The Time is Now
Accelerating Local Solutions for Global Change
IIIEE SSC-REPORT 2019 | LUND UNIVERSITY
Destinations

Kaliningrad, Russia
Västernorrland, Sweden
Nur-Sultan, Kazakhstan
Figueira da Foz, Portugal
Mallorca, Spain
Lesvos, Greece
Nairobi, Kenya

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Introduction

The time to act is now. Sea levels are rising. Biodiversity is disappearing. Our climate is changing. Decisive action is needed if the world is going to address the many environmental problems by which it is beset. If we rise to the occasion, we can seize the moment and chart a new course.

Our shared passion for the environment, and vision for a better future, is what motivates each of the twenty-seven authors of this report. As Master’s students studying Environmental Management and Policy (EMP) at the International Institute for Industrial Environmental Economics (IIIEE) in Lund, Sweden, we are committed to the IIIEE’s mission of accelerating the transition to a climate-neutral and resource-efficient economy by producing and sharing actionable knowledge that can benefit society.

The EMP programme is defined by both its dual focus on how businesses and governments can contribute to a sustainable future, and its commitment to hands-on learning experiences. Embodying this commitment is the Sustainability Solutions in Context project which has become a hallmark course of the EMP programme. During this project, seven teams were sent to countries across Europe and beyond to engage with different issues concerning sustainability and the environment. Each project was curated by the IIIEE in collaboration with local clients to provide a unique learning experience, but also present an opportunity for theoretical knowledge to be applied in a practical context, adding value to both the client and the planet.

The following pages present the investigations into: creating a climate adaptation plan in Portugal; promoting ecotourism in Russia; utilising olive oil production waste in Greece; developing business models for Biochar in Spain; measuring investment impact in Kenya; collecting PET bottles in Kazakhstan; and supporting sustainable consumption in Sweden. This resulting report is the culmination of over 7 000 hours of work on these seven projects. Each project had its own challenges and local context, but they are all linked and demonstrate the prevalence of environmental issues across the globe. These projects are not theoretical undertakings but have practical consequences and tangible impacts.

We hope these projects illustrate the changes that can be made to accelerate our transition to a more promising future. There is a saying that the best time to plant a tree is ten years ago, the second-best time is now. The best time to solve our global environmental challenges was ten years ago, and the next best time is now.
Climate Adaptation
Figueira da Foz Municipality
Acknowledgements

We would first like to thank the IIIEE for giving us the opportunity to engage in such an enriching project in the beautiful country of Portugal. Special thanks to our supervisor Åke Thidell for his constant words of motivation, exquisite note taking, and extensive knowledge of Port wines.

We are very thankful to our interviewees for taking the time to answer our barrage of questions, providing us with useful inputs and accommodating the interviews in English. Rest assured, your English was way better than our Portuguese.

We are deeply grateful to the municipality of Figueira da Foz for their engagement and valuable insights, and for making sure we were given everything we needed for our project. Finally, we are especially grateful to our point of contact, Henrique, for coordinating our entire trip, providing us food (for thought) and showing us a side of Figueira that tourists often do not get to see.

The Team

**Levke Albertsen** is from Germany. She holds a BSc in Environmental Sciences from Leuphana University Lüneburg and specialised in environmental assessment. Levke is passionate about finding solutions for sustainability problems in sectors such as mobility, raw materials, and energy.

**Ramya MA** is from India and holds a Btech in Chemical Engineering from Anna University. Previously, she worked on research projects in the field of environmental engineering and with nature conservation NGOs. She is interested in climate policy and sustainable development.

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**Mariana Sanchez** is from Mexico. She holds a BA in International Affairs from the Monterrey Institute of Technology and Higher Education. She previously worked at Mexico’s Ministry of Economy. She is interested in international trade, environmental policy and climate change issues.
Moving from Strategy to Action

Kickstarting Climate Adaptation Action in Figueira da Foz, Portugal

By Levke Albertsen, Ramya Mandyam Anandampillai, Justin Rehn, Mariana de la Luz Sanchez Vargas

Portugal is known for its beautiful coast and exceptional wine. However, in the past couple of years the country has made headlines due to several disasters including cyclone Leslie (2018) and massive wildfires (2017) in central Portugal, resulting in a number of casualties and injuries. These are just two examples of events that have intensified and are expected to increase in frequency due to climate change.

While it is crucial to mitigate climate change as much as possible, certain changes are unavoidable due to historic and near-term greenhouse gas emissions, forcing countries such as Portugal to adapt [1]. As part of the adaptation process, Portugal presently follows a National Climate Change Adaptation Strategy (ENAAC) and Plan (P-3AC) to respond to such challenges.

However, adaptation is also needed at a local level, prompting thirty Portuguese municipalities to develop adaptation strategies in recent years, as part of the ClimAdaPT.Local project. Our client, the municipality of Figueira da Foz (Figueira for short), participated in this initiative and adopted a comprehensive adaptation strategy in 2016 [2].

Client

Figueira is a coastal municipality located almost halfway between Porto and Lisbon with a population of around 62 000. Its geography is characterised by a long coastline, surrounding forests, and the Mondego River, passing through the city. The main economic activities include pulp and paper production, naval construction and fishing.

The direct contact was Henrique Simões, a Strategic Environmental Analyst within the Urban Planning department of Figueira, who is coordinating the climate change adaptation process in the municipality.
FIGUEIRA DA FOZ, PORTUGAL

Image 3.: Henrique Simões (right) explaining a map of Figueira to Åke Thidell

Task

Since the adoption of its climate adaptation strategy, Figueira has proposed a number of options to enhance the climate resiliency of the municipality. As a next step, the municipality aims to develop an action plan specifying timeframes, funding sources, and monitoring mechanisms in order to operationalise this strategy.

After consulting with Henrique Simões, the scope of our work was defined as helping the municipality jumpstart the action planning process by:

➢ Illustrating important methods and steps related to climate adaptation
➢ Providing best practices in action planning based on other municipalities
➢ Offering initial examples and a proposed template for adaptation actions

Approach

In order to solve the task, a four-step research process was incorporated, split across desktop and field research (see Figure 1).

Figure 1: Research process

The main objective of the background & methodology stage was to gain a general understanding of climate adaptation including its political implications and critical success factors, and more specifically, the process by which adaptation actions plans are developed.

Next, six adaptation action plans from Cascais, Leiria and Loulé in Portugal; Dublin, Ireland; Barcelona, Spain; and Kristianstad in Sweden were used as case studies to gain a better understanding of potential actions and assess the use and presentation of action plans in municipalities with comparable challenges regarding climate change adaptation.

The final two stages of the research approach involved nine semi-structured interviews with municipalities; regional authorities, universities and consultants; and local stakeholders such as a water company and pulp producer. Before and after the interviews, informal discussions were held with Henrique Simões to gain additional context into the stakeholder’s roles and responsibilities, and to clarify responses.

Image 4: Visit at Leiria municipality
In the next sections we present the progress and current state of Figueira in their adaptation process, the challenges they face, and our recommendations based on identified best practices.

**Adaptation process**

In the process of institutionalising climate change adaptation, Figueira has followed the methodology of the Urban Adaptation Support Tool (UAST) provided by the Covenant of Mayors for Climate & Energy. This tool serves as a practical guidance for the adaptation process in urban areas and outlines six steps as shown in Figure 2 [3].

As the first step, Figueira built the foundation for the adaptation process by assigning the responsibility of coordination to the Urban Planning department, identifying relevant stakeholders and obtaining high level political support from the city’s counsellors.

In step two, the main climate risks and vulnerabilities were assessed (see Table 1). These include strong waves and sea level rise, which can cause coastal erosion and damage to infrastructure and vegetation; increased temperatures and heat waves, which increase the likelihood of forest fires and threaten biodiversity and human health; excessive precipitation, which can create flooding and mudslides; and strong winds, which can cause property damage [2].

