scientific research carried out by SiEUGreen project is expected to be delivered in WP6.

Regarding the exploitation, partners have already started elaborating their business ideas/models which will be further developed and integrated with the relevant business plan in the upcoming D*5.5 Business plan* (M46). The upcoming *D5.3 Market Analysis III (M38)*, will be focused on the market aspects around the exploitable outputs that partners have considered for commercial (or potentially commercial) exploitation, helping to shape the approach towards target markets and customer segments.

As the showcase deployment activity is still ongoing, project results and activity outcomes that may arise will be further examined and considered by the consortium for exploitation.

References

- Agritecture, 2020. Six impacts of COVID-19 on agriculture. Available at: https://www.agritecture.com/blog/2020/3/23/6-impacts-of-covid-19-on-agriculture
- Hemingway A., Ellis C., and Norton E., 2016. What does care farming provide for clients? The views of care farm staff. NJAS - Wageningen Journal of Life Sciences Volume 79, December 2016, Pages 23-29. Available at: https://www.sciencedirect.com/science/article/pii/S1573521416300501
- International Panel of Experts on Sustainable Food Systems (IPES-Food), 2020. COVID-19 and the crisis in food systems: Symptoms, causes, and potential solutions. Communication by IPES-Food. Available at: http://www.ipes-food.org/_img/upload/files/COVID-19_CommuniqueEN.pdf
- REGULATION (EU) No 1290/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006
- World Economic Forum, 2020. Grow your own: UF is flourishing during the coronavirus lockdowns, 2020. Available at: https://www.weforum.org/agenda/2020/04/grow-your-own-urban-farming-flourishes-in-coronavirus-lockdowns/

ANNEX I – SiEUGreen Outputs & Exploitation questionnaire

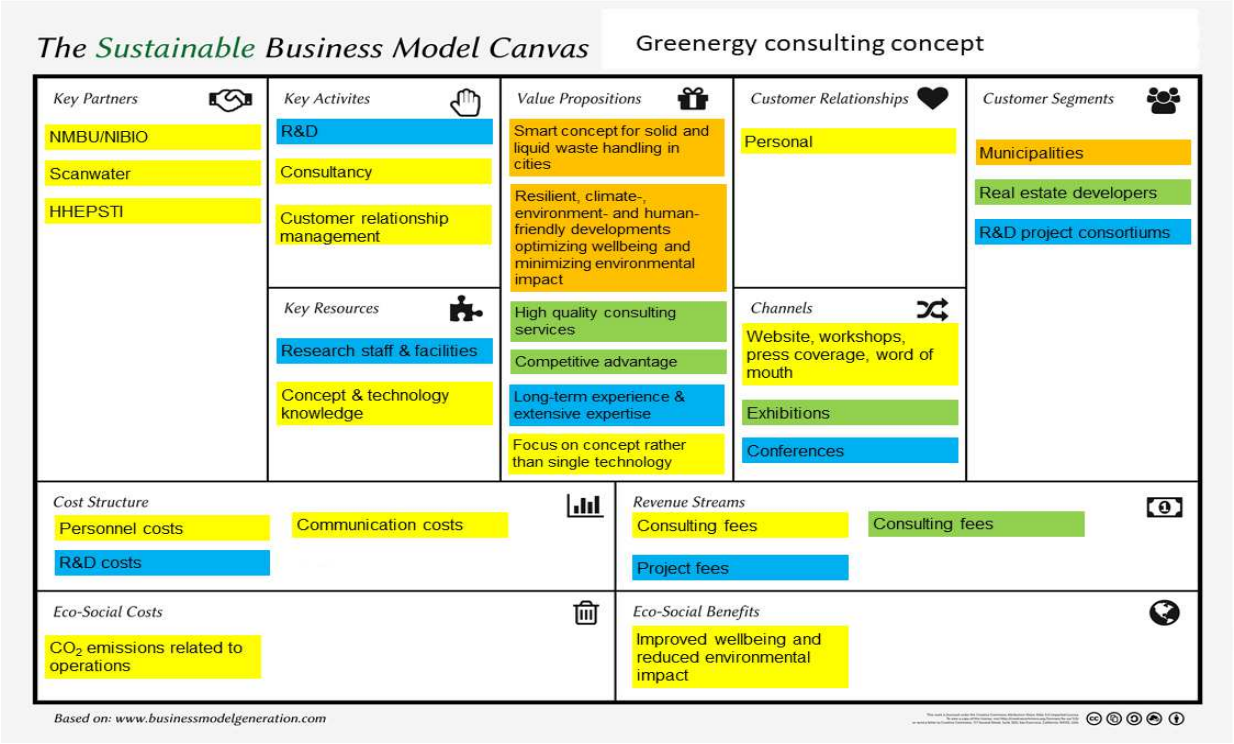
SIEUGREEN OUTPUTS & EXPLOITATION												
N	Potential Outputs	Link to: -specific Technology (ies)? - Use number from list of techologies/ - Project related activity (ies)? - Name the activity/Task Yes: Which one; No: Explain how came up	Categorisation/characterisation : - use the drop down menu for your choise - if other; describe in the next column	Other	Partner that created the outputs (leading)	Partner(s) involved (Name of the partner(s))	Intention to exploit?				
							YES (use the choise of the drop down menu)	YES (in case for more than one ways of exploitation - describe in this column)	No (put X if no intention to exploit)	Input provided by	Comments from the reporting partner

Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

ANNEX II – Draft Business Canvases

GREENergy concept



Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

Hatay showcase

The Sustainable Business Model Canvas — Hatay showcase

Key Partners
- Hatay Metropolitan Municipality
- NGOs:
  - Woman Cooperation
  - Syrian Social Groups Association
- Universities
- Local Community
- SMEs
- Investers
- Chamber of Agriculture
- Chamber of Commerce

Key Activites

Key Resources
- Smart Greenhouses and Aquaphonic System (Field of practice)
- PPP Model
- Researchers on UA and Aquaphonics (Technical Support)
- Consultants (Marketing & BM)
- Public Authorities (Policy making)
- Manifucturing companies – Energy and Aquphonic (Technical Support)
- Refugees and Local Communities (Workforce)
- Operation Management Staff

Value Propositions
- Training refugees to operate the greenhouses and make the investment ready
- Support included women to join the workforce (vegetable production) using new technology
- Access and practice into innovative urban agriculture systems
  And Internship opportunities for the University students
- Provide fresh, local, pesticide free, organic food
- Provide new technologies of aquaponics and hydroponics and offer profitable opportunities for investment

Customer Relationships

Channels

Customer Segments
- Refugees
- Women association
- University students, University researchers
- Local community
- Farmers and business investors

Cost Structure

Revenue Streams

Eco-Social Costs

High expenses of the new technology / Not many experts in the field / Lack of manifucturers for providing the complete system / High renewable energy investment costs / Lack of intermediate staff

