BONUS RETURN
Reducing Emissions by Turning Nutrients and Carbon into Benefits
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X	PU	Public.
	PP	Restricted to other project partners.
	RE	Restricted to a group specified by the consortium.
	CO	Confidential, only for members of the consortium.

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1 INTRODUCTION

The degradation of the Baltic Sea is an ongoing problem, despite investments in measures to reduce external inputs of pollutants and nutrients from both diffuse and point sources. Available technological and management measures to curb eutrophication and pollution flows to the sea have not been adapted adequately to the contexts in which they are being applied. Furthermore, measures are often designed based on single objectives, thereby limiting opportunities for multiple benefits.

In addition, there is a general sense that measures to address the deterioration of the Baltic ecosystem are primarily technologically-driven and lacking broader stakeholder acceptance, and the "experts" who define these measures have little engagement with industry, investors, civil society and authorities. This problem is exacerbated by governance and management taking place in sectoral silos with poor coordination across sectors.

As a result, research shows that regional institutional diversity is presently a barrier to transboundary cooperation in the Baltic Sea Region (BSR) and that actions to achieve national environmental targets can compromise environmental goals in the BSR (Powell et al. 2013). The regional dimension of environmental degradation in the BSR has historically received weaker recognition in policy development and implementation locally. However, developments in recent years suggest a new trend with growing investments in environmental protection supporting social, economic, and territorial cohesion.

The BSR is an environmentally, politically and economically significant region and like other regions globally, its rapid growth needs to be reconciled with the challenges of sustainable development in a global setting that demands unprecedented reductions in GHG emissions. This poses a truly wicked problem exacerbated by the fact many of the challenges in BSR will also magnify in a changing climate. In order to navigate the uncertainties and controversies associated with a transformation towards a good marine environment, BONUS RETURN uses an innovative trans-disciplinary approach for identifying and piloting systemic eco-technologies.

The focus is on eco-technologies that generate co-benefits within other interlinked sectors, and which can be adapted according to geophysical and institutional contexts. More specifically, emphasis is given to eco-technologies that reconcile the reduction of present and future eutrophication in marine environments with the regional challenges of policy coherence, food security, energy security, and the provision of ecosystem services.

1.1 Project Objectives

The **overall** aim of BONUS RETURN is to improve the adaptation and adoption of eco-technologies in the BSR for maximum efficiency and increased co-benefits.

The **specific objectives** of the project can be divided into 6 categories presented below. These categories are interlinked but for the purpose of providing a step-wise description, the following overview of each category proves useful. BONUS RETURN will:

1) **Support innovation and market uptake of eco-technologies:**
- Contribute to the application and adaptation of eco-technologies in the BSR through an evidence-based review (systematic map) of the developments within this field.

- Contribute to the development of emerging eco-technologies that have the capacity to turn nutrients and carbon into benefits (e.g. bio-energy, fertilizers), by providing an encompassing framework and platform for rigorous testing and analysis.
- Development of decision support systems for sustainable eco-technologies in the BSR.
- Contribute to better assessment of eco-technology efficiency via integrated and participatory modelling in three catchments areas in Finland, Sweden and Poland.
- Contribute to methodological innovation on application and adaptation of eco-technologies

2) Reduce knowledge gaps on policy performance, enabling/constraining factors, and costs and benefits of eco-technologies

- Assess the broader socio-cultural drivers linked to eco-technologies from a historical perspective
- Identify the main gaps in the policy environment constraining the implementation of emerging eco-technologies in the catchments around the Baltic Sea
- Inform policy through science on what works where and under which conditions through an evidence-based review (systematic map and systematic reviews) of eco-technologies and the regional economic and institutional structures in which these technologies evolve.

3) Provide a framework for improved systematic stakeholder involvement:

- Develop methods for improved stakeholder engagement in water management through participatory approaches in the case study areas in Sweden, Finland and Poland.
- Enact a co-enquiry process with stakeholders into opportunities for innovations in eco-technologies capable of transforming nutrients and pollutants into benefits for multiple sectors at different scales.
- Bring stakeholder values into eco-technology choices to demonstrate needs for adaptation to local contexts and ways for eco-technologies to efficiently contribute to local and regional developments.
- Disseminate results and facilitate the exchange of learning experiences, first within the three catchment areas, and secondly across a larger network of municipalities in the BSR.
- Establish new cooperative networks at case study sites and empower existing regional networks by providing information, co-organize events and engage in dialogues.

4) Support commercialization of eco-technologies:

- Identify market and institutional opportunities for eco-technologies that (may) contribute to resource recovery and reuse of nutrients, micro-pollutants and micro-plastics (e.g. renewable energy).
- Identify potential constraints and opportunities for integration and implementation of eco-technologies using economical models.
- Facilitate the transfer of eco-technologies contributing to win-win solutions to multiple and interlinked challenges in the BSR.
- Link producers of eco-technologies (small and medium enterprises - SMEs), to users (municipalities) by providing interactive platforms of knowledge exchange where both producers and users have access to RETURN's envisaged outputs, existing networks, and established methodologies and services.

5) Establish a user-driven knowledge platform and improve technology-user interface

- Develop an open-access database that maps out existing research and implementation of eco-technologies in the BSR. This database will be intuitive, also mapped out in an interactive geographical information system (GIS) platform, and easily managed so that practitioners, scientists and policy-makers can incorporate it in their practices

- Develop methodologies that enact the scaling of a systemic mix of eco-technological interventions within the highly diverse contexts that make up the BSR and allows for a deeply interactive media of knowledge.