![Image 5: Visit at Edge Pulp Industry (Celbi), S.A.](image)

![Figure 2: Urban Adaptation Support Tool Process](diagram)

**Table 1: Climate risk assessment for Figueira [2]**

<table>
<thead>
<tr>
<th>Main events/climate impacts</th>
<th>Climate risk</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current</td>
<td>Medium term (2041-2070)</td>
<td>Long term (2071-2100)</td>
</tr>
<tr>
<td>Strong waves/Sea level rise</td>
<td>4</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>High temperatures/Heat waves</td>
<td>4</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Excessive precipitation (flooding)</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Excessive precipitation (mudslide)</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Strong winds</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
Based on these risks, adaptation options were identified in step three and assessed and prioritised according to several criteria in step four. As a result, thirty adaptation options ranging from broader options such as *Improvement of the rain runoff systems in critical areas* to more specific options such as *Artificial feeding of the beaches in the south of the county through the dredging of the Mondego River in the port channel of Figueira* were selected and integrated in the adaptation strategy. The adaptation options mostly addressed spatial planning, forest and agriculture as well as information and awareness.

The implementation of adaptation actions in step five is usually guided by the strategy and specified in an action plan. Despite the lack of a formal action plan, Figueira has already identified flood risk zones and integrated *no-construction* areas into a Municipal Master Plan, revised forest fire resistance and resilience regulation, and is currently separating the storm drainage system from its sanitary sewer system.

The final step of monitoring and evaluation is necessary to assess both the status of implementation and whether the objectives for adaptation are being achieved with the given actions. Based on the findings in this step, the strategy and action plan may be revised. Thus, the adaptation process is iterative and requires regular engagement of staff and stakeholders.

**Challenges in Figueira**

When it comes to moving from the climate adaptation strategy to action (step five), Figueira faces several challenges. The first one originates from within the municipality. Currently, Figueira does not have a dedicated team working on climate adaptation. Instead, all employees are expected to work on this topic in addition to their regular workload.

Besides the difficulty of taking on more responsibilities, for many municipal employees it is unclear what their exact responsibilities would be in relation to climate adaptation, considering the action plan has yet to be developed. In some cases, there is also a need to further awareness about the municipal work that would fall within the umbrella of climate adaptation.
Progress in the implementation of climate adaptation options also faces financial constraints. Figueira is a small municipality with a limited budget for climate adaptation. The adaptation strategy was developed with a grant from the European Economic Area and the Portuguese Carbon Fund. Figueira plans on applying to EU calls to fund future projects, but without an action plan it is ineligible for many of these grants.

In addition, most EU grants cover only a share of the total cost of a project, so Figueira should be able to demonstrate it has sufficient funds to cover the remaining cost. At the political level, ongoing changes in Portugal to promote further decentralisation will increase budgetary and staff pressures for municipalities [4], as they have to take on more responsibilities in areas like education, health, and transport, among others.

The engagement with external stakeholders is another area that could be improved. During the drafting of their climate strategy, Figueira worked in close coordination with a wide variety of public and private actors in the prioritisation of their adaptation options. Together, they identified possible partners for future work and created five working groups: Water Resources; Tourism and Green Areas; Energy, Health and Buildings; Coastal Areas; Agriculture and Forest, with the last two groups being the most active. It is worth noting that in the absence of an adaptation action plan, keeping stakeholders engaged in a consistent and meaningful way becomes even more challenging.

The organisational issues, budgetary pressures, and difficulties with engaging stakeholders described above have already caused some delays in the timeframes envisioned in implementing Figueira’s climate adaptation options.

Recommendations

Based on our findings from the initial and field research, we presented our recommendations with the overarching aim to jumpstart the action planning process in front of the Mayor, a number of City Councillors, and other external stakeholders in Figueira’s City Hall. In the following section, we provide a summary of these recommendations.

Internal organisation

The best-case scenario for Figueira to make progress on climate adaptation would be to...
put together a team working exclusively with this issue, but under current budgetary and staffing pressures, it seems rather complicated. The municipality could instead resort to alternative solutions for filling the staff gap, such as hiring interns or obtaining funding to employ people on a project basis.

When it comes to increasing internal engagement with the adaptation strategy, the development of the action plan will help clarify responsibilities. Additionally, implementing internal awareness campaigns could help improve understanding of the link between climate adaptation and the work of different departments. It is also advisable to integrate a formal interdepartmental climate adaptation task force to promote regular communication and coordination between departments in the municipality.

**Stakeholder involvement**

By jumpstarting the development of the climate adaptation plan for Figueira, the municipality has the chance to reinvigorate the engagement of external stakeholders. It is important that the municipality works closely with all relevant actors during the implementation, monitoring, and evaluation of the action plan. As in the case of the internal stakeholders, having an action plan will also help stakeholders get a clearer picture of their roles.

We also suggest the reorganisation of the current stakeholder working groups based on five predominant themes found in the adaptation options (see Figure 3). Under the proposed restructure, the Coastal Protection as well as the Forest and Agriculture groups would remain, but three new groups would be added: Spatial Planning and Development, Water Management, and Information and Awareness.

With the suggested reorganisation of the working groups, it would be easier for Figueira to link the different stakeholders with specific adaptation actions to work on, facilitating stakeholder engagement.

**Communication and awareness**

To enhance communication and awareness regarding climate adaptation, Figueira could implement practices that have proven successful in other municipalities.
1. Create an adaptation brand

In Loulé, a municipality in southern Portugal, creating a common brand for activities related to climate adaptation has improved internal and external communication (see Image 10). A simple and clear brand logo can help improve engagement and awareness amongst stakeholders and integrate activities across different municipal departments under the common umbrella of adaptation.

![Image 10: Loulé's climate brand logo](image)

2. Link adaptation actions to the SDGs

The Sustainable Development Goals (SDGs) are “a blueprint for a better and more sustainable future” set out by the United Nations [5]. The SDGs have become increasingly well-known and used by stakeholders to understand and assess their commitment towards sustainability. Hence, linking climate adaptation actions to the relevant SDGs would not only make it easier to visualise and communicate the benefits of an action but also understand other climate impacts or areas addressed by it.

3. Focus on actions with tangible results first

A success factor in other municipalities is the prioritisation of actions that are easy to implement, commonly referred to as low hanging fruits. To gain public support, they also focus on actions that carry tangible and visible outputs or benefits for citizens. For example, Figueira has installed drinking water fountains to combat dehydration due to increasing heat waves (see Image 11). By linking negative health impacts with climate change, adaptation becomes more accessible for stakeholders.

![Image 11: One of the drinking water fountains in Figueira](image)

**Funding**

Generally, there are three main potential sources for financing local adaptation measures in Figueira [6]:

- Government grants (EU, national, municipal)
- Bank/Financial loans or guarantees
- Private stakeholder funding such as direct investment, crowdfunding or green bonds

The interviews with other municipalities provided evidence that governmental funding from the national or European level is by far the most employed financing within climate adaptation in Portugal. The EU’s long-term budget is expected to increase in the period 2021-27 and the share of climate-related spending might increase from 20% to 30%. Thus, it is key for Figueira to acquire knowledge on these funding mechanisms and their application requirements to qualify for such financing opportunities.
Financing adaptation measures via bank loans or private investments is uncommon thus far because the measures usually do not provide short-term financial returns. One strategy to increase private investment or public-private partnerships (PPP) could be to stress the immediate benefits and/or co-benefits of adaptation measures for affected sectors and groups. Moreover, market instruments such as green bonds can be a promising form of climate finance for cities and municipalities. Thus, it could be worthwhile for Figueira to gain economic knowledge to utilise these alternative funding opportunities.

Furthermore, the early integration of adaptation needs into planning (e.g. urban, water management) and regulation (e.g. building standards) can provide co-benefits at no or limited additional costs [6]. These co-benefits can help avoid costs for adaptation by reducing the need for larger investments later on. Thus, Figueira should continue their efforts to mainstream adaptation as they did with defining no-construction areas in the Municipal Master Plan based on flood projections.

**Actions**

With regards to the actual action plan, it is equally important that it provides a set of actions under each adaptation option while also aiding the decision maker on how to implement them. This is why we propose the use of a template describing various aspects outlined in the UAST for each identified action (see Table 2).

The proposed template first provides an overview of each action in terms of the climate risk(s) addressed and a short description of the action, its justification and how it can be implemented. Then, a key leader and corresponding partners are defined, enabling effective monitoring and coordination of the action.