Eco-Social Benefits

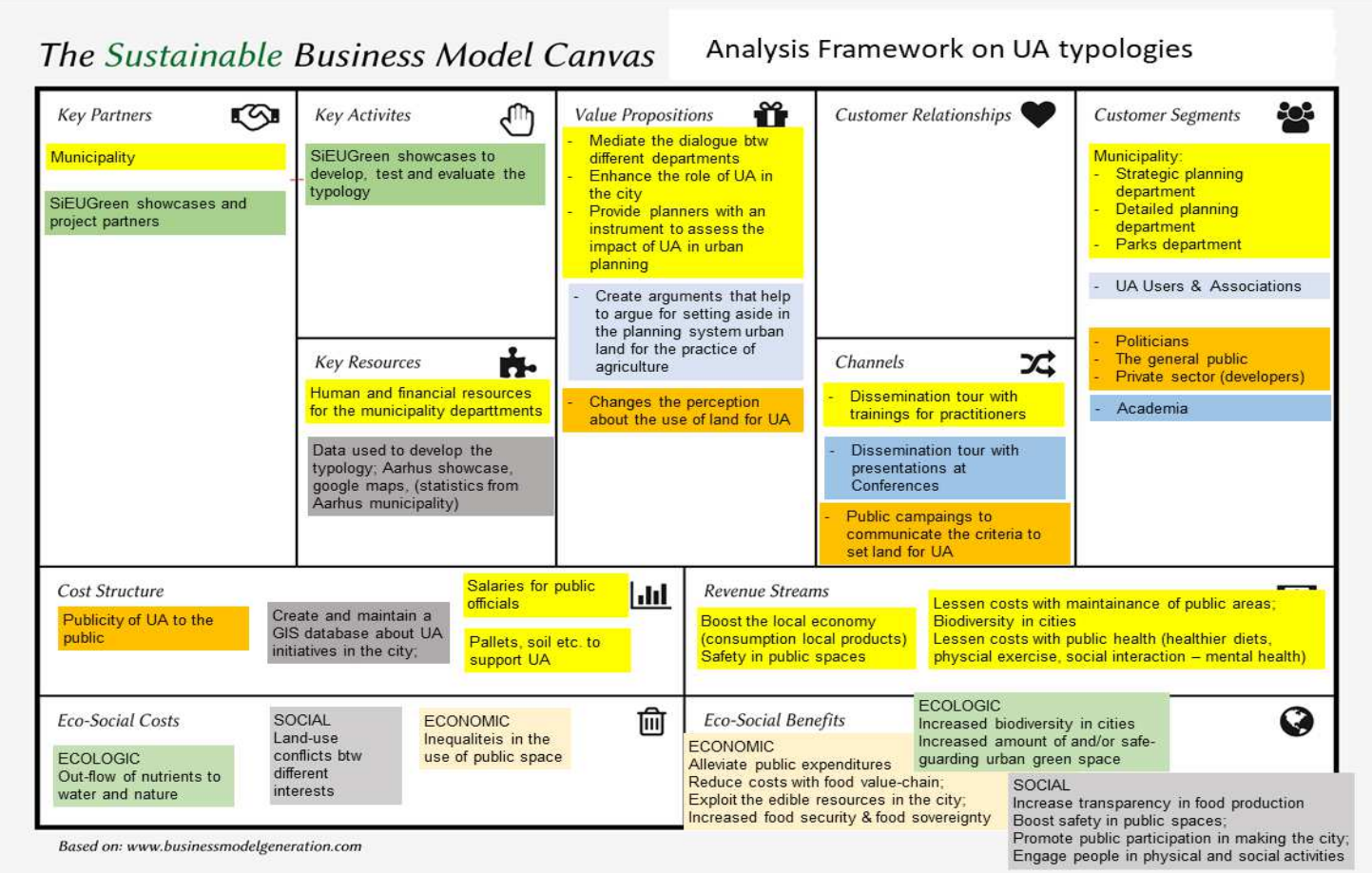
Less landuse for Agriculture Activities / Less Water Consumption (Up to %90 less) / No use of pesticides,fertilizers / Use of renewable energy sources / High quality local organic food for a low price / Woman inclusion / New employment oppotunities for disadvantaged groups (refugees etc.) / Less labor cost

Based on: www.businessmodelgeneration.com

Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

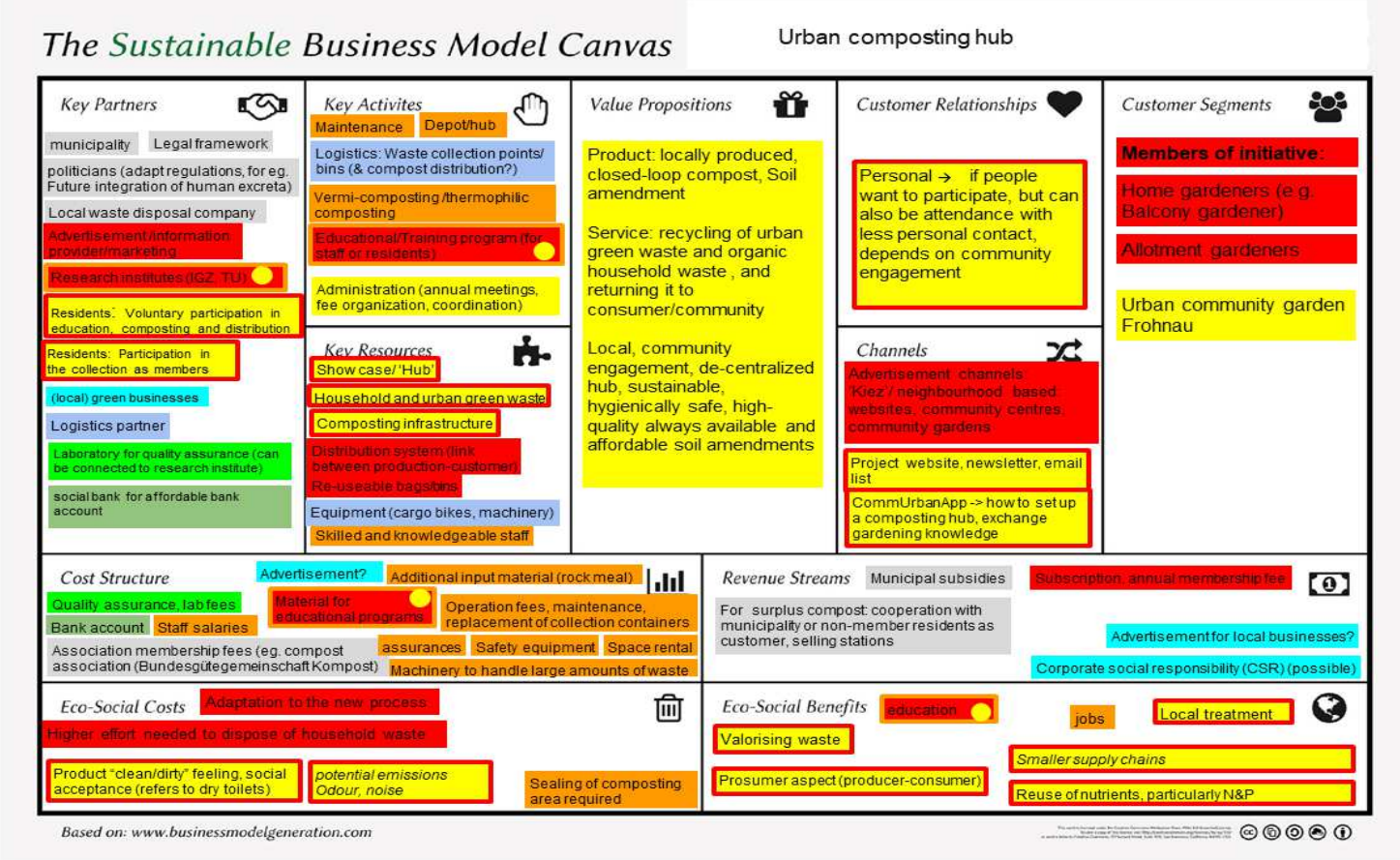
Integrated multiscale analysis framework on UA typologies



Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

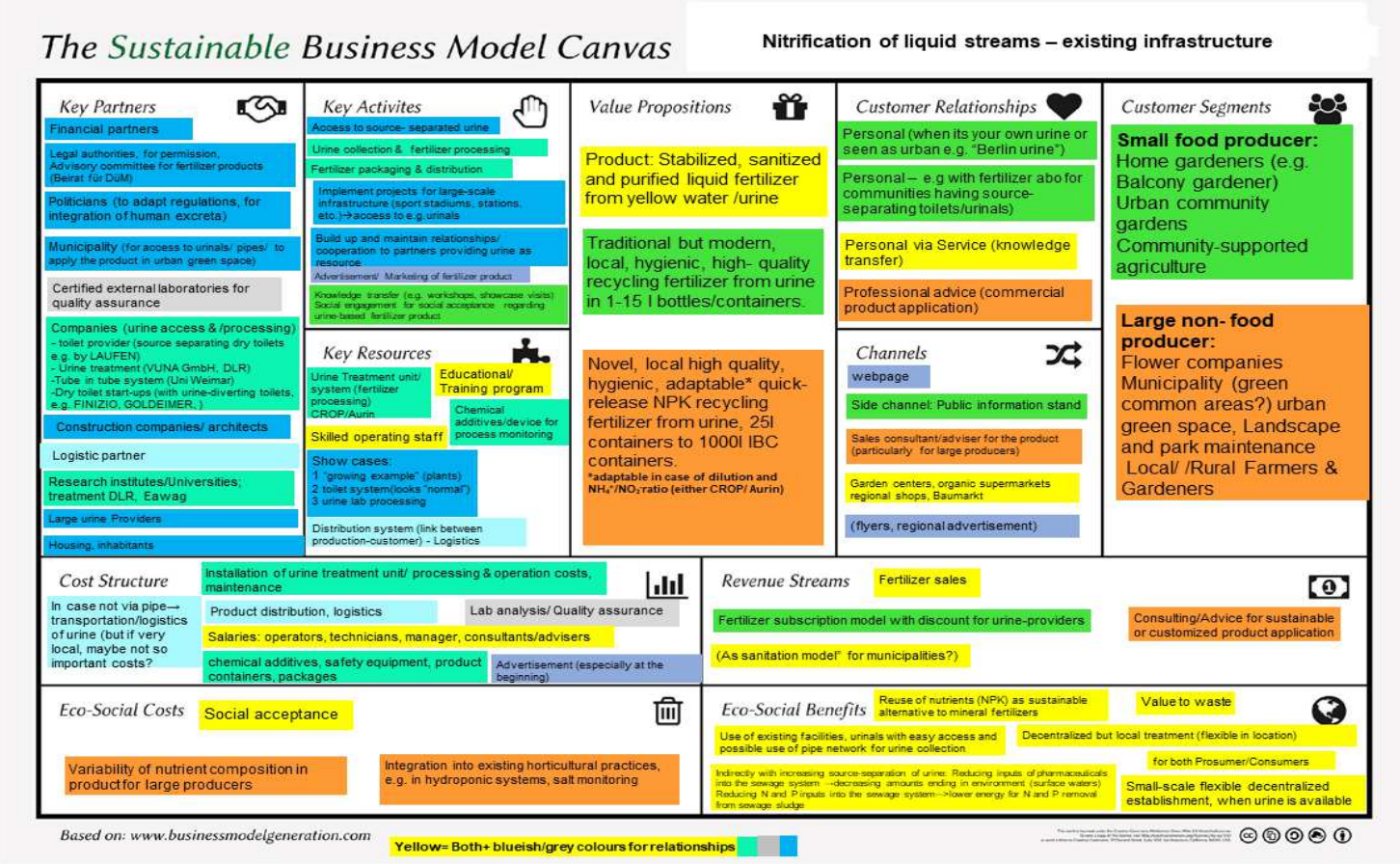
Urban Composting Hub



Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

Nitrification of liquid streams – existing infrastructure



Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

Nitrification of liquid streams – GREENergy concept

SiEUGreen

The Sustainable Business Model Canvas

Nitrification of liquid streams - Greenergy

Key Partners

Financial Partner

Legal authorities, for permission, Fertilizer inspection service

Certified external laboratories for quality assurance

Municipality

Politicians (to adapt regulations, for intergration of human excreta)

Company ((Scandwater/toilet provider (Eawag) Provider of biogas digester (Ecomotive)

Housing, inhabitants

Advertisement/information providers

Logistics (fertilizer distribution)

Research institutes (NIBIO)/University (NMBU, NORDEGIO)

Key Activites

- Installing biogas reactor & post treatment facility
- Processing/Converting the household organic waste, including human excreta and food waste, into marketable quality level product (bio-fertilizer : liquid/solid))
- Demonstrate the value of waste bio-based products
- Quality assurance test to meet the regulatory requirements,
- Pre-market assessment, registration and creating bio-based market

Key Resources

- Biogas reactor, Post-Treatment reactor (fertilizer processing)
- Organic wastes, energy input, chemicals device for process monitoring
- Skilled operating and managing staff
- Educational/Training program
- COMMURBAN app

Value Propositions

Bio-based circular economy from household organic wastes created

Provision of Safe bio-fertilizer for Local, high-quality and sustainable organic food production

Improved environment through reduction in waste generation and disposal.

Customer Relationships

- Direct interaction/Personal contacts
- Co-operation and partnering
- Provide training
- Personal assistance/community services

Channels

- Existing partners
- COMMURBAN app
- Commune/Municipalities
- Online :Social media/Websites
- Demonstration and showcase sites
- Wholesales and retails
- Education, research and training centers and
- personal contacts for creating awareness

Customer Segments

Small food producer:

Home gardeners (e.g. Balcony gardener)

Urban community gardens

Community-supported agriculture/Local food producers

Large non- food producer

Flower companies

Municipality (urban green space, Landscape and park maintenance

Local/Rural Farmers & Gardeners

Cost Structure

- Cost of equipment and infrastructure (Investment costs)
- Research and Development
- Operation and management/running costs
- Quality control, Purification and packaging costs (disinfection, nutrient quality upgrading)
- Marketing, promotion, distribution costs

Revenue Streams

- Sale of organic fertilizer
- Indirect Cost from Wastewater discharge and treatment
- Reduced cost of chemical fertilizers
- Fees from provided technology and services,