1.2 Project Structure

BONUS RETURN is structured around six Work Packages that are implemented in three river basins: The Vantaanjoki river basin in Finland, the Słupia river basin in Poland, and Fyrisån river basin in Sweden.

Work Package 1: Coordination, management, communication and dissemination.
Work Package 2: Integrated Evidence-based review of eco-technologies.
Work Package 3: Sustainability Analyses.
Work Package 4: Environmental Modelling.
Work Package 5: Implementation Support for Eco-technologies.
Work Package 6: Innovative Methods in Stakeholder Engagement.

1.3 Deliverable context and objective

The current deliverable (D 6.4) is part of *Task 6.6 Capacity building for exchange of knowledge and learning at the regional level* in WP6. The objectives of WP6 are to serve as the platform to enable a co-enquiry process between stakeholders and the project. Stakeholder platforms have been established at the case study sites to support the identification of eco-technologies for analysis in WP3, WP4 and WP5. These platforms serve as opportunities to further test, develop, adapt and use the eco-technologies based on the assumption that their effectiveness depends on context, as defined by institutional, economic, social and bio-physical barriers and opportunities. WP6 thus contributes to understanding historical drivers, policy instruments and governance structures and local needs with regards to implementation of the selected eco-technologies in the three case study sites. WP6 is responsible for developing and facilitating an innovative game system, using the empirical materials generated throughout the project to support the co-learning environment and more specifically mediating the interactions and critical reflection between the project and stakeholders.

This deliverable provides an overview of BONUS RETURN's second Regional Exchange and Learning Event held on 16th May 2019 in Gdansk, Poland. It describes the event and summarizes the presentations, panel discussion and interactive sessions. The event attracted a total of 58 participants representing a range of countries across the BSR, scales and sectors, including academia, the public sector, the private sector and civil society. See Appendix 1 for a full list of participants and their respective organisations.

1.4 Outline of the report

Section 2 introduces the purpose and scope of the event and describes the approach, methods used, and key topics included in the event. Sub-section 2.1 gives a summary of the keynotes, 2.2 provides a summary of the innovation panel discussion, and sub-section 2.3 summarizes key points from each of the four thematic group discussions. The agenda, participant list, and presentations are included in the appendices.

2 DELIVERABLE 6.4 REGIONAL EXCHANGE AND LEARNING EVENT 2

In line with BONUS RETURN's approach of engaging with all the sectors involved in the circular economy of the BSR, we sought to bring together a diverse set of actors to the second Regional Exchange and Learning Event in order to facilitate a cross-sectoral discussion. The main theme of the event was *Symbiosis in a Circular Economy: Exploring solutions for improved water and nutrient governance.*

The purpose of the event was to facilitate learning exchange between the project partners and local stakeholders as well as a broader network of actors from industry, academia, public, and private sectors in the BSR in order to contribute to discussions on opportunities and challenges for deploying systemic innovations and eco-technologies in the BSR.

The event's structure consisted of two keynote presentations to set the scene for the thematic discussions to follow, an innovation panel discussion and four breakout sessions that ran parallel in the morning and afternoon.

2.1 Keynotes

The keynotes served as inspiration for the regional learning event and set the scene for the subsequent parallel sessions. The first keynote was given by Ludwig Hermann from the European Sustainable Phosphorus Platform (ESPP) and the second one by Paula Land from Local Governments for Sustainability (ICLEI). (See appendices 3 and 4 for their presentations).

Ludwig Hermann – European Sustainable Phosphorus Platform (ESPP)

Ludwig Hermann started off by introducing global trends and challenges related to nutrient use. He presented the concept of the Great Acceleration, showing how material use has increased exponentially over the past 50 years in particular. Driven by this acceleration, humanity has now transgressed the so-called planetary boundaries for both nitrogen and phosphorus, and Europe faces nutrient loss and eutrophication challenges.

Ludwig then went on to introduce some key global and European policy changes within the area of nutrient management, such as the EU Circular Economy Package, including the new EU Fertilizer Regulations, and the proposed new Common Agricultural Policy.

After an overview of some key technologies for phosphorus reuse – including struvite, P recycling from ash, and tailings, he concluded that remaining barriers include lack of market demand for more sustainable, circular processes, and lack of apparent willingness to accept a premium for sustainability.

For policy makers that want to support a transition towards a circular economy, there are a set of available pathways for incentivizing reuse including taxes on landfill and nutrient effluents, mandatory phosphorus recycling, binding agreements with industry and municipalities, and taxation of externalities (CO2 in particular). He stressed that regulations should also consider N_20 emissions, possibilities to integrate nitrogen recovery, the energy balance of wastewater treatment plants, and life cycle analysis of circular solutions.

Paula Land – Local Governments for Sustainability (ICLEI)

Paula Land argued for the importance of working with cities for circular economy, and why they are well-placed to deliver on circular economy targets. She explained that cities are well familiar with local markets, stakeholders and goals and they have an interest in creating a liveable city. For example, as

the ozone layer problem showed, when one city took the first initiative to phase out products, cities can be drivers of change.

In ICLEI's The CityLoops project, they support the implementation of ambitious circular economy demonstration actions in the fields of construction and demolition waste (including soil) and organic waste in six small-to-medium sized European cities. The project assesses material flows and develops circularity indicators for urban areas. Another initiative called PROCURA+ European Sustainable Procurement Network connects European cities and public authorities for exchange of knowledge and learning in terms of actions on sustainable and innovation procurement.