**Table 2: Proposed action template**

<table>
<thead>
<tr>
<th>Action</th>
<th>Name of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate risk</td>
<td>What risk(s) does it address?</td>
</tr>
<tr>
<td>Description</td>
<td>Short description of action</td>
</tr>
<tr>
<td>Leadership</td>
<td>Who takes the lead?</td>
</tr>
<tr>
<td>Partners</td>
<td>Who else can contribute?</td>
</tr>
<tr>
<td>Timeframe</td>
<td>Estimated implementation time?</td>
</tr>
<tr>
<td>Investment</td>
<td>Estimated investment costs?</td>
</tr>
<tr>
<td>Funding</td>
<td>Which are potential sources?</td>
</tr>
<tr>
<td>Indicator</td>
<td>How to monitor success?</td>
</tr>
</tbody>
</table>

Further aspects crucial for implementation, such as an estimated timeframe and investment are provided along with the potential sources for funding. This is targeted at overcoming the barrier of reduced knowledge on funding sources amongst decision makers. Finally, every action should be paired with an indicator in order to ensure effective monitoring. The indicator can be both a process-based indicator, monitoring the progress in implementation, or an outcome-based indicator, measuring the effectiveness in achieving the intended outcome.

As part of the client report, we provide a set of suggested actions for the five thematic areas using the proposed action template. An example of such an action is to create a municipal forest manual to help increase forest resilience. Our intent is that the proposed actions serve as a starting point.
for the discussion with stakeholders to develop Figueira’s action plan.

Conclusion

In recent years, climate change mitigation and adaptation have become increasingly important issues on the global agenda. However, our month-long journey into climate adaptation and the collaboration with Figueira has taught us that while climate change is global, adaptation is local. Adaptation actions undertaken by one community to protect itself from coastal erosion may differ significantly from another community situated only a short distance away along the same coast.

In the case of Figueira, substantial strides have already been made through the adoption of an adaptation strategy. Still, as a signatory to the Covenant of Mayors and as a community that has experienced devastating climatic events in recent years, Figueira is committed to taking the next step in its preparations.

We have highlighted three key areas for future success in Figueira’s development of an action plan: close collaboration with internal and external stakeholders, ongoing communication and awareness, and knowledge development on funding opportunities for climate adaptation.

There is certainly a lot left to do to make the municipality of Figueira a more resilient and sustainable community. Political will and progress are present in certain instances and we are confident that by combining this momentum with our recommendations, the community can secure the capacity to move from strategy to action and become a leader in climate adaptation in the years to come.
References


List of people interviewed

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Gomes, H. Deputy Director. CEDRU. 22 October 2019.


Mota, R. Technician. CIM Coimbra Region. 23 October 2019.


Ecotourism Development
Vishtynetskiy Administration
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The Team
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Roohi Ghelani is from Singapore and holds a B.Sc. in Environmental Science. She has a background in sustainability consulting and a strong interest in environmental conservation and nature photography.

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Aziliz Le Rouzo is from Brittany, holds a B.Sc. in Business and Administration from HEC Montréal in Canada and has experience in consulting. She has a strong interest in environmental policy, ecosystem protection and restoration.
The Hunt for a Sustainable Future

An Exploratory Study of Development Pathways in the Vishtynetskiy Regional Nature Park

By Yu-Ting Chiu, Maya Gryesten Fields, Roohi Ghelani, Aziliz Le Rouzo

What is the cost of development? Can natural conservation and socio-economic development co-exist? These are some of the questions faced by the people and administration of the Vishtynetskiy Regional Nature Park, Kaliningrad Oblast, Russia. In recent years, political plans for development have included increasing the number of tourists to the area. This presents challenges to preserving the natural resources of the Regional Nature Park. In addition, since past development efforts excluded local residents, trust in governmental actions is low, and there are tensions between the visions of local residents and the regional government.

As a result, the team was invited by Ms. Amal Samerkhanova, Head of the Department for Environmental Education and Touristic Development of the Vishtynetskiy Regional Nature Park, to provide strategic support in the sustainable development of the Regional Nature Park. To achieve this aim, we defined the following objectives.

Our Objectives

- Learn local perspectives and visions for the future of the Regional Nature Park
- Assess potential for ecotourism
- Provide recommendations to support the sustainable development of the Vishtynetskiy Regional Nature Park

Our Approach

To fulfil these objectives, we first conducted an extensive literature review. We identified that it was necessary to obtain a greater understanding of sustainable development, ecosystem services, ecotourism, and innovative management methods to improve the dialogue between local stakeholders and the government. We then analysed this in the specific context of the Regional Nature Park.

In the next phase, we spent four days in the Vishtynetskiy Regional Nature Park and two in Kaliningrad city conducting interviews with key stakeholders and noting observations. These included a total of 14 informal semi-structured and conversational interviews with local entrepreneurs, small-scale business owners, farmers, youth workers, experts,
community leaders, and government officials.

These types of interviews were determined to be a valuable method to allow personal reflections and visions of the Vishtynetskiy Regional Nature Park to surface. In addition to the 14 key stakeholders, opinions from 20 school children aged eight to 18, and two teachers were observed at a Nesterov school through an interactive presentation and subsequent informal discussions on sustainable development. One activity centered on asking students to share how they envisioned the Vishtynetskiy Regional Nature Park in 30 years in the future.

Site visit observations and interviews were analysed and grouped into these key themes: Nature Appreciation, Communication, Park Restrictions, Economic Development, Tourism and Access, and Challenges of the Frontier Region.

Based on our research, interview findings and observations, we conclude this report with specific recommendations for the sustainable development of the Vishtynetskiy Regional Nature Park.

Limitations

The team faced several challenges in project planning and implementation because of time and resource constraints. Our scope of work evolved over the course of the project to better accommodate the Regional Nature Park administration’s specific needs due to ongoing developments in the area.

As all interviews were arranged by the client, statements gathered from the interviews may only represent the perspectives of those individuals most involved in Regional Nature Park activities. These may therefore not represent the opinions of other residents. Another limitation is that the team does not speak Russian and was reliant on Ms Samerkhanova’s translations. The dynamics of our interviews may have been influenced by the presence of Regional Nature Park officials, and in some cases a journalist.

In addition, we were unable to include the two large agribusinesses in the region, Miratorg Agribusiness Holding and Dolgov Group, in the research process due to time constraints. As they own large amounts of land in the periphery of the Regional Nature Park, the omission of their opinion may have affected our results.

Vishtynetskiy Regional Nature Park

The Vishtynetskiy Regional Nature Park was established in 2011 and is located in the southeast corner of the Kaliningrad Oblast, approximately two to three hours from the city centre. Kaliningrad is a region often referred to as a ‘double periphery’ because it was excluded from the major modernisation processes in both the European Union and
KALININGRAD OBLAST, RUSSIAN FEDERATION

the Russian Federation. The Vishtynetskiy Regional Nature Park shares a border with Lithuania and Poland and contains part of the expansive Rominska Forest. The Rominska Forest is one of the largest uncut lowland forests in Central Europe and about two thirds, approximately 40 000 hectares, are located within the Russian Federation. Historically core activities in the Rominska Forest include logging and hunting [1].

The Regional Nature Park is split into three key zones as per the Vishtynetskiy Regional Nature Park Strategic Development Plan [2]. In the Strict Security Zone, access and use is entirely restricted. In the Protection and Recreation Zone, recreation on foot, bicycle, or horseback is permitted. In the Buffer Zone, cultivation of food, fishing and other developments are allowed.

**Network of Actors**

The Vishtynetskiy Regional Nature Park is host to a large and complex actor network. These include small villages and businesses from small-scale such as beekeeping, agritourism and horticulture, to large agribusinesses working with livestock breeding and cow farming. In total there are circa 11 250 inhabitants distributed over 21 villages. The population density is the lowest in the Kaliningrad Oblast, as is life expectancy [1].

The Vishtynetskiy Regional Nature Park is regulated by the Ministry of Natural Resources and Ecology of the Kaliningrad Oblast. The activities in the Park are under the Regional Park Vishtynetskiy administration and the villages are governed by the municipal “Nesterovskiy city district”.