Eco-Social Costs

- Variability of nutrient composition in product (depending on input material) could affect professional usage
- Risk during operation (gas leakage, explosion) smell, pathogen contamination (Possible negative health effect)
- Product "clean/dirty" feeling, social acceptance
- Adaptation to the new product
- *Potential emissions*

Eco-Social Benefits

Reduced waste generation and waste disposal

- Reduced pollution
- Improved access to waste collection services
- Improved health and hygiene
- Local treatment, In-situ sanitation

Valorising waste

Reuse of nutrients, particularly N&P

- Reduced fertilizer cost
- Job creation

Based on: www.businessmodelgeneration.com

ANNEX III – SiEUGreen Partners & Individual Exploitation

Norwegian University of Life Sciences, NMBU

NMBU is a university focusing on education, research and innovation in environmental- and bio-sciences. Its core research activities provide a foundation for education, post educational training and policy input to the public and private sector. NMBU, with its roots in the former Agricultural University of Norway (NLH), has for more than three decades working on circular systems for waste and water management and recycling of waste resources to agriculture. Through SiEUGreen, this research and educational activities are given a boost. The results and inspiration from SiEUGreen have been used to initiate a "National Center for Urban Agriculture" (NCUA) financed through "seed" money over 3 years from NMBU in February 2019. NMBU is planning for a new MSc program in urban agriculture from August 2021. This is a trans-disciplinary MSc program that involve a collaboration of all seven faculties at NMBU, as well as the Learning Centre. As a fruit of SiEUGreen the Norwegian Research council has given funding for complementary national activities and a "Forum for circular economy in Norwegian wastewater management" was initiated and launched by NMBU in November 2019. With a particular focus on the research activity regarding green and blue technology, NMBU will disseminate the SiEUGreen outcomes through scientific publications. These activities will sustain the ideas of SiEUGreen, promote more collaboration within NMBU, and also lead to more activities in years to come.

Norwegian Institute of Bioeconomy Research, NIBIO

NIBIO is one of the largest research institutes in Norway with approximately 700 employees. It contributes to food security and safety, sustainable resource management, innovation and value creation through research and knowledge production. NIBIO has a long-lasting experience in European cooperation within the EU and European Economic Area (EEA) countries as well as bilateral collaboration with China since 2004.

Through the SiEUGreen project, NIBIO partner has not only contributed some know-how to SiEUGreen but also acquired good knowledge and experience through SiEUGreen project promoting the future exploitation of SiEUGreen outcomes.

NIBIO will exploit the scientific outcomes relating to WP2 activities, strengthening its research on green technology (including but not limited to the paper-based microgreen production, hydroponics and aquaponics etc.), and disseminating relevant results in Europe and China.

With a focus on the hydroponics based vegetable production, NIBIO is planning to further continue the current research activity on the use of plant nutrients derived from organic wastes e.g. kitchen waste and agriculture waste. This is formulated in to a new research proposal that will allow further the investigation of the potential, advantages and hurdles of organic waste based plant nutrients in to hydroponic production systems.

In collaboration with NMBU, NIBIO aims at exploiting the research outcomes regarding the blue technology e.g. waste water management and purification, in to further research activities. Additionally, NIBIO aims to continue the research activity on the social science aspects. This links to the results regarding *T2.3 Cultural adaptation of technology in circular economy*, that will be used to understand the user acceptance of utilizing human waste based fertilizers in to food production.

Chinese Academy of Agricultural Sciences, CAAS

CAAS is the leading Chinese Institute for Argo-products Processing Science and Technology with various filed of expertise covering multiple cultivation techniques of horticultural crops, composting of agricultural waste and use for fertilization, as well as hydroponics and aquaponics techniques.

CAAS aims at exploiting scientifically the research and technology related outcomes to further support its scientific and educational activities within the sectors of crop production, composting and innovative production technologies, as well as capitalizing on the SiEUGreen outcomes to initiate further research (via national and international funds and collaborations).

The Institute, leading together with BAEISU the Beijing showcase, will capitalize on the knowledge developed within the showcase activities and continue its research and education at the Sanyuan farm. Additionally, will further provide technical support and expertise to BAEISU for the further development and implementation of the aquaponics system.

CAAS has a long standing collaboration with the European counterpart NIBIO, and through the SiEUGreen activity is capitalizing on the common research outcomes and knowledge transfer between the EU and China regions, and builds a stronger basis for a continuous collaboration. Beyond ensuring the strengthening of inter-regional collaborations CAAS aims at disseminating at local/national as well as international level the project outcomes, contributing the international research and policy/decision making communities around urban agriculture techniques and innovative production methods.

NORDREGIO

NORDREGIO is a leading Nordic and European research Centre for regional development and planning – under the Nordic Council of Ministers. The primary research and competence areas are Regional Rural and Demographic Development, Urban Planning and Sustainable Development, Regional Innovation and Green Growth, Governance and Policy. The center adopts a multi-disciplinary approach with a broad competence base within social sciences, including urban and spatial planning, human geography, political science, institutional economics, resource and environmental economics, sociology. NORDREGIO is an active knowledge broker between practitioners and researchers contributing to sustainable regional development in the Nordic Region. NORDREGIO provides a forum where authorities and practitioners can collaborate and work together to share knowledge and seek solutions to common problems. The research methods include both advanced quantitative analyses and qualitative research with an emphasis on comparative case studies as well as performing evaluations at different levels.

The SiEUGreen project has been an opportunity for NORDREGIO strengthen knowledge and build up capacity on urban agriculture research and new networks with project partners and UA practitioners across Europe and China. The transdisciplinary character of

the project with the participation of partners with complementary types of knowledge (scientific, practical, and other) has enabled acknowledging different dimensions (e.g. technical, organizational and social) helping to bridge the gap between science and practice.

Within this process of co-creation, NORDREGIO has gathered information through an extensive dialogue (interviews, study-visits, online exchanges, meetings) with different actors (UA practitioners, planners, citizens, politicians, technology providers, national experts, etc.) from the various showcases. By doing, this NORDREGIO has also improved the capacity of facilitating and coordinating participatory processes through the organization of several workshops with SiEUGreen partners and UA practitioners, online and physical meetings as well as study visits to the different showcases

The know-how and experience acquired from SiEUGreen project have - and/or will - enabled NORDREGIO to:

- Build up capacity and expertise in transdisciplinary multi actor approach (MAA). This approach regards to bridging not only the knowledge between the consortium and the UA target groups in the different SiEUGreen showcases but also between the various members of the SiEUGreen consortium (academics, technology providers, consultancy companies, SMEs, civil servants).
- Search for opportunities to disseminate and deepen the knowledge acquired in SiEUGreen to other contexts. For example, NORDREGIO will pursue the Swedish Institute7 grant opportunity 'Third Country Participation in the Baltic Sea region'. This call offers actors based in Sweden the opportunity to apply for project funding for the inclusion of actors from Russia or the countries of the EU Eastern Partnership (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine) in a current EU project. If granted, this funding will support the dialogue and exchange of knowledge between the SiEUGreen showcases and other UA initiatives from Russia and possibly Georgia.