2.2 Innovation Panel Discussion

The theme of the panel discussion (Figure 1) was "*What make innovations symbiotic?"*. The discussion was moderated by David Nilsson from Royal Institute of Technology (KTH), Sweden with the presence of the following innovators:

- Aquacare (Netherlands), represented by Prashanth Suresh Kumar
- Ragn Sells and EasyMining (Sweden), represented by Pär Lärshans and Yariv Cohen
- Kalundborg Symbiosis Center (Denmark), represented by David Marhauer-Nimb
- Advanced Aerobic Technology (Sweden), represented by Anna Calo
- Agro-ecological Symbiosis (Finland), represented by Kari Koppelmäki

Figure 1. Innovation panel discussion at regional exchange and learning event in Gdansk

David Nilsson introduced each panelist with a short pitch of their respective innovations. All panelists were asked to choose which is more challenging: the technology or the market – and everyone chose the market. Kari Koppelmäki stated that balancing supply and demand is difficult when production is small-scale. You need to recover phosphorus of the same quality that is on the market to be able to sell the product.

On the question of what needs to happen to drive a transition and broader uptake of the innovations, David Marhauer-Nimb explained that the development needs to be economically viable, but legislation can help to create new business opportunities. It depends on where one is in the process: trust and awareness are important in the early stage but legislation can play an important role in the next stage. Without trust, there will be no change since circular economy is about collaboration, as Pär Larshans emphasized. Anna Calo added that one way of taking it to the next level and facilitating a broader

uptake, is to organise demonstration and exchange visits. Guests and visitors to her company's pilot plant have resulted in potential clients from different parts of the world.

2.3 Parallel breakout sessions

The four sessions below ran parallel in a group of 8-12 participants per session, in the morning and afternoon of May 16 (2019). In this regard, the participants were given the opportunity to partake in two of the four sessions. The sessions included:

- Session 1 – Public procurement for circular innovations
- Session 2 – Testbeds: infrastructure, finance and setup
- Session 3 – Payments and other schemes for nutrient and carbon recycling
- Session 4 – Requirements for market uptake of recycled fertilizer products

Session 1 – Public procurement for circular innovations

Facilitated by Sten Stenbeck (Research Institutes of Sweden, RISE) and Sari Väisänen (Finnish Environment Institute, SYKE)

Public procurement constitutes a major share of public spending and is increasingly recognized as an untapped potential for driving a transition towards a circular economy. Germany, Denmark and the Netherlands have new national policies in place to support circular procurement, and successful experiences are starting to emerge in the Baltic Sea Region. Some of the strategies raised for supporting circular procurement include the use of circular procurement criteria, procurement of circular products, procurement of services (such as leasing), and procurement that supports the creation of industrial symbiosis and circular systems. However, challenges remain for putting circular procurement into practice for the agriculture and wastewater sectors.

This session was focused on how cities and municipalities can use public procurement to enhance the uptake of circular innovations, thereby supporting a transition to a circular economy. Charlotta Möller from RISE, gave a presentation on *innovation procurement and its links to sustainable procurement* to set the scene for the discussion where she defined and explained different types of procurement as outlined below (see Appendix 5 for her full presentation).

Summary of the presentation:
Innovation procurement is procurement of services and goods that are not yet ready for the 'normal' commercial market. Sustainable Public Procurement is not the same as innovation procurement and is, in this perspective, a procurement for products and services in the 'normal' commercial market but with evaluation criteria looking at Best Total Value including social, economic and ecological values instead of the traditional focus on purely economic values. As can be seen in Figure 2 below, the different types of innovation procurement are based on the readiness level of the products and services. Development-promoting procurement is the type closest to the 'normal' market while Pre-commercial Procurement (PCP) is used for early goods and services which demand research and development. Public Procurement of Innovation (PPI) aims at goods and services that are more validated and market ready.