As the Rominska Forest crosses the borders of Russia, Poland and Lithuania, the Russian Federal Security Service (FSB) has jurisdiction over areas within 5 km of the border on the Russian side. Special restrictions are imposed by the FSB and permits must be obtained by visitors coming from outside of the Kaliningrad Oblast, including those from mainland Russia.

In addition to such direct management, other government agencies such as the Ministry of Agriculture and Development,
the Ministry of Tourism, and many more indirectly govern the rules and regulations of the region.

The multitude of decision-makers and stakeholders, and their varying levels of responsibilities and jurisdictions complicates the management of the Regional Nature Park.

**Understanding People and Nature**

**Sustainable Development and Ecosystem Services**

Sustainable development is commonly understood as “development which meets the needs of current generations without compromising the ability of future generations to meet their own needs” [3]. In the context of the Vishtynetskiy Regional Nature Park, political decisions play a crucial role in influencing the performance of ecosystem services and how they affect the well-being of current and future generations. Ecosystem services are the benefits ecosystems provide to people and can be categorised into four groups [2,4].

Provisioning services provide resources for human consumption, which in the Vishtynetskiy Regional Nature Park include mainly timber, fuelwood, meat, fish, berries, mushrooms, herbs, honey, water and air.

*Supporting services* provide resources for the ecosystem to continually function, such as soil formation and nutrient cycling.

*Regulating services* stabilise the operation of nature, for instance, soil stabilisation, purification, and climate regulation.

*Cultural services* provide immaterial benefits such as meeting recreational, spiritual, and religious needs.

These services contribute to overall human well-being in the greater Vishtynetskiy area. However, demographic changes and human activities such as agriculture, tourism and policy change may pose a challenge to the ecosystem services provided. From this point of view, it is clear that natural systems and socio-economic systems are highly interdependent. As a result, trade-offs often need to be made when prioritising one over the other. For example, increasing tourist infrastructure may require clearing forested areas.

This is a serious challenge, as the recovery of an ecosystem or its services is difficult and may even be impossible. It is therefore important to understand these systems and interlinkages before making political decisions. As plans to expand tourism in the greater Vishtynetskiy area are underway, there is a need to ensure this development does not come at the cost of natural systems.
The Prospects of Ecotourism

Today’s conventional mass tourism has been characterised by its drastic effects on the environment as well as the stress it imposes on local populations. Waste accumulation, significant increases in sewage and land-use, reduction in forest cover, coastal modification, habitat loss for many species and intense pollution are amongst the most well-known effects of concentrated mass tourism [5]. Additionally, economic benefits from tourism may not always be distributed equitably among locals.

On the other end of the spectrum, ecotourism provides multiple advantages. Ecotourism is a touristic trend which is defined by the International Ecotourism Society as “responsible travel to natural areas that conserves the environment and improves the well-being of local people” [5].

Ecotourism relies on a harmonious relationship between tourists, locals, and nature. Notable examples include hiking, picking berries, collecting mushrooms, rock climbing, fishing, kayaking, sailing and bird watching. The reconciliation of local needs and natural protection makes ecotourism a more sustainable form of tourism [5]. More than solely being considered as an activity, ecotourism can also be seen as a model for sustainable development. In Scandinavian countries, which are widely known to be leaders in sustainable development, the increase in interest for ecotourism has been such that an ecotourism label was developed by Sweden in 2002. Naturens Bästa, or Nature’s Best, aims to guarantee that activities contribute to nature conservation and the protection of the cultural heritage of the destination. While displaying the Nature’s Best label can be of strategic marketing importance, there are many reasons why an area might decide to focus on ecotourism as a means for sustainable development [5].

In addition to being environmentally conscious, ecotourists also value activities that will enhance their learning of the local culture and environment. This dimension of ecotourism implies that by gaining greater knowledge of a certain area, tourists may tend to behave more responsibly. Moreover, ecotourism targets small-scale, isolated and carefully planned experiences, located in unique peripheral environments. This desire to get off the beaten track leads ecotourists to venture into more rural areas otherwise excluded from main tourist centres. A low to medium flow of tourists can be particularly beneficial for rural development. The provision of guesthouses by locals can encourage tourists to extend their stay while consuming local goods and craftsmanship [5].

In addition, the cultural orientation of ecotourism suggests that ecotourists are more willing to take part in small-scale guided tours, workshops and activities, hence allowing locals to retain their traditional activities. Improved communication with local communities also helps ecotourists to better understand the local rules applicable to the environmental protection of the area.

Ecotourism is then a means of enhancing economic activities in a designated area while preserving the local culture and environment.
How Many Are Too Many?

With potentially harmful impacts of uncontrolled tourism, it is important to manage tourist flows within appropriate levels. A common method used to do so is carrying capacity, which aims to define maximum acceptable numbers of visitors [6]. The calculation of carrying capacity is a complex process in which many components must be considered. These include physical, ecological, economic, perceptual, social and political components. It is not about calculating a single concrete value but rather an adaptive method that depends on the entire tourism development process.

Methods for Rebuilding Trust

With this in mind, we assessed community engagement and management of protected natural areas around the world to understand the best practices for sustainable development. Within these best practices, the management methods, tools, processes and initiatives broadly revolved around two common themes: enhancing collaboration between stakeholders and increasing benefits to local residents.

Increasing Collaboration

Authorities have used various methods to increase the level of engagement of local residents and ensure that they are provided with different degrees of decision-making ability. Encouraging individuals to come together and create a common vision helps to develop a sense of responsibility, and this can be formalised by creating official and meaningful roles for various local stakeholders [7]. It is key to ensure equitable distribution of these benefits by including typically underrepresented social groups such as youth, women and the elderly [8]. Finally, it is important to nurture existing grassroots initiatives and ensure they are highlighted as these often go on to inspire further action among others.

Increasing Benefits

In addition to involving stakeholders, it is necessary for them to feel tangible benefits. These may include grants or government support for certain sustainable activities [9]. In a more transactional manner, direct financial compensation could be provided in return for stakeholders avoiding the use of certain resources or ecosystem services [10].

Bringing It Together

A comprehensive approach would involve both components. This can be done by taking a holistic view and basing actions on a deep understanding of the socio-
ecological systems and their ability to absorb changes [4]. A stepwise process could involve a strategy for empowering local stakeholders, building skills, ensuring certain ecosystem services remain accessible, and economic diversification [4].

**Observations and Findings**

This section presents the information we collected from our interviewees and the overall observations we made during our stay in the Kaliningrad Oblast. This information allowed us to better contextualise the theory described above and understand what recommendations we could make to the Regional Nature Park administration.

**Nature Appreciation**

When asked to visualise the community and the Vishtynetskiy Regional Nature Park in 30 years, all interviewees expressed a wish for the natural areas to remain undisturbed by major human intervention. It was noted that schoolchildren used the word “Our” to describe the Regional Nature Park, illustrating strong ownership and connection to nature. Further, multiple interviewees mentioned the “Spirit” of the forest, indicating benefits derived from spiritual and cultural ecosystem services. From observations, it was clear that residents within the greater Vishtynetskiy area are strongly dependent on provisioning ecosystem services such as food products and collection of fuelwood. Further, appreciation for historical and ecological information on the current park signage was expressed as important to multiple stakeholders. This suggests the perceived educational value of the Regional Nature Park.

**Communication**

As expected, local interviewees expressed strong dissatisfaction with being excluded from the development dialogue in the past, but also perceived the current Regional Nature Park administration as more actively including the local community in the development of future strategies. All local interviewees stated a willingness to take on greater management responsibility.

It was observed that the Regional Nature Park administration, while physically located in Kaliningrad city, spend two to three days a week within the borders of the Regional Nature Park working with
conservation, environmental education, and planning activities with key stakeholders. Some challenges presented by our interviewees were the high turnover rate of managerial officials, as well as some level of local mistrust in government-run activities.

Many local business owners expressed confusion regarding the Regional Nature Park’s zonation and their designated restrictions. Nevertheless, it was noted that the current Regional Nature Park administration had started to clarify these zoning aspects through updated maps and pamphlets.

One of our interviewees, a social researcher who had previously conducted surveys in the greater Vishtynetskiy area, reminded us not to let the opinions of the most entrepreneurial citizens reflect the views of all. The interviewee was concerned that this might overshadow the voices of less active Regional Nature Park residents.