[7] https://si.se/en/apply/funding-grants/third-country-participation-baltic-sea-region/

- Develop frameworks that can help estimate the pros and cons of urban agriculture. The SiEUGreen deliverables' D1.2. Baseline study including key indicators and development of a typology' and 'D1.3 Guidelines for a new interactive impact assessment approaches' are likely to provide a robust basis for further develop tools that can be used by planners and decision-makers in different urban contexts.
- Contribute to the academic debate on the role of UA for resilient cities with the publication of a few scientific articles. In February 2020, a scientific manuscript was already published[8], while NORDREGIO will further furnish the academic discussion with the publication of at least one more scientific paper until the end of SiEUGreen project.

EMETRIS

Partner EMETRIS has been focusing the last fifteen (15) years on mainly three thematic areas: Strategy, Raising finance for Innovative Investments and Regional Planning. The company targets both private and public customers, and fully exploits its global network and knowledge base. The SiEUGreen project is extremely relevant to the company's strategy since:

- Boosts the company's competence on policies and strategies in regional and local planning;
- Involves innovative concepts and early stage funding;
- Builds the company's almost ten years' experience of the Chinese market and
- Integrates our target markets and services in one project

Additionally, EMETRIS sees the opportunity to increase its expertise on how to implement several technologies in integrated smart projects in the cities like Digital Innovation Hubs, or digital and tech transformation.

8 Borges, L. A.; Hammami, F.; Wangel, J. (2020): Reviewing Neighborhood Sustainability Assessment Tools through Critical Heritage Studies. Sustainability, 2020, 12(4), 1605; https://doi.org/10.3390/su12041605.

VILABS

ViLabs is an SME that acts both as a private research and innovation laboratory and as an innovation Hub for startups both in Greece and Cyprus. ViLabs provides a wide range of research, development and consulting services to national as well as international enterprises and organizations, utilizing a unique set of tangible and intangible resources, including knowledge, facilities, human and financial resources, supporting researchers and entrepreneurs to innovate. VILABS is active in the sectors of Information and Communication Technology (ICT), agriculture, social innovation and entrepreneurship through all stages of Research, Technological Development and Innovation.

From its participation in SiEUGreen, the company has gained insights in the area of urban agriculture within the whole value chain of the circular economy, including knowledge about the technology, social inclusion, energy efficiency and food security. ViLabs personnel has acquired knowledge on the whole Si-EU deployment process in real showcase environments and will enhance the current consulting services offering on startups, entrepreneurs and local network of experts and contacts. In this way, the company will be able to utilize these observations in future research activities and apply the findings in studies and projects related to urban agriculture.

ViLabs is willing to exploit the SiEUGreen results related to the showcase deployment, including the public deliverables about the deployment instructions, concepts and results, aiming to:

- make use of the findings in future projects, and use the SiEUGreen reports as a basis when working on new approaches and energy efficiency offerings
- introduce the deployment methodology to several stakeholders
- promote the SiEUGreen showcase deployment to its wide global network of experts
- promote the findings in international events and conferences

After the contractual end of the project, ViLabs is going to:

- Commercialize the new consulting services to offer in future European funded projects. Such competitive services will support communities to effectively adopt

Si-EU technologies for urban agriculture, offering them a successful mature methodology and training.

- Prepare promotional material and fact sheet applicable to ViLab's role in the project and indicating expertise in the field.
- The project description on the company's website will be updated to reflect on the outcomes of the project and provide a link to the SiEUGreen results.
- Continue building the human capital on the basis of the learnings from SiEUGreen.

OKYS

OKYS is a Bulgarian SME that provides reliable, trustworthy, integrated Information and Communications Technology (ICT) solutions, through technology innovation and successful project management to both public and private organizations. OKYS, through the extensive experience of its personnel provides R&D services (and high-quality, customized solutions using state-of-the-art technologies, on the following areas: Cloud-based solutions, Internet of Things (IoT), Application Program Interfaces (APIs), Software development and Data analytics and behavior analysis.

The interdisciplinary team at OKYS focuses on the intersection between ICT and Society to provide smart solutions to citizens, consumers, decision makers and SMEs. OKYS has an extensive network of collaborators including organizations and companies around Europe and as well as individual scientists and senior consultants (business experts, IT professionals and investors).

From its participation in the SiEUGreen project so far OKYS has gained further knowledge in the area of developing and maintaining software applications and programs. The development of SiEUGreen website and its related services proved to be a chance for testing and applying new technology tools including bug fixing, content update, software update, helpdesk and users support. OKYS main goal throughout the end of the project and beyond, will be to continue maintaining the COMMURBAN app and the services offered, as well as use the process oriented knowledge gained, with the aim to increase the company portfolio of expertise and service offering, in the area of urban agriculture oriented IT services within the whole value chain of the circular economy, including knowledge about

the technology, social inclusion, energy efficiency and food security and by promoting SiEUGreen project as a best practice.

OKYS is willing to exploit the SiEUGreen results, after the end of the project in the following ways:

- Expand the service offering usage outside the project consortium and to new regions. Provide access to the web-based technologies for visualization and related services for localization and for the provision of technical or social innovation expertise, utilizing the knowledge gained.
- COMMURBAN app: OKYS will promote the app and the overall SiEUGreen IT services to urban agriculture initiatives that currently do not have digital environment for their processes. OKYS will provide access to the app and service, with the appropriate guidelines.
- Process oriented knowledge gained: OKYS will offer the new knowledge acquired as consulting services offering to start-ups, entrepreneurs, and local initiatives/communities, as well as to urban agriculture initiatives that have a digital supporting environment but want to improve it.
- Add new dissemination materials on OKYS website of the results and the outcomes of SiEUGreen project with an accent of OKYS involvement and expertise brought in the project.

Beijing Green Valley Sprouts, BGVS

BGVS is an SME company focusing on the research and development of native plant resources, using innovative technologies and non-soil growing methods. BGVS is the inventor of the paper-based plant growing technique and within SiEUGreen is the provider of knowledge and material for the research activities performed under WP2. Additionally the company is supplying the SiEUGreen showcases (Chinese showcases and in Norway) with the paper based microgreen material used in the home/balcony microgreens and vegetable production.

The company continuously promotes, researches, manufactures and sells new devices and procedures for cultivating edible sprouts on paper as an alternative to sowing seeds into

the soil. Following the successful growth in the Chinese market over the last decades, BGVS now aims to further expand their presence in the Chinese market but also explore entering new markets abroad for their cultivation devices and paper-based sprouting micro greens and vegetables. Utilizing the successful product validation as performed within WP2 and the demonstrations and tests within the Norway showcase, BGVS' is aiming to exploit the outcomes of the showcase demonstration and via evaluate a market entry to Europe.

ScanWater

Scandinavian Water Technology AS (ScanWater) has been a supplier to the water and wastewater sector since 1985 and has extensive experience, excellent references and an established position in the sector in Norway but also in China, India, Uganda and other countries. ScanWater team consists of multi-disciplinary highly experienced engineers which ensure the provision of bespoke products and systems in a professional manner to their customers and partners. ScanWater water and wastewater products and solutions fulfil needs within the following markets:

- Water solution (turnkey projects);
- Humanitarian & aid; and
- Municipal preparedness.