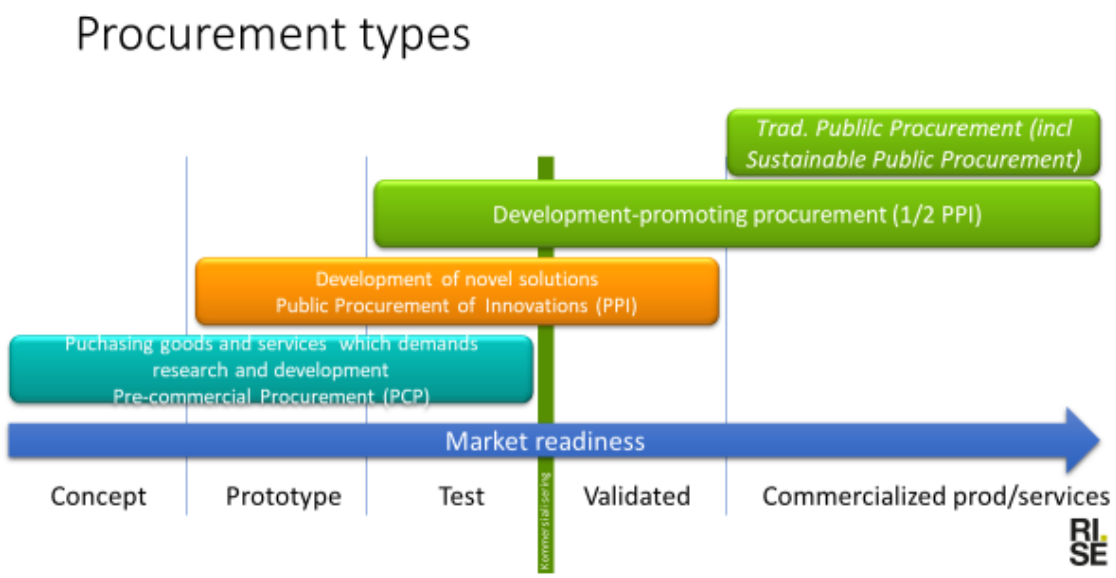

Figure 2. Types of procurement

The presentation was based on The *Eafip* Toolkit[1], which aims to provide support to policy makers in designing PCP and PPI strategies, and to procurers and their legal departments in implementing such procurements.

The session further explored questions related to the benefits, barriers and challenges for innovation procurement (see Table 1 below for a summary), as well as risk management.

BENEFITS	BARRIERS and CHALLENGES
Value for money	Expertise, knowledge and competence
Support for start-ups and SMEs	Lack of experience
Service-oriented opportunity	Fear of legal battles
Allow circular economy solutions	Need for resources from the buyer and seller
Adherence to standards for many	Failed innovative solution
Private companies' procurement	Risk for both the seller and the buyer
Total best value	Not enough resources in small cities
Risk minimising and mitigation	Uncertainties and trust

Table 1. Summary of benefits, barriers and challenges for innovation procurement

[1] https://eafip.eu/toolkit/

Existing barriers and challenges

1. Instruments and plans in projects are often not applicable in real-life situations.
2. For startups in cities where products exist but contracts are not easy to come by, it is challenging to up-scale them and give testing opportunities as well as make deals with companies.
3. The need for flexibility in regulations continues to be a challenge as there are ways to build procurement criteria around existing flexible legislations. There are several projects modelling procurements to upcoming products, which could be incorporated in a better way.

Managing risk

Can sharing market risk be financed by both parties together? Small companies cannot finance pilots, so the buyer has to pay at least a part of it. For instance, there might be an area without sewage, and the municipality knows that there is at least one available solution that would work. When you make a procurement, you will probably get an offer from the one you already know, but many others that you are not aware of also existed.

Companies might already know that they have a valuable product. They can ask to set up a pilot in a municipality, so that other potential buyers can see the value of their product and how it solves their problem.

In risk-sharing, the main obstacle is changing people's attitudes. At the moment, those making decisions, which could end up going wrong, are heavily blamed. This makes people hesitant to take risks and prefer familiar and conservative solutions, thereby hindering the uptake of innovations. Could these attitudes be changed by looking for people who are ready to share risks?

In municipalities, there are different layers of risks, one of them is that politicians do not want to make wrong decisions with long lasting effects. To a buyer, the risk can be political, but for the vender it might be a market risk.

Case example:

In Denmark, one municipality organized workshops where they informed companies about their needs and problems which they needed solutions to. Other municipalities are facing the same problems and also looking for solutions, so in the long run, potential markets would be larger than just this one municipality. Companies had better knowledge beforehand on what the buyer was looking for. This is important for companies as they take financial risks when developing products, because they cannot be sure if they ultimately work, or if someone else's product will be chosen anyway. In the workshops, all the data and wishes provided by the municipality were published, so everybody could have access to these; also, companies could be involved in the procurement process. Companies in the workshops did not gain any added leverage and would have otherwise been excluded from the actual procurements (since there are cases where venders have had too much contact with the buyer thus biasing the procurement).

Figure 3. Participants engaging in a discussion in one of the parallel sessions in Gdansk May 16, 2019

Session 2 – Testbeds: infrastructure, finance and setup

Facilitated by Erik Kärrman and Solveig Johannesdottir from RISE Research Institutes of Sweden

Test and demonstration environments, referred to as testbeds, allow for cheap, fast and small-scale testing of innovative approaches. As goods and services are developed at a more rapid pace and become increasingly complex, testbeds are becoming increasingly important for the public and private sectors alike.

Testbeds for circular solutions require adequate infrastructure as well as innovative business models and other agreements between different actors. Testbeds are often found to run into challenges of sustaining the activities beyond project funding and finding business models that are sustainable over time. Furthermore, circular solutions remain a niche market with limited profitability, which may require identifying and establishing innovative partnerships.

The main focus of this session was to evaluate testbeds and associated arrangements for circular solutions in nutrient and water management. Below is a summary of the discussion.

Purpose and benefits of testbeds

Partnerships help support innovations to increase their Technology Readiness Level (TRL).

Testbeds can have very different purposes. If not accelerating innovations, a driver can be to improve the environment such as shortage of water, for example, or for other benefits like local symbiosis.

Sharing benefits and outcomes

Having a strong partnership is an important factor. Companies with “secrets” that need to be managed, e.g. patents and know-how, might be reluctant to participate because they want to protect their “know-how”. Typically, companies can have secrecy agreements or work directly with the customers, or they simply build the pilots themselves because they can afford it.

The following questions were raised: How can one get interested companies to join the testbed? Innovations without resources need testbeds to develop but companies with enough resources can do it all in-house, how can we attract them and still ensure their secrets are kept?