**Park Restrictions**

While all interviewees were positive about the creation of the Vishtynetskiy Regional Nature Park in 2011, many remarked that certain restrictions should be lifted for increased local trust in the bureaucratic system. The most contested restriction was a driving ban issued to all Regional Nature Park roads as per the Federal Law on Protected Areas [11], except those designated for common use. To drive on restricted roads, a special permit must be obtained from the Regional Nature Park administration office in Pugachevo. Locals complained that “the best spots for berry and mushroom collection” are located off restricted roads, and local residents perceive it to be inconvenient to apply for a permit every time they wish to access certain territories of the Regional Nature Park. In addition, many residents expressed confusion with the location of the restricted roads. In some cases, residents mentioned having incurred fines whilst unknowingly driving on a restricted road. We also observed that there was a lack of road signs clarifying the restrictions.

Multiple interviewees agreed with such restrictions for outsiders and tourists but requested the Regional Nature Park administration to provide year-round access for local residents. Key authoritative figures remarked on how challenging the allocation of such extended rights would be due to few residents being officially registered in the region. Finally, a respected local leader noted that many local residents often disregarded current Regional Nature Park rules.

**Image 6: Signs in the Vishtynetskiy Regional Nature Park**

**Economic Development**

While key stakeholders and local residents wish for continued natural preservation of the Regional Nature Park, an underlying desire for greater economic prosperity was stated by many. We observed areas with abandoned houses in states of disrepair. One local leader even mentioned that the
“towns are dying”. We also heard third person accounts that some people perceived jobs to have been lost due to the creation of the Regional Nature Park.

With growing agricultural development by the two large agribusinesses, small-scale farmers are increasingly dependent on their assistance. In general, we observed that the majority of local residents live on a subsistence basis.

Finally, we heard from multiple interviewees that bureaucratic barriers for local entrepreneurs exist, as well as a lack of sound knowledge on the legal and financial aspects of running businesses. Many expressed an interest in gaining new skills in business development. There was also a broader interest in knowledge sharing within the community.

**Tourism and Access**

![Image: Tourist information in the Vishtynetskiy Regional Nature Park]

While local interviewees were positive about an increase in the number of tourists, it was stressed that tourism should remain small-scale and local, with no large hotels, resorts, or major external investors. One interviewee in the Nesterov regional government presented the opinion that the area was too unattractive for development; “there are no restaurants, no cafés, who would come here just to walk in the forest?”. Other residents were more optimistic and presented ideas including historical and ecological guided tours and chocolate workshops.

It became clear that the handful of guesthouses, activity providers, and shops were currently only capable of catering to a small number of visitors, and at present struggle to sustain their businesses. Some interviewees highlighted that part of the reason for low visitor numbers was lack of public transportation to the greater Vishtynetskiy area. Additionally, the trail maps currently displayed in the park are outdated. It was also observed that the Regional Nature Park is not well equipped with bins and that waste separation is not in place at the moment.

**Challenges of the Frontier Region**

As the Vishtynetskiy Regional Nature Park is part of the larger Rominska Forest, interviewees perceived the national border as a barrier to both international collaboration regarding the protection of natural areas, as well as accessibility for Regional Nature Park visitors. The Nesterov regional government in particular, noted that this was an immense challenge to increasing touristic developments, as the FSB restricts visitation within 5 km of the border to those with special permits. These 5 km are host to some cultural and natural monuments, including the popular Lake Vishtynetskiy.

**Recommendations**

Based on the above analysis, recommendations for sustainable development in the Vishtynetskiy Regional Nature Park were formed. The
recommendations are grouped into the broader categories of infrastructural, managerial, political and regulatory, and those involving knowledge creation.

*Physical Infrastructure*

Improvements within the Regional Nature Park should include updated maps, clear signs on restricted roads, and waste bins. Public transport options for the greater Vishtynetskiy area should be investigated; this could initially begin with a bus to and from Nesterov twice a day and expanded over the longer term to transport to and from Kaliningrad city. Additional Regional Nature Park infrastructure should then include hospitality venues such as cafés and restaurants, shelters, and composting toilets to better accommodate Regional Nature Park visitors. In the longer term, it is recommended that waste separation and the necessary supporting infrastructure is investigated and implemented, perhaps beginning in Nesterov.

*Management*

Under the new administration of the Regional Nature Park, communication has improved significantly, and we recommend that this should be continued. However, to further improve stakeholder engagement, it is recommended that a council comprised of local citizens should be formed granting these representatives greater decision-making power and officially recognised statuses. It is also recommended that the rangers for the Vishtynetskiy Regional Nature Park be from the greater Vishtynetskiy area. This would not only contribute to livelihood diversification among locals but would also enable easier enforcement if exceptions were made to allow locals to drive in certain otherwise restricted areas.

*Policies and Regulations*

The restriction on cars is a major source of conflict in the Regional Nature Park to date that urgently requires a solution. This could be achieved via the provision of physical permit cards handed out to each household located within Regional Nature Park boundaries. This permit could allow driving within the Protection and Recreation Zone, while still restricting activities in the Strict Security Zone. Another solution could be to routinely lock restricted road barriers and provide local households with a key. However, more research regarding potential ecosystem impacts and the number of villages included would be required. Overall, it is recommended that activities permitted in the Protection and Recreation Zone are reassessed with local input.

Furthermore, should decision-making capacity be granted to a local council, it is recommended that such capacity be clearly drafted in Regional Nature Park legislation to ensure its continual validity, regardless of changes in local or regional administrators.
Knowledge Creation

A variety of training sessions should be offered to interested parties located within the Regional Nature Park. This could include tips on creation of guestrooms in local houses, legal advice for sole proprietors, accountancy training, and information on how to market ecotourism services. This would assist the local population in navigating the complicated legislative systems of the region. In addition, as there are a number of knowledgeable and skilled entrepreneurs in the villages in and around the Regional Nature Park, skill seminars on various topics, such as reconstruction with second-hand materials or creation of handicrafts, should be arranged and supported by the Regional Nature Park administration.

In addition, we recommend the consolidation of information about all current Regional Nature Park activities, guesthouse options, and details of local goods and service providers as soon as possible. Further, signs and leaflets indicating restricted or open road access should be provided.

Conclusion

The hunt for sustainable development is no easy endeavour, especially with complex interlinkages between people, ecosystems and governments. However, we have found there is strong potential for implementing pathways to ensure sustainable development of the Vishtynetskiy Regional Nature Park. Communication and trust form the core of these pathways, and our key recommendation for the administration of the Regional Nature Park is to continue its efforts for a more participatory approach to governance.
References


[2] Regional Nature Park Strategic Development Plan


List of people interviewed

Alexandr Samsonkin, farmer who provides agritourism services, 28 October 2019.


Anna Karpenko, sociologist and director and founder of the Art space Vorota, 31 October 2019.

Judith Kloiber, Consultant for Sustainable Tourism & Regional Development, trans NATOUR, several interviews before and during the field trip.

Liubov Korshunova, teacher of Biology and Ecology, 29 October 2019.


Nesterov school students, 29 October 2019.

Sergey Schulz, Deputy Director of the Regional Center for child and youth recreation “Zhemchuzhina” (Pearl), 30 October 2019.

Sergey Zaets, farmer & landowner, 27 October 2019.

Viktor Samsonenko, farmer and builder, 29 October 2019.

Viktor Sergeyev, Rector of the Kaliningrad Institute of Retraining of Specialists Agribusiness, 31 October 2019.

Vladimir Sudiyan, Head of Municipal Entity Nesterovsky city district, 30 October 2019
Olive Mill Waste Valorisation
Falcon SA
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The Team

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**Rachel Adell** is from the United States and currently lives in California. She has several years of experience working in solid waste management, outreach and education, recycling and resource recovery. Her passion for all things waste made this project a joy to be a part of.

**Ísak Jóhannesson** is from Akureyri, Iceland. He holds a B.Sc. in Biology and has experience working in research and urban environmental health. He is particularly interested in resource efficiency and waste management.
Finding Value at the End of the Road

Olive Mill Waste Valorisation in Lesvos, Greece

By Andrea Mora, Ísak Jóhannesson and Rachel Adell

Olives are foundational to Greek culture and national pride. Greece is the third largest producer of olive oil worldwide with a strong tradition of cultivation and production which is evident upon visiting the olive groves.