Within SiEUGreen, ScanWater conducted experiments on the development of the innovate water management solution-GREENERGY, a smart, green concept for integrated water and sanitation, storm water management, energy supply and nutrient management in cities based on the principle of resource recovery and safe reuse aims to increase the resilience of cities, make urban development more climate-, environment- and human-friendly with near zero emissions, circular economy, low climate and water footprints.

ScanWater aims at exploiting the GREENergy concept, and the knowledge gained, to enlarge its commercial service portfolio in:

- the provision of consultancy services for innovative water management and wastewater treatment systems to private as well as public customers;

- process engineering design to developer/construction companies as well as real estate agencies and consulting companies for the incorporation of building/structure adapted decentralized wastewater treatment systems.

Chinese Academy of Social Science (CASS)

CASS is a national academic organization focusing on researching rural economy and social development in China, supporting the formulation of strategic concepts and policy aspects regarding Chinese rural development. Within SiEUGreen CASS, considered as the Chinese counterpart of NORDREGIO has been evaluating the outcomes and socio-economic research of urban agricultural development and is researching on a relevant policy recommendation.

SAMPAS

SAMPAS has been offering various products & services in smart city businesses and running hundreds of municipalities' automation systems using its management information solutions, geographical information solutions, citizen centric solutions, mobility solutions and smart plain irrigation management solutions. Besides, SAMPAS has experience in public sector cloud computing and developing projects within Service Oriented Architecture (SOA) for several years, using its experience in architecture definition, service implementation, pilot demonstrations and dissemination for several national and international projects.

SAMPAS participates in SiEUGreen as the smart cities and local government solutions provider and support the Hatay showcase. Its interest lies in the results that will arise from the implementation of UA applications and their accompanying impacts in the local communities. Within SiEUGreen, SAMPAS aspires to create a methodology for the successful technologic and socio-economic integration of UA systems. The technologies to be implemented under the scope of the project would be the first examples of Turkey. Therefore, there is not a well-established management foundation for these systems. SAMPAS foresee to establish a long-term management organization together with the Hatay Metropolitan Municipality. Consequently, SAMPAS aims to exploit the created management model through other stakeholders working on similar projects.

At the same time, SAMPAS foresee to generate and exploit a multilevel analysis framework within the showcase. Connected to project outcomes and results SAMPAS aims to:

- Provide policy recommendations on urban agriculture practices
- Commercialize new consulting services for future projects and support the communities to adopt innovative agriculture systems.
- Consolidate the innovative urban agriculture systems through sharing the knowledge gained from the project with other clients
- Create a catalogue of guidelines for UA practitioners
- Support and encourage the capitalization of the COMMURBAN App by promoting it through existing and new stakeholders in order to reach a wider local following throughout other Turkish cities.
- Further exploit the COMMURBAN App and extend its use beyond SiEUGreen timeline by promoting its capabilities such as a tool for the engagement of citizens, a revenue generator and an urban farming incubator etc. among different organizations and other public and private initiatives.
- Use the expertise gained from the project to familiarize innovative urban agriculture typologies for urban planning
- Introduce a methodology for the social integration of different groups including disadvantaged groups with UA and consult the stakeholders through the process.
- Add information and solution materials of the project via SAMPAS website in order to extend the outreach to other urban agriculture initiatives and local initiatives/communities.

In addition, the research results and implemented methodologies developed within SiEUGreen will further increase the expertise level of SAMPAS in the areas of decision support systems and policy making for UA focused smart city applications thereby, will ease the way for addressing even more complicated requests through its customer cities. Furthermore, SAMPAS will take advantage of outcomes resulted within the project by

integrating them into its current smart city solution portfolio to be re-used in future projects.

The aim is to offer new services integrated with SAMPAS's already established Intelligent City Automation System (AKOS) that are focused on boosting UA applications in Turkey. SAMPAS' existing customers who are principally governmental institutions especially municipalities will be the main target for these outcomes.

Hunan Hengkai Environmental Protection Science and Investment Group (HHEPSTI)

HHEPSTI focuses on the remediation of contaminated sites (including soil, industrial lands, mining areas, rivers, lakes, groundwater) as well as in water supply, wastewater treatment, sludge handling, and solid waste disposal. Within SiEUGreen, HHPESTI conducted experiments on demonstration of the GREENergy concept (partially) applied in the Changsha showcase as well as research activities on the struvite precipitation.

HHEPSTI is aiming to exploit the knowledge and outcomes of the research and demonstration activity regarding the deployment of the Changsha showcase. The R&D team of the company will capitalize on the knowledge and experience gained within the research performed regarding the GREENergy concept, and will further continue the development of the wastewater system. HHEPSTI is aiming to commercially exploit the GREENergy concept as an integrated decentralized waste and wastewater treatment system in China. The company has recognized the potential and market opportunity for such a system, aiming to enhance its services towards public and private clients. Via its mother company Futianxingye, real estate developer, HHEPSTI intends to capitalize its experience in the Changsha showcase and the GREENergy concept and expand further its activity in to the development of green housing/building structures.

Furthermore, the R&D staff of HHEPSTI will continue their research activity on the struvite precipitation and its conversion to products for soil conditioning and slow release ecological fertilizer, generating knowledge and researching on potential business ideas on innovative products for their soil remediation projects.

SEECON

Since its creation in 1998, SEECON initiated, developed, managed and participated in a multitude of local and international projects developing products and services - amongst others - in the following thematic areas: Circular Economy and Resource Management, Sustainable Sanitation and Water Management (SSWM), Business Development, Climate Change, Organizational Development, Change Management, as well as Regional Development and Sustainable Tourism.

The SiEUGreen project allows SEECON to further

- develop focused and effective solutions under a process-oriented framework and following a learning-oriented approach,
- broaden knowledge-based concerning innovation and policies aspects of Urban Agriculture, and
- strengthen and extend core services including SSWM and Resource Recovery and Reuse (RRR) training and consulting services, business development and coaching, market assessments for SSWM products, facilitation and coordination of participatory processes, as well as ecological engineering and resources management.

SEECON benefits tremendously from extensive knowledge, knowhow and experience acquired through the SiEUGreen project concerning innovation and policies aspects of Urban Agriculture and newly established/strengthened partnerships and collaborations. This opens-up additional market potential for consultancy in the transfer and roll-out of proven business models providing resilience in the water, energy and food security nexus.

SEECON cultivates an extensive, global network of successful, impact-oriented small and SMEs in the field of water, sanitation and resource management, supporting them with sector-specific business development services. SEECON aims to extend its core services by offering new services in facilitating the successful transfer of specific business model knowledge and know-how to foster the roll-out of proven business models that address the multidimensional and multifaceted links and relationships between and contribute to increased resilience of water resources management and food security.

In consultation with concerned IPR holders, SEECON will exploit integrated business models, SiEUGreen technology knowhow and business model innovation approaches resulting from the SiEUGreen project by incorporating them into capacity development programs, business development trainings and coaching, and the transfer and roll-out of proven Urban Agriculture business models providing resilience in water resource management and food security in times of crises (such as COVID-19) and ensuring food supply, income and livelihood.