Partnerships, roles and responsibilities
The constellation of stakeholders or partners should include:

- Research and Development (R&D) (e.g. university or institute, public or private) – provides quality.
- Problem owner – the end user may be an individual, a municipality, a region or an industry.
- Innovator(s) – provide(s) ideas, surveys, and products to solve the problem. The innovator may be the problem owner or the research and development actor.
- Investor – provides financial support

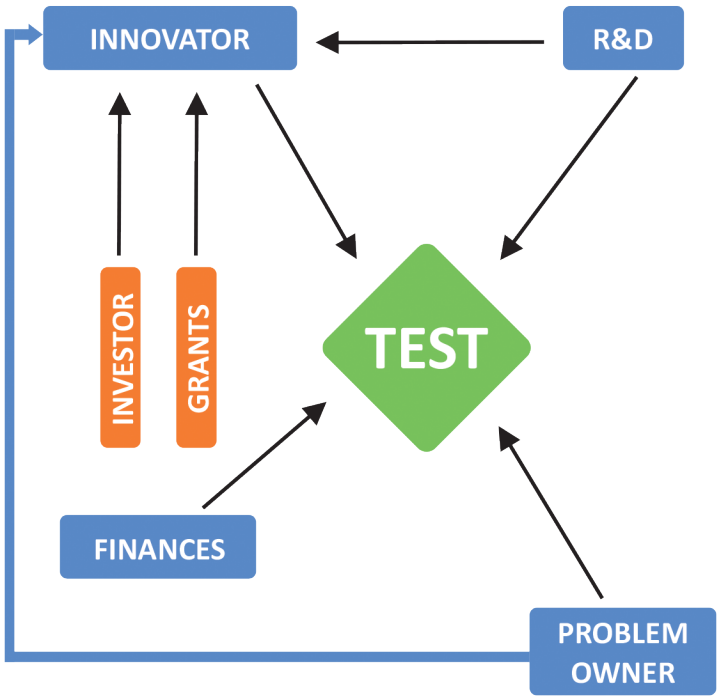

Figure 4. Constellation of stakeholders or partners

Each stakeholder type has sub-levels. There can also be associated partners who are not financially involved but provide knowledge, for instance. The level of partnership is local, regional or international, and it is important to identify a lead partner.

Research and development (R&D)
Research and development is a third party that helps with the evaluation of results, e.g. consultant or institute. A financer is needed as a partner.

Research and development recognize that their solutions help solve specific problems.

Funding and publishing are the main goals for R&D as research results are the driver. Implementation is not the main goal here. For private companies, application is the goal. R&D needs private companies to take innovation to the application stage. Therefore, collaboration between R&D and private companies is key for success.

To achieve success in Research & Development the following is required:

- An innovator such as a company, university or other.
- Municipality for wastewater treatment plant, land, or testing field in general.

- Commercialization: to move into the business and private sector. A key pre-condition for success is that R&D cannot only be public.
- The setting is also important. The R&D needs to have a loose mandate with the purpose of serving the needs of the testbed and other partners. Therefore, if the R&D is solely in a project to write papers, that may be the wrong set-up.
- Finally, customers or end-users are important. This could be the problem owner such as a municipality or individuals with a vested interest, depending on how close one is to the market or application.

R&D is crucial in testing stages where the problem may not be entirely understood, or the technology is uncertain.

Problem owner
The one in need of a solution to a specific problem. It doesn't have to be the municipality, they can also have the role of mediator, working through a bottom-up approach.

Roles and responsibilities
It is good to have fulltime managers as it is more efficient than having several people working part time (less than 50%). It could be beneficial to the project to keep stakeholders close.

The same partner could have two or more roles, even all of them – but generally all roles need to be filled. A third, independent party is needed. All roles could be filled by one partner, but one independent partner is essential.

For innovators who have ideas but not the means to set up the testbed then the model illustrated in Figure 4 above would work. The other partners could have the means to set up the testbed on their own. R&D is generally instrumental in securing funding. Partners will be reluctant to get on board before financing is in place, however one needs to set up the project and put in a lot of work before applying for funding.

Trust
It takes time to develop trust and collaboration. People leaving the municipality can be problematic as one may be required to start all over again. It may be that research is produced and a city is invited to join the collaboration. It should perhaps be that the city is the problem owner and thus influences the research at a much earlier stage than what is typically the case today.

Investor
Should support solving of the problem with the testbed only if all other three roles are represented. Any kind of financing goes, as long as it is apparent what the problem is, who the innovators are and who represents R&D. These can be the same actors/persons, but all these interests need to be represented.

Financing
To start with financing, one needs to know who has the right to the knowledge or material. This could depend on whether the financing is governmental, or private. It is critical to define from the start who has the right to the results and how they will be broadcast from the testbed. Profits and commercialization have agreements from the start. There needs to be a clear definition of what financial models to use, licence fee, percentage of profit etc., as this could be different for different partners.

The outcome is not always financially interesting. For instance, one could be preventing losses but not making profit. The profits could be beneficial to the general public, for instance by improving the environment. In any case, it should be agreed from the start what financial models to use.

When sharing profits between the four roles (Figure 4 on pg. 13), the type of financing can impact the distribution of profits/outcomes. Private, public investors or grants affect what model to use. A common solution could be that the innovator gets the main share of the profit.

Should the model or framework for financing in testbeds be developed?
A strong innovator with enough resources and financial power does not need testbed partners. It is typically the innovators seeking environmental solutions that are mostly in need of testbeds.
This is why when setting up the testbed, it is important to have an agreement on the financial models. The distribution of profits and how results will be presented and used, etc., need to be clearly defined at the very beginning.