On the island of Lesvos outside the village of Sigri, Falcon SA is operating a burgeoning olive grove and currently constructing a new olive mill. With high production demands, good business sense and strongly held beliefs of doing no harm to the environment, Falcon SA is determined to create high quality and sustainable olive oil.

Since olive mill waste is damaging to the environment [1], Falcon SA is looking for innovative solutions for waste from their future modern mill that fit with the sustainability ideals already established at the company. The company tasked Team Olives with pinpointing the best options for managing waste. The team provided improved composting, biogas, and industrial applications as three alternatives to current waste management practices for Falcon to consider.

Context

The island of Lesvos is the third largest in Greece and has nearly eleven million olive trees [2]. Most olive trees are found on the eastern side of the island. The western half, which was geographically carved by a volcanic explosion millions of years ago, is more barren and has dry and rocky soil. It is not rare to see small olive groves around, but there are far fewer on the western side of the island.

Figure 1. Map of Lesvos, Greece. Sigri is marked on the west coast of the island (© Google, 2019).

A Village at the End of the Road

The village of Sigri sits on the western coast of Lesvos, at the end of the main road that bisects the island. The village’s tagline is: “it’s worth reaching the end.” Home to 300 full-time residents, the village expands to nearly 1 000 people in peak summer months. Built for tourism, its remoteness has helped maintain its charm. However, the recent refugee crisis has severely impacted the number of visitors.

Construction of a new port and expansion of the main road has residents and business owners hopeful of a resurgence of tourism in the area. It is unclear if there is a plan for how to maintain the character that makes Sigri so appealing while growing to accommodate larger seasonal crowds.
A company with a vision

Falcon SA is a family owned company that was founded in 1994 whose operations focus on the imports and production of raw materials for pharmaceuticals, animal feed, and industrial food and beverage. In 2010, the company expanded and developed a new trademark under the name of Ol-eve which is dedicated exclusively to the export of bulk and retail food products. Ol-eve products are sourced from Faros Estate. The estate sustainably operates 100 hectares of land that includes 30,000 olive trees, along with pomegranate, fig, and palm trees, among others.

The family that runs Falcon SA has a strong connection to the community with roots going back at least four generations in Sigri. They have a reputation of being hard working and successful businesspeople. Residing permanently in Athens, where the company's headquarters are located, the family makes casual visits to Faros Estate, which is their “paradise”. While it seems the family's interaction with the broader community is limited, they do provide extra produce to the community, so it is not wasted. At the moment, the construction of their new olive mill is in progress and is expected to be completed by mid-2020 along with a sustainable waste management system. This will be the most innovative and sustainable olive mill in Greece.

Research Approach

When working towards solutions to manage waste it is important to map the impact waste has on social, economic and environmental sustainability of nearby communities. This mapping, supported by a literature review, interviews, and study visits, helped inform which solutions to manage waste would be sustainable and maximize value to the client.

Literature Review

A literature review was conducted to understand olive oil production, the impacts of waste, and potential solutions for sustainable waste management. A process map of olive oil production was developed to determine the difference between two- and three-phase production and understand associated wastes which will be discussed later in the report.
With a clear understanding of the process, extensive research on the environmental impacts of olive solid waste and wastewater were examined. Current and innovative methods of waste management were researched to understand solutions available. Research then focused on gaining a complete understanding of all possible solutions for treating or valorising the olive mill waste by finding examples and study cases.

**Study Visits and Interviews**

Before arriving in Lesvos, interviews were conducted with several experts and personnel from universities, olive oil related industries, waste management systems, EU funded projects, researchers, and members of the community, among others.

Several study visits were organised in the island of Lesvos to gather information about the context where the olive mill will be operating and the possible stakeholders of interest. These visits included Faros Estate, where the olive mill is currently being constructed, a sheep farm, two- and three-phase olive mills, a centralised environmental management service facility, a small olive grove and some of the towns in the surrounding areas.

**Value Framework**

The potential solutions for the olive mill waste for Falcon SA were put into three categories that aimed to create advantages for both the business and the local community. As a result of the framework categorisation, the solutions were identified as (1) usable on site (*value saved*), (2) adding revenue by diversifying the business model (*value added*) or (3) leveraging resources from the community (*value exchanged*).

**Multi-Criteria Evaluation**

In order to evaluate the performance and aid in decision making, the suggested waste management solutions were weighted on six different criteria based on the needs of the client and the context in which they operate. The criteria are the following:

- **Effectiveness** of the method in handling the amount of waste.
- **Environmental impact** of the solution, emissions to air, soil and water. Positive or negative.
- **Cost** of investment, operation and potential for return on investment.
- **Resource availability**, whether the resources needed are available to the company, including technology, manpower and knowledge.
- **Reliance on others**, how much cooperation with external stakeholders is needed to implement the solution.
- **Innovation**, whether the solution is novel in the industry or country specific context.

*Image 4: Freshly picked olives from Faros Estate*
Olive oil
Making olive oil is complex and there are conflicting opinions about which production methods yield the best results. A knowledge of the process is important when determining waste solutions because the alternative production methods yield different waste streams.

Production Process
The scope of the project focused on where the bulk of the waste is generated which included picking and pruning through olive oil extraction (see Figure 1). The typical modern olive oil extraction process includes sorting, washing, crushing, malaxing, decanting and separating. Once picked, debris, such as sticks and leaves, are first sorted out and the olives are washed with water on a conveyor belt (Image 5). The fruit is then ground after which the paste is “malaxed” or mixed in a horizontal trough with spiral mixing blades which run at low speeds (Image 6). During this process, oil droplets are formed.

Image 5. Sorting of the olives before washing

The next step of the process is ‘decanting’, when the oil is separated from the residuals in a horizontal centrifuge. Two methods of decanting are common and create different waste streams: ‘three-phase extraction’ and ‘two-phase extraction’. In three-phase extraction (Image 7), a substantial amount of water is added to the mixture and results in three residual fractions: oil, wastewater (vegetable water), and solid waste (dry pomace). In two-phase extraction little or no water is added and the process results in two outputs: solid waste (wet pomace) and oil.
Image 7. The three-phase decanter has three outputs: oil and dry pomace which are released on the top of the decanter while wastewater can be seen underneath.

Finally, in both methods, the oil is further separated in a vertical centrifuge, which sometimes includes additional water, to separate remaining residues from the oil (Image 8). The pure olive oil is then tested and stored in stainless steel tanks before it is bottled.

The mill at Faros Estate will mostly be utilising two-phase extraction with limited additions of water once it begins operations in 2020. In certain cases, the mill will be able to use three-phase extraction. Therefore, it is important that the waste management solutions be able to handle waste from both extraction processes.

**Olive Mill Waste**

The composition of olive mill waste depends on the technique used in the extraction process [1]. For three-phase extraction the outputs are wastewater and dry pomace and for two-phase the output is wet pomace.

_Wastewater_ consists of vegetable water and fresh water used in the extraction process. It is foul-smelling, acidic, contains high concentrations of phenolic compounds with antimicrobial properties, and it is rich in nutrients and organic compounds. If discharged into the environment, the wastewater can negatively impact soil and water quality and the surrounding environment.

_Dry pomace_ (Image 9) consists of crushed pits, pulp and husks, as well as residual oil, and is ideal for composting or burning as biomass. _Wet pomace_ (Image 10) consists of vegetable water, crushed pits, pulp and husks. It shares the same characteristics as three-phase wastewater and has a sludge-like consistency. These attributes make it challenging to transport and manage.

Additionally, some amounts of leaves and branches accumulate from pruning and washing of olives.

Image 8. Extra virgin olive oil flowing from a vertical centrifugal separator following two-phase extraction.
Waste Management Status Quo

The most common management of olive mill waste on Lesvos entails olive pomace from both two- and three-phase extraction. The pomace is transported to a centralised environmental management service company where it is further processed into by-products, such as residual pomace oil and biomass.