Leibniz Institute of Vegetable and Ornamental Sciences, (IGZ)

IGZ is one of the largest publicly funded institutions for horticultural research in Germany. IGZ operates at the interface between plant science, environment, food and nutrition. Within SiEUGreen, IGZ conducted experiments on existing recycling fertilizer, particularly based on human excreta. We thereby focused on the fertilizers' suitability for application in different horticultural food production. From our "proof-of-concept" studies, we could get insight into different application options and exchanged information on experimental results and data with SiEUGreen colleagues. Based on our research experience within the SiEUGreen project, we generated knowledge that can be further exploited by us, our partners and beyond. In addition, the team working at IGZ benefits tremendously from scientific knowledge, methodological skills, international and intercultural experience, and practitioners' knowhow acquired through the SiEUGreen project. This will support and empower the junior scientists and master students in their future career in academia or horticultural practice alike.

The results of the experiments with recycling fertilizers, including a urine-based liquid fertilizer and fecal compost, are going to be published in three scientific articles (one already accepted and in revision process; the other two to be submitted in 2020). For further science communication, we prepared a leaflet in which we summarize major findings from our experiments. The aim is, to consult project partners, practitioners and, in particular, urban gardeners, on the use of the recycling fertilizers produced from anthropogenic resource collected in modern, circular sanitation systems.

Supported by our knowledge and experience from within SiEUGreen, we initiated another project, funded by the German national organization for standardization - Deutsches Institut für Normung (DIN) in 2018. In this project we developed a product standard (DIN SPEC) for “Quality assurance of recycling products from dry toilets for use in horticulture” and, therefore, coordinated a team of about 20 experts contributing to the standard development. The DIN SPEC will be published in July 2020. Target groups for the product standard are dry toilet start-ups and SMEs, commercial compost producers and practitioners, as well as hobby gardeners and political decision makers. In the mid-run, the standard shall be used as decision support for policy making, i.e. the adaption of the German fertilizer ordinance to include human urine and feces in the list of input materials allowed for the production of commercial fertilizers. On a long-term basis, and depending on further developments of policies and regulations for recycling fertilizers, the standard can be used for quality assurance by horticultural food producers, large-scale non-food producers or by municipalities for urban green space.

Based on our experimental results, we could evaluate the potential for urine-based fertilizers in horticulture, which can further be applied by the showcases and other novel urban food production systems in general. Particularly for NMBU and NIBIO, who both work on the production of a Nitrified Urine Fertilizers (NUF), our recommendations for plant production systems can be transferred to their newly developed product, e.g. for the Norway showcase. Also, our field data from an experiment with NUF in combination with fecal compost can further serve as a risk assessment for the Arhus showcase, where human excreta from dry toilets are composted and will be used for plant production. In relation to that, the developed DIN SPEC product standard will be translated to English and is planned to be tested at the Aarhus showcase with support of NMBU. The fecal compost produced at Aarhus will be evaluated by the requirements of the product standard to see whether adjustments to the Danish fertilizer law would be required. This evaluation in Aarhus and beyond serves as a proof-of concept for the standard and we can get feedback on the applicability and suggestions for further adaptations of the DIN SPEC. After three years the standard will be automatically re-evaluated and can be re-published in an adjusted way or can further be "upgraded" to become a national norm (DIN), European norm (CEN) or even an international norm (ISO). A product standard to assure the quality of fertilizer from

human excreta can benefit urban and rural food producers alike and promote a circular economy.

Ultimately, relevant data from IGZ and other SiEUGreen partners on the various plant experiments dealing with recycling fertilizers can be compiled to a publication in "Nature Food". The article is expected to focus on comparing and systematically evaluating different approaches to utilize urban producing urban fertilizers. Together with European and Chinese partners from the SiEUGreen, we will elucidate how the recycling products are characterized and what conclusions we could draw for urban food production from our experiments in Europe and in China. The different showcases and geographic locations could add a high value to the publication, especially when also including the social aspects and put our conclusions in the context of food security.

Within the Business Model webinar, the IGZ team worked on two business models, based on our research focus: (1) a commercial model for a urine-based fertilizer product and (2) a non-commercial urban compost hub. Both business ideas are presented in section 5.

The urine model is based on the experience we gained on existing urine fertilizers and could be further adapted to the urine product currently developed by NIBIO and NMBU. The compost hub model is developed against the backdrop of an existing project idea in Berlin. Local urban green waste and source-separated household waste would be collected, composted by the hub and could then be returned to the community. This approach would target local hobby gardeners or community gardens, promoting social engagement in the context of urban nutrient recycling. The business model could further be adapted and serve as a baseline model for the Arhus showcase with its community gardens.

Beijing PHOTON Science & Technology Co, PHOTON

PHOTON specializes in the development of innovative agricultural intelligence solutions, greenhouse constructions, facilities and related products, including balcony production and water saving irrigation systems. PHOTON is providing the SiEUGreen Chinese showcases with technical support and customized solutions/appliances for home and balcony production. PHOTON designed and developed the kitchen garbage processor and a fruit and vegetable planter that will be used in the Chinese showcases. PHOTON aims to

leverage participation in the SiEUGreen and the outcomes of the Chinese showcases to enhance its research and development department but also expand its presence in the Chinese market.

DRAXIS

Partner DRAXIS aims at primarily capitalizing on the COMMURBAN application that developed within the SiEUGreen project. DRAXIS is an Environmental ICT company that specializes in the development of user and data driven applications and platforms to support environmental and agricultural management. Beyond the COMMURBAN application the company will exploit the acquired knowledge in the sectors of urban agriculture and circular concepts for water and waste value chains. These aspects along with the exploitation approaches, are fueling the company's portfolio for utilization in future research activities and the development of more tailored services to private and public clients around urban agriculture, resource efficient management, coupled with societal inclusion.

ANNEX IV – Showcase Exploitation

Norway Showcase

The Norway showcase is led by NMBU. The showcase focuses on demonstrating a proof of concept for a smart and green retrofitted building - the GREENergy concept. NMBU aims to use the Norway pilot to demonstrate how it is possible to:

- Reduce greenhouse gas emission
- Reuse CO_2 and waste-based nutrients in a local greenhouse
- Reduced water use
- Produce biogas/energy from domestic organic waste
- Produce fertilizers from domestic organic waste
- Promote urban agriculture
- Promote circular economy solutions to the dwellers as well at local municipality

Smaller scale GREENergy concept and infrastructure will be installed in a student residence in Campus Ås that is set to replace the original building that was planned for demonstration of SiEUGreen project. The infrastructure that is expected to be installed in Campus Ås will be sustained beyond the SiEUGreen project termination. Campus Ås will be used as a demonstration area of the GREENergy concept, informing and raising awareness to stakeholders in line with the objectives described in the vision for the Norway showcase, as well as to contribute to further socio-economic and environmental research on smart and green cities. The implementation of the GREENergy concept under the scope of the Norway showcase will raise awareness about circular solutions and sustainable development not only in the local municipality but also in other municipalities and at the national level.

A diverse group of stakeholders, local municipality, academia and private actors, will collaborate on the construction and knowledge development, creating Norway "showcase" as an eco-smart urban development in Norway. The technologies and experiences acquired can be transferred to other regions in Norway as well as other countries.