Risk analysis and management
Example: Wanting to test a wetland compared to filtering at a wastewater treatment plant. What happens when you treat the effluent in the wetland for the testbed? What are the effects on the wetland, negative effects, and risks? Who has the responsibility of assessing this? Risk of downstream effects?

Risk assessment should be part of the project plan, and transparency is very important. If an accident occurs during testing, who is responsible? Responsibility depends on what is being tested, preferably shared so not all is on the company or innovator in order to stay supportive of innovations.

Upscaling
Upscaling depends on what the technology is. Sometimes only one unit needs to be tested if full scale is modular. Some technologies work better on a small scale rather than on a larger scale.

Session 3 – Payments and other schemes for nutrient and carbon recycling

Facilitated by Neil Powell and Thao Do – SWEDESD, Uppsala University

The Baltic Sea Region faces pressing challenges such as nutrient emissions, soil degradation, and biodiversity loss resulting from agricultural production processes. These challenges are likely to increase with climate change. There is a growing need for 'win-win' approaches that reverse CO_2 emissions, manage nutrients and water sustainably, and provide benefits for farmers. "Carbon farming" has emerged as a potential payment scheme to serve these purposes and enable a transition to a climate-smart agriculture. Using carbon sequestration as the organizing principle, carbon farming promotes land management and farming practices that bring about multiple benefits: retaining and recycling nutrients, improving soil structure and water holding capacity, thereby enhancing the productivity of the land, at the same time, addressing climate change mitigation through carbon sequestration.

Carbon farming practices capture excess (waste) CO_2 from the atmosphere and transform this to soil organic carbon (reuse), which is an important component of the global carbon cycle and the basis of soil fertility. Furthermore, under this scheme, farmers that generate carbon credits through on-farm projects can sell the credits to the government through an existing emission reduction framework, or to individuals and organisations that are committed to offsetting their carbon emissions in the voluntary carbon market.

In order to set the scene for the discussion, Neil Powell gave a short introduction on a carbon farming scheme where farmers get paid to sequestrate carbon in the soil. Carbon farming has been implemented substantially in Australia and Canada and demonstrated great impact in generating co-benefits. The question raised was "*Is carbon farming feasible to enact in Europe*"?

The participants were asked to come up with opportunities and challenges related to carbon farming in Europe, from their perspectives and positions. The following is the list brought up during this session:

Challenges	**Opportunities**
- Lack of understanding of carbon farming among different actors. Knowledge gaps exist about the impact of new carbon farming practices (e.g. economic, environmental impact, effectiveness…) - Another scheme on top of other existing schemes would cause confusion among farmers and make it complex for them to navigate. Different concepts lead to achieve more of the same. - It is challenging to change the way farmers think from an economy-oriented to environment-oriented perspective and to convince a critical mass of farmers to implement carbon farming to have a considerable impact on climate change. - There is a need for economic incentives for farmers to participate in a carbon farming scheme. - The challenge of up-scaling: how to scale it up big enough and fast enough to have a climate mitigation impact. - Difficulty in monitoring, auditing and modelling the effects of carbon farming practices in different soils and climates. - Enacting carbon farming requires a systemic transition. - Carbon farming might not be accepted as a form of payment scheme at the EU level. - Current agricultural policies favor monoculture, which will make it difficult to shift to carbon farming practices. - Uncertainty about spin-off effects with other nutrients such as phosphorus and nitrogen. There is a risk of increasing leaching when increasing organic matter in the soil. - How to prevent carbon leakage.	- Animal and crop farmers could potentially increase the cycling of manure across the land use practices in order to increase carbon farming. Carbon farming could initiate manure trading between animal farms and crop farms - There are lots of underutilised lands around the Baltic Sea that could be used for carbon farming. Carbon farming could also be undertaken in urban areas. - Farmers can have higher yields by keeping carbon in the soil, i.e. soil fertility is improved due to carbon farming practices. Due to generally low profit in agriculture, this approach can provide extra income for farmers. - Carbon sequestration can potentially decrease expenditures for nutrients as it reduces losses of nutrients and water and thus increases use efficiency of inputs (e.g. fertilizer, irrigation). - Peer-to-peer learning could be a way to convince farmers to take up carbon farming practices. - Carbon farming is sustainable soil management as it really is about implementing a series of conservation and management practices in the agricultural system to enhance soil organic matter and carbon stocks.

During this session, the participants discussed a number of carbon farming practices and whether they are feasible to be implemented in Europe, as well as the conditions needed to enact payment for these practices. Some key issues were raised during the discussion as below:

- There is little understanding about what carbon farming is and lack of evidence on how well different carbon farming practices perform.
- Is carbon sequestration result-based or measure-based? Should one get paid for results or measures? In Finland, farmers can get well paid for planting cover crops. But the quality of measures is poor. Farmers simply want to save money, so they opt to use cheap measures. So perhaps there is a need for combination of results-based and measures-based payment schemes.
- An example of carbon farming practice in Switzerland: Carbon is directly captured from the air and then stored in containers. Solid carbon (in the form of carbon palettes) is produced and added to the soil.
- Carbon farming can be applied not only in terrestrial but also in marine ecosystems. The ocean can become carbon sinks (by capturing atmospheric carbon).
- There are opportunities for harvesting phosphorus from algae and new plants in the seabed.
- The national trading scheme for carbon offsets is not easy to access. The voluntary carbon offset market is regulated by the Gold Standard, a standard for non-governmental emission reductions projects in the Clean Development Mechanism (CDM), and other climate and development interventions.
- So many programmes involving agro-environmental measures cause too much administrative work for farmers. However, farmers are interested in improving soil management so there is a need to reduce administrative burdens.
- There is a need to exploit carbon sinks i.e. bogs could grow peat.
- Adding biochar into the soil can be considered a carbon farming practice.
- Pricing is key, i.e. it won't happen if the pricing is inadequate; should be valued the same as fossil fuels.
- What is considered as "carbon farming" management practices is not entirely clear. Some of these management practices are agro-environmental measures that have already existed under the Rural Development Programme.