While this is the conventional option for Falcon SA to dispose of the waste they will produce, it might not be the most sustainable option. To extract the remaining oil in the pomace, it is again run through a three-phase extraction process using additional amounts of water substantial amounts of water. The wastewater is treated in evaporation ponds, producing considerable amounts of methane emissions in the process. The remaining solid waste is then dried and sold as biomass. To create the biomass, some is burned on-site and there did not appear to be any cleaning mechanisms on the stacks coming from the boiler. Moreover, the potential by-products that could be put to use on the estate would be lost.

Research states that wastewater can improve the quality of the olives if pre-treated and applied in limited quantities. Greek regulation supports use of wastewater from cleaning and three-phase extraction by allowing up to 20 cubic meters of water per 0.1 ha of olive groves [3].

However, the high quantity of wastewater used in three-phase extraction exceeds the allowable limits for land application and it is unclear what level of treatment is needed or being conducted at mills in the area.

Falcon will need to consider this legislation since they plan to use cleaning water for irrigation and will need a solution for the few times three-phase extraction will be done at their mill.
Table 1. Evaluation of Potential Waste Management solutions

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In order to compare the options against the criteria, information from literature review and interviews was qualitatively aggregated and synthesised on a three-point scale; either positive or negative (see Table 1).

**Compost**

The by-products from both two- and three-phase olive oil extraction can produce high quality compost due to the high level of organic matter content and valuable nutrients in them. Although the olive pomace from two-phase has a high content of water its composting can be feasible by using pruning waste from the plantation as a bulking agent [4].

Falcon SA is already doing a very basic form of static composting at Faros Estate where all feedstock is mixed in a pile and left to decompose for a period of over a year. However, once the mill starts running, the current composting will need to be adjusted in order to properly treat the more sludge-like waste from the two-phase process.
Additional considerations need to be taken to improve the effectiveness of the composting:

- **Consistent availability of feedstock** that make a good mix for the compost, including: the olive pomace, animal manure, dried seaweed and pruning waste from the olive plantation and the palm trees on the property.

- **Equipment** needed for the collection of the waste, transport and continuous monitoring and turning of the compost, so the aeration is adequate.

- **Expertise and further training** about the new improved composting method.

- **Time**, composting can be shortened to three to four months, instead of the one to two years that it takes now.

- **Space** to place the compost and store the finalised fertiliser.

- **Facilities** needed.

*Image 12. Current compost piles at Faros Estate, manure (left) and seaweed (right)*

For Faros Estate, composting represents an opportunity to build mutually beneficial relationships with other members of the community. For example, an alliance with some of the farms in the surrounding area to exchange their animal manure for good quality fertiliser brings a win-win possibility to all the stakeholders as they all would avoid the cost and carbon footprint of buying extra feedstock and transporting it across the island.

**Industrial Applications**

Olive mill waste is rich in bioactive compounds such as antioxidants, vitamins, fatty acids and minerals, polyphenols and antimicrobial compounds [5]. These are leftover in the pomace and/or wastewater from the milling process. In high concentrations, and left untreated, they can negatively affect water and soil quality [1] and disrupt other waste treatment solutions such as biogas and composting. However, there is a growing market for these highly sought-after compounds in the cosmetics industry and as food additives. Removing the compounds not only increases the productivity of other waste treatment options but also provides an added value for industries attempting to find alternatives to fossil fuel-based chemicals. Industrial applications were presented to Falcon SA as a value-added option through two avenues:

- An in-house line of cleaners, cosmetics or food supplements that could expand their Ol-eve brand.

- As a supplier of compounds for food additives, cosmetic ingredients or alternatives to fossil fuel derived chemicals to other companies. Falcon SA has the research and development infrastructure set up to create a number of industrial applications. There is a significant amount of research available on which compounds are valuable and how they can be extracted [5,6]. Much of the research has not been tested on a commercial scale, but there are a handful of companies in Spain, Italy, and Israel that are already using olive mill by-products for these purposes.
The challenges of this solution are the high initial investment costs and time devoted to the development of a new product stream. As well as the planning of whether to process the waste on site before shipping or to ship the waste for treatment elsewhere. Despite these manageable challenges, there is an undeniable added value of creating marketable products and still providing a resource for soil amendment on the plantation.

**Biogas**

Using olive mill waste for biogas production has the benefits of being both an effective method of treating the total amount of waste produced and being able to provide two valuable outputs: energy, which would replace energy produced from fossil fuels; and digestate, which can be used as a nutritious fertilizer for the olive grove [6].

Biogas shares the same consideration as the composting option needing consistent availability of feedstock, production and monitoring equipment, expertise for running the equipment and space for the plant and storage tanks for digestate.

According to the literature review, this solution does however have some potential drawbacks. First, this technology is expensive. Second, the presence of inhibiting compounds (polyphenols and/or lignin), low nitrogen content and acidity in olive mill waste can inhibit the digestion process and therefore a co-digestate, such as manure, may be needed making this solution reliant on external stakeholders. Third, the seasonality of olive-oil production and therefore the production of waste makes efficient production challenging since the type of feedstock needs to be relatively consistent throughout the year for efficient digestion [6,7].

These challenges indicate that in order to use olive mill waste for biogas production it would need to be just one input in a bigger system and if pursued would best be executed in a co-operative project on a local or regional scale.

If the intention is to use solely waste from the olive mill for biogas production, specific decanting equipment and infrastructure is needed to separate the input material appropriately (see Box 1).

**Box 1: Case of Biogas in Puglia, Italy**

Based on the initial research biogas production seemed technically challenging. While writing this report the team heard back from a producer in Italy that currently operates a small-scale biogas at their olive mill. The gas is used for co-generation which provides the mill with energy for all its operations and also feeds electricity to the grid [8].

They use decanting technology that separates the pits and lignin from the rest of the pomace, leaving the so-called ‘olive paté’ (pulp and vegetable water), which can be stored and fed slowly to the anaerobic digester which contains a strain of bacteria capable of digesting olive mill waste. The polyphenols inhibit aerobic digestion of the waste during storage but become inert under anaerobic conditions and do not interfere with the bacteria. Due to the fact that new bacteria are not constantly being fed to the digester, they are vulnerable to environmental fluctuations.

The olive mill processes 7500 tons of olives each year producing 770 MWh of electricity and 1,000 MWh of thermal energy. The digestate is used for soil amendment in the company’s groves.

**Recommendations**

The solutions suggested are not exclusive from one another. They can be implemented simultaneously in an integrated manner or incrementally over a longer timeframe. For instance, bioactive compounds can be extracted from the olive
mill waste, the output fed to a biogas reactor and the digestate mixed with compost for soil amendment. Or, implementing an improved compost system and initiating other treatments later.

The client was also provided with more recommendations that would give additional value to the company:

1. Implementation of an environmental management system and becoming ISO 14001 certified will help the company meet legislative requirements for waste treatment and will add to the holistic sustainable management of the new mill and grove.

2. The opening of the port and new road will make accessing Sigri easier than ever before. Tours of the mill and plantation present an opportunity to contribute to community prosperity by providing another destination for tourists to spend additional time in the village. Tours can also serve as a point of pride for family to showcase their environmental initiatives and helps support the case for the more innovative solutions such as industrial applications or biogas.

3. Falcon SA has the potential to be a leader in the economic prosperity of Sigri by using their influence to create new business and job opportunities within the local community. A strong business network can help the community grow in a sustainable way and ensure that Sigri maintains its charm as tourism increase.

**The Road Ahead**

Falcon SA needed research to support their existing sustainable practices and their initial ideas on how to manage the waste at the mill. This project was able to provide evidence so they can make informed decisions on best practices while looking into how to add value to each kilo of olives collected.

The motivation to be sustainable was balanced with other operational practicalities such as cost and time to project implementation. Moreover, the factor of time was not originally considered in the evaluation criteria. The team learned how an implementation timeline can play a significant role in the final considerations.

Valorisation of waste does not need to happen overnight. Having a stepwise plan to treat the waste in the short-term (e.g. composting) can leave a sustainable path for more value-added (e.g. industrial applications) and innovative treatments (biogas) in the long-term.