NMBU and NIBIO are planning to use the Norway case as a living example to draw political attention to the use and re-use of household waste and water resources as well as the

support for innovative concepts, including UA. Thus, both research institutions will have a focus on the showcase beyond the termination of SiEUGreen project. The different knowledge outcomes of the project will be disseminated through various scientific publications in peer-reviewed international high-impact journals, conference presentations, workshops and promoting videos.

The development of Norway showcase has already caught the interest of several developers and consultants in Norway, and they have approached NMBU for discussion of new potential projects using the GREENergy concept. This indicates that the innovative GREENergy concept has a commercialization potential in Norway and beyond.

Aarhus Showcase

The Municipality of Aarhus aims at maintaining and increasing an existing citizen-driven network of UA initiatives, to support the demonstration and production of food within the urban area. At the same time, these initiatives also support the strengthening of socially inclusive places and communities around the city. The Municipality is aiming at strengthening the technical capacity of its staff and the Taste Aarhus program exploiting SiEUGreen integrated multiscale analysis frameworks to assess the benefits and drawbacks of urban agriculture and strengthen the positioning of UA in to the Municipality's action plan for urban development.

The Municipality already capitalizes on the project outcomes to mediate the dialogue between different municipal departments and UA initiatives and practitioners in order to enhance the role of UA in the city. The municipality will be using the systematic approach of the SiEUGreen typologies and engagement strategies to demonstrate the value created by UA activities, to secure the inclusion and further support of the Taste Aarhus program within the municipality's planning to strengthen the sustainability character of the city. This supports the existing plan for dialogue with the citizens and businesses on the development of the city.

Furthermore, capitalizing on the SiEUGreen analysis frameworks, the Municipality aims to integrate different components in to the municipality's urban planning, allowing for better assessment of inactive and under-utilized public spaces in applying UA. This will aim at

enhancing the municipality's approach and planning for urban development as well as increasing the potential financial support for the expansion of existing UA initiatives or creation of new ones.

While the showcase activities are still ongoing, the project has already demonstrated potential benefits using different low tech and composting methods. The Municipality through the demonstration activities within the 2 sites, the World Garden and Brabrand Common Garden, allow practitioners to consider alternative crop production systems (polytunnels, mobile gardens) around the city. This is aimed to enhance citizens' involvement in UA activities and to promote consumption of food produced within the city. The Municipality will consider using the outcomes of the experiments regarding the solar-driven toilet beyond the end of the project in another site, to further demonstrate the potential benefits of composting and help to change people's perceptions and potentially also local regulations (allowing the use of composted human waste for food production). In order to use the solar-driven toilet for SiEUGreen activities the municipality granted a 4-year dispensation from current regulations.

Additionally, the Municipality will exploit the COMMURBAN application as a means to maintain and expand a dynamic communication and knowledge/guidance exchanges, with UA initiatives and practitioners but also enable interaction among and between them.

Hatay Showcase

The Hatay municipality aims to use the innovative technologies in order to increase local productivity via traditional and innovative greenhouse production, including aquaponic. Further they aim to educate local vulnerable communities and refugees in food production techniques. The municipality has developed a business model on the basis of which the existing infrastructure of the project will be used as a hands on training center for local UA practitioners, students, and local communities with particular focus to unemployed women and refuges Aquaponics and hydroponics are new technologies for the Turkish market, and their developments are in the early stage. Within SiEUGreen, Hatay municipality's showcase will be conceived in to an innovative business model being first of its kind for the

local authorities. By doing so, it will further guide local authorities in to adopting and developing similar systems.

The main objective of the Hatay exploitation plan is to develop a comprehensive system which will not only widen the usage of UA technologies but will also maintain its potential for replicability throughout Turkey. In addition, it aims to create added-value for social-economic development of local authorities and communities focusing on the involvement of various economic level citizens and disadvantaged groups.

In order to facilitate this, the municipality will capitalize on the SiEUGreen outputs to strengthen its urban plans and incorporate UA structures and activities for local development. Within and after the completion of the SiEUGreen project, Hatay Metropolitan Municipality aims to exploit the project outcomes and thus plans to:

- Describe a re-applicable model for local food production by urban agriculture which provides social-economic added value for different groups including refugees.
- Introduce the deployment methodology to the stakeholders
- Create training materials to reach to larger communities and further share the SiEUGreen outcomes for educational purposes.
- Establish a UA manual for other municipalities with limited knowledge
- Initiate a policy framework that enables disadvantaged social groups to join to the agricultural workforce by participating in urban agricultural food production.
- Promote the use of COMMURBAN app as the main platform for the communication and knowledge sharing of UA enthusiasts and communities. Thus allowing the social integration and the capitalization of the COMMURBAN App dually.
- Promote the SiEUGreen showcase deployment to newly developing Turkish UA market and government organizations.
- Add the information material of the SiEUGreen project to the municipality website and social media channels further elaborating the project results to reflect the impact and the added value of the project to promote similar practices.
- Promote the findings in local and international events and conferences

Beijing Showcase

The Beijing showcase is led by the SiEUGreen partners CAAS and BAIESU. The Beijing showcase is relating to the Sanyuan Farm that has been in place since 1949 as a common farm where urban dwellers can cultivate their plots. BAEISU, is practicing aquaponics methods, have developed systems, incorporating the hydroponic and aquaponic crop cultivation techniques. These are further investigated within the SiEUGreen by CAAS and NMBU. The Sanyuan Farm aquaponics system (and the farm at large) will continue being used as an educational and research facility for CAAS. BAEISU is aiming to exploit the aquaponics system of the Beijing showcase as an attraction sight for visitors as the system is quite new for most people in China. Additionally, BAEISU will exploit the aquaponics system as industry production plant which primarily provide fresh vegetables and fish to the local restaurant. Due to the regional regulations against river and lakes pollution, fish farming is not allowed in the region, and aquaponics could be considered for commercial fish production. In order to explore the untapped potential of the Beijing showcase aquaponics system, BAEISU and CAAS plan to continue their research and investigations on the technical specificities of the system to allow them to identify the most efficient and market aligned combination of vegetable and fish species production.

Changsha Showcase

The Changsha showcase is led by partner HHEPSTI. The company aims at demonstrating a partial Greenergy concept, as an integrated waste and wastewater treatment system. HHEPSTI is an environmental investment group and intends to further expand its activity in to the development of green housing via its mother company Futianxingye, a real estate developer. The Changsha showcase will operate as the “first of its kind” circular building of the company and will be the demonstration site for potential clients, strategic partners and governmental bodies. The building structure and the functionality of the integrated system will be used by the resear4ch and development (R&D) team of the company to continue research on circular systems, as a concept that can realize the recycling of sewage resources as well as minimizing pollution. The overall operational cost of the showcase will be fully

covered by the company and regarded as the marketing strategy for green-circular buildings.

In rural China centralized wastewater treatment systems are rare. At the same time China's regulations demand any wastewater to be treated before disposal. This is seen as a great opportunity for HHEPSTI to market and replicate the integrated wastewater treatment system of the Changsha showcase. The showcase infrastructure is aimed to increase the attention of potential clients to the company's commercial activity and on also support the recognition and use of innovative decentralized wastewater treatment systems by the relevant public institutions.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774233

SiEUGreen
Sino-European innovative green and smart cities