Session 4: Requirements for market uptake of recycled fertilizer products

Facilitated by Søren Marcus Pedersen (University of Copenhagen, UCPH) and Linn Järnberg (Stockholm Environment Institute, SEI).

Recovery and recycling of nutrients from agricultural, industrial and urban waste has been strongly promoted in EU circular economy policies. Within the Baltic Sea region, in recent years, HELCOM has called for enhancement of phosphorus recycling especially from manure and sewage. Despite this, most of the Baltic Sea countries do not yet have a holistic strategy for nutrient recycling. The use of recycled products, such as recycled phosphorus, as agricultural fertilizers is still limited. There have been concerns about high costs compared to traditional mineral fertilizers, contaminants (e.g. residues of pesticides, pharmaceuticals, heavy metals), or consumer perception related to food safety. To increase the adoption of recycled fertilizers, there is a need for greater understanding of the fertilizer market as well as the end-users' requirements and their decision-making processes. This involves not only farmers as primary end-users of reused fertilizer products, but also secondary end-users such as

food-processing companies, food retailers, consumers, and agricultural suppliers (e.g. fertilizer and feed industry).

This session focused on discussing the perceptions, requirements and choices of end-users to enable market uptake of recycled fertilizer products. The following is a summary of the key issues discussed.

Reuse products need to be attractive to farmers in terms of price and quality

- Make reused products more attractive to farmers either through higher quality, or lower price so that they can become a first-hand choice and not a risk. Need to make sure that farmers benefit from recycled products; that it is 'recycled' constitutes a benefit for the farmer. Innovators often forget about the farmers. There is a need to distinguish organic from inorganic fertilizer – so that with clean organic products, the price will be competitive. There are companies working in both areas, and the quality of the organics is becoming better.
- Mineral fertilizers have low efficiency and often use technologies that are old-fashioned. This could be an opportunity for introducing recycled fertilizers – if we can get a higher efficiency (i.e. lower use intensity), farmers may be willing to pay more.
- The format of fertilizers affects their applicability. For instance, pellet form is preferred since it fits the existing machinery. Fertilizer producers need to take into account how it will be applied by the farmer.
- Change the legislation – need a subsidy or the like, to enforce more recycling. Why not impose a tax on mined phosphorus in order to increase user efficiency and reuse?
- Most companies have focused on the recycling component, but not the product quality. The fertilizer industry has been reluctant to share know-how, although this seems to be changing.

Quality criteria should focus on the product, not the origin

- There are regulations in place at EU and national levels for reuse products based on origin rather than content quality. For example, it is not allowed in the EU regulation to use recycled phosphorus from wastewater for animal feed.
- The price of phosphorus from waste sources is higher than conventional fertilizer sources, but rock phosphate typically has a "natural" heavy metal content, for which there is little restrictions in the EU. Only cadmium has received attention.
- There is a need for risk assessment and consumer awareness related to use of raw sewage sludge in agriculture. Recycled phosphorus as a fertilizer from these sources might be considered unsanitary among the general public.

Standardization is key

- Reused nutrient products are still an emerging market with a lot of uncertainties. Regulations and standardization will help, including standardized criteria across product types.
- Recycled fertilizers are more expensive today but have environmental benefits which motivates subsidies. One can learn from the example of cars – for example the "Bonus malus" system in Sweden: a money transfer system where polluting cars are taxed, and "clean" cars are subsidized. We could have a similar system for mineral fertilizers and reused fertilizers.
- Certification by a well-known third-party actor could provide credibility and quality assurance. A sustainability label for food could provide added value. The Marine Stewardship Council (MSC) label (for fish and seafood) is a positive example that is well-known among consumers.

- Need to provide good examples/role models. Role models – associate it with people with high social capital. E.g. Christer Fuglesang recorded a video on the space shuttle of drinking water extracted from urine[2], since that is necessary source of water in space. It is then seen as a "space technology", people associate it with the front line – not "backwards". Need to connect with people in communication and marketing. Need to associate it with status and social capital.
- Legislation on mandatory reuse – need to learn from other sectors. Should learn from Germany and Switzerland that are legislating mandatory recycling of P from various sources including incinerated sludge.

3 APPENDIX 1. LIST OF PARTICIPANTS

	NAME	ORGANISATION/PROJECT
1	Brenda Ochola	Stockholm Environment Institute - SEI
2	Thao Do	SWEDESD, Uppsala University
3	Sten Stenbeck	RISE - Research Institutes of Sweden
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5	Arno Rosemarin	Stockholm Environment Institute - SEI
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7	Turo Hjerppe	Finnish Environment Insitute - SYKE
8	Sari Väisänen	Finnish Environment Insitute - SYKE
9	Jari Koskiaho	Finnish Environment Insitute - SYKE
10	Filippa Ek	Stockholm Environment Institute - SEI
11	Helene Forsberg	Interpreters/ Stockholm Environment Institute - SEI
12	Ulf Liljenbäck	Interpreters/ Stockholm Environment Institute - SEI
13	Linn Järnberg	Stockholm Environment Institute - SEI
14	Solveig Johannesdottir	RISE - Research Institutes of Sweden
15	Erik Kärrman	RISE - Research Institutes of Sweden
16	Karina Barquet	Stockholm Environment Institute - SEI
17	Neil Powell	SWEDESD, Uppsala University
18	Søren Marcus Pedersen	University of Copenhagen
19	Marta Księżniak	Warsaw University of Life Sciences - WULS
20	Tomasz Okruszko	Warsaw University of Life Sciences - WULS
21	Paweł Osuch	Warsaw University of Life Sciences - WULS

[2] A video of Christer Fuglesang drinking water (extracted from urine) on board the space shuttle. (In Swedish): https://www.rymdstyrelsen.se/upptack-rymden/bloggen/2017/03/favorit-i-repris-christer-fuglesang-leker-med-vatten-i-rymden/

22	Mikolaj Piniewski	Warsaw University of Life Sciences - WULS
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26	Georgia Savvidou	Stockholm Environment Institute - SEI
27	Andrea Norgren	Stockholm Environment Institute - SEI
28	Elisabeth Kvarnström	RISE - Research Institutes of Sweden
29	Olle Olsson	Stockholm Environment Institute - SEI
30	Charlotta Möller	RISE - Research Institutes of Sweden
31	Eija Hagelberg	Baltic Sea Action Group, Järki project & Carbon Action project
32	Beata Szatkowska	Gdańsk Water Foundation
33	Erica Toft	Marint centrum Simrishamn
34	Nina Alkærsig Jensen	Symbiosis Center Denmark
35	Prashanth Suresh Kumar	Wetsus/Aquacare
36	Yariv Cohen	EasyMining Sweden
37	Markku Nieminen	City of Hyvinkää
38	Andrzej Tonderski	POMInnO, Gdynia
39	Anna Häger	KTH/SEI
40	David Nilsson	KTH Royal Institute of Technology
41	Berndt Björlenius	RISE - Research Institutes of Sweden
42	Pär Larshans	Ragn-Sells AB
43	Gerald Schwarz	Thünen Institute of Farm Economics
44	Magnus Bergström	Skogsvision AB
45	Annica Brink	Government of Åland/Central Baltic Interreg project SEABASED
46	Kestutis Navickas	Freelancer
47	Ludwig Hermann	European Sustainable Phosphorus Platform
48	Emma Gabrielsson	Race For The Baltic
49	David Marhauer-Nimb	Symbiosis Center Denmark
50	Paula Land	ICLEI Local Governments for Sustainability
51	Anna Calo	Advanced Aerobic Technology Sweden AB
52	Tord Söderberg	Advanced aerobic technologi Sweden AB
53	Kari Koppelmäki	University of Helsinki
54	Erik Sindhöj	RISE / SuMaNu platform project
55	Meelis Sirendi	BONUS

56	Marzena Smol	Mineral and Energy Economy Research Institute of the Polish Academy of Sciences
57	Piotr Czerwczak	Wodociągi Słupsk
58	Robert Żmuda Trzebiatowski	Wodociągi Słupsk

4 APPENDIX 2. AGENDA

08:30 – 08:45 Registration and mingle
08:45 – 09:00 Opening, Moderator – Sirkka Tattari, SYKE
09:00 - 09:15 Welcome remarks – Tomasz Okruszko, WULS
09:15 – 09:30 About BONUS RETURN – Karina Barquet, SEI
09:30 – 09:50 Keynote 1 – Ludwig Hermann, European Sustainable Phosphorus Platform
09:50 – 10:00 Workshop Instructions – Brenda Ochola, SEI
10:00 – 10:30 Coffee break
10:30 – 12:00 Parallel Breakout Sessions 1
12:00 – 13:00 Lunch
13:00 – 13:20 Keynote 2 – Paula Land, ICLEI–Local Governments for Sustainability
13:20 – 14:15 Discussion Panel with Innovators – facilitated by David Nilsson, Royal Institute of Technology (KTH), Sweden

- Aquacare – Prashanth Suresh Kumar (Netherlands)
- Ragn Sells and EasyMining – Pär Lärshans &Yariv Cohen (Sweden)
- Kalundborg Symbiosis Center – David Marhauer-Nimb (Denmark)
- Advanced Aerobic Technology – Anna Calo (Sweden)
- Agroecological Symbiosis – Kari Koppelmäki (Finland)

14:15 – 14:30 Coffee break
14:30 – 16:00 Parallel Breakout Sessions 2
16:00 – 16:45 Presentation of results from parallel sessions in plenary
16:45 – 17:00 Closing remarks – Olle Olsson, SEI
19:00 – 23:00 Dinner

5 APPENDIX 3. LUDWIG HERMANN'S PRESENTATION

6 APPENDIX 4. PAULA LAND'S PRESENTATION

7 APPENDIX 5. CHARLOTTA MÖLLER'S PRESENTATION

8 REFERENCE

Powell, N., M. Osbeck, R. K. Larsen, K. Andersson, G. Schwartz, and M. Davis. 2013. "The Common Agricultural Policy Post-2013: Could Reforms Make Baltic Sea Region Farms More Sustainable?" Stockholm Environment Institute (SEI).