Biogas can be viewed as the most sustainable option (see Table 1). The case in Italy demonstrates biogas as a technically feasible option with less reliance on others than initially perceived. However, considering investment and time constraints it may not be the most practical one to implement straight away.

Alternatively, improved composting as a means for waste treatment and valorisation would be easily implementable in the short time frame before the new mill begins operations. While the staff and know-how to develop industrial applications is already in place, this option can be easily explored in the future.

In addition to executing all its operations at the highest quality, Falcon SA recognises the importance the environment represents for the company and their family. Any combination of the proposed solutions of this report can help them to meet their vision of a high-quality product and highly sustainable business model.
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Biochar Business Models
Circle Carbon
Team Mallorca

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Daniel Borg is from Sweden and has more than 10 years of working experience with management and sales in the online marketing business. He has an MSc in Business Administration focusing on marketing. Innovative business models and how they can drive sustainability is of special interest.

Romy Kölmel is from Germany and holds a BSc in Geography. She has working experience in research projects around sustainable consumption and production and sales and is interested in circular economy, social innovation, socio-technical transformations and waste management.

Tzu-Ling Kuo is from Taiwan and completed her undergraduate in Sociology and Economics. She has working experience in promoting renewable energy with a social enterprise. Solving social inequity through the involvement of renewable energy, corporate social responsibility, or other environmental relevant strategies are of her further interests.
Bringing it Back to Earth
Exploring Business Model Opportunities for Biochar in Mallorca

By Asna Kashif Dodhy, Daniel Borg, Romy Kölmel, Tzu-Ling Kuo

The Client and the Task
The production of charcoal is one of the oldest industrial practices developed by humans. Using charcoal in agriculture was an old practice forgotten and rediscovered in the form of biochar.

Circle Carbon, our client, is a startup located in the Balearic island of Mallorca. The company combines business with social and environmental values. Circle Carbon strives for greater value than only economic profit. Our main contact is Christer Söderberg, who co-founded Circle Carbon in 2018, to promote the use of biochar in agricultural practices on the island. A central motivation for the founder is promoting the use of biochar for climate change mitigation. Additionally, he strongly believes in its contribution to soil enrichment in order to increase food security.

Circle Carbon’s main business is the application of biochar to improve soil properties for plant growth, and it has its own production facility. The biochar is mixed with compost and other value-adding components to create a product that can be used to enhance soil quality in many applications such as for example agriculture, city gardens and plantations.

At its headquarters, Circle Carbon also offers courses and workshops on soil regeneration and organic farming. A greenhouse covering approximately 7000 m² is used to showcase the production and growth of a range of food crops using biochar in the soil. To further increase engagement around organic agriculture and the use of biochar, there are plans to establish a community garden for social sharing and knowledge transfer.

As a startup Circle Carbon is still in the early stages of the business lifecycle and the company is facing many of the challenges associated with this phase [1]. Among the challenges are production capacity, lack of knowledge of their products in the market and gaining momentum in sales. Given the task of developing a scalable and replicable business model for biochar products on Mallorca’, the first step was to analyse current activities of Circle Carbon. Initial observations showed that these are explorative and less explicit at the moment. An approach to systematically identifying business opportunities within the local context was developed. The general aspects
of this approach can be used by biochar initiatives in other contexts. With the client’s aim to describe an exportable business model, the process of identifying areas for improvement in their own model was initiated. In this way, a concrete business model can be developed and delineated in the next steps.

**Approach**

Desktop research was done before the on-site field trip. The research looked into the agricultural and political structures in Mallorca as well as biochar initiatives and business cases around the world. Key stakeholders of Circle Carbon were identified at this stage along with an analysis of the current business operation by using elements of the Sustainable Business Model Canvas (SBMC) [2]. A SWOT analysis was also used to initiate the understanding of the current strengths and weaknesses of the company's business model and to assist in the identification of external opportunities and threats.

A field trip to Mallorca was carried out from 21st till 29th October 2019. Interviews with stakeholders from the local government, waste management company, farmers and local researchers provided us with insights and reflections on the assumptions that the desktop research was based on.

The information and insights gained from the interviews were analysed together with the team’s own research. The final outcome is organised as key findings and recommendations for the client.

**Limitations**

The team acknowledges there are some limitations to this project, as it involved a short intensive on-site trip with limited access to informants and resources to cover all potential sources of valuable information.

![Figure 1. Summary of the approach](image)

**Biochar**

To create biochar, a charcoal that is specifically suitable for the application in soil management, organic residues, like wood chips, tree bark, corn stover are treated in a special form of pyrolysis. Under low-oxygen conditions and temperatures between 400 and 800 °C the organic matter is transformed into char with a high surface area [3]. The high porosity of the char changes the soils properties as it can hold nutrients, water and soil biota. This phenomena, called adsorption, also stores surplus nitrates or toxins in the soil and prevent them from leaching in the groundwater.

![Image 3. Biochar in the open kiln](image)
waste or manure microbes can inhabit the pores, resulting in a substrate that is highly fertile and can be used as some kind of super soil.

**Value Propositions**

Based on its properties and its production process there are different ways biochar can deliver value to the producer, the applicant and the environment [4]. In order to address potential customers, it is important to take this business oriented perspective on its benefits.

**Waste management**: Biochar production is a solution to create value from waste, like green cuttings and agricultural residues.

**Carbon sequestration**: Carbon in the structure of biochar decomposes much slower in the soil than if biomass is added directly. After 100 years, approximately 40% of the carbon is still captured in the soil [3].

**Soil improvement**: The improved water and nutrient-holding capacities can decrease drought sensitivity and support soil fertility. This can lead to increased plant resilience and higher yields [5].

**Energy services**: Depending on the technology used, excess heat from the production process can be used for district heating or to generate electricity.

**Biochar Initiatives**

Many different biochar initiatives operate globally. From small-scale projects funded by Non-Profit Organisations to large-scale operations backed by large companies. The initiatives vary in terms of scale and focus depending on the local or regional context. The initiatives range from using biochar as soil improvement to wastewater treatment. The team looked into various projects and selected specific cases, to identify key success factors. Some of these cases were part of existing systems like using the waste management system in a municipality. Other cases developed their own systems, such as for example a research project in Germany which used a mobile kiln. However, the initiatives strong dependency on the context, limits their transferability. The success factors for biochar initiatives seem to vary locally and no case study on a context similar to Mallorca could be identified.

**The Context of Mallorca**

Mallorca is the largest of the four Balearic Islands in the Mediterranean Sea. It is 100km wide and 75km long and has a population of 880,000 people (2018), out of which around half resides in the capital, Palma [42]. The island’s climate is characterised by long, hot, dry summers and mild, wet winters. The average temperatures range from 8°C to 29°C.

Politically, Mallorca has its own regional government and parliament. Hence,
policies passed by the government include the local context. The largest economic sector of Mallorca is tourism. Mallorca is well known for mass tourism. However, in recent years, there has been a shift to more sustainable forms of tourism that are supported by local politics. Since 2016, tourists are charged a tourism tax. The income from the tax is redistributed to environmental, social and cultural projects.

Although, the agricultural sector only accounts for 1% of the regional GDP, the farmers manage 73% of the land. The traditional forms of agriculture on Mallorca are dry farming, including extensive land use with almond and olive trees. Other forms of agriculture are vineyards, crop production or vegetable horticulture. Organic agriculture is relatively big on the island (10-12% of all farming) and is supported politically [6].

On-site Activities

During the field trip we conducted interviews with internal and relevant external stakeholders. Furthermore, we facilitated an interactive workshop with the Circle Carbon team and two external stakeholders.

External Stakeholder Interviews

The interviewees were selected based on a stakeholder mapping exercise conducted during the desktop research prior to the trip, as well as their availability during the trip.

Figure 2. Stakeholder mapping for the interview
The purpose was to confirm previously researched information and gather further knowledge on Circle Carbon and the socio-political structures around agriculture, waste management and climate change action on the island.

To gain insights on the current agricultural structures and practices, representatives of the agricultural department of the local government and the local organic farmers association were interviewed. A successful and innovative organic farmer was also interviewed to gain practical understanding.

In order to understand local structures around waste management, the team spoke with a representative of the largest municipality on the island, Palma. We also had a meeting with the Director for circular economy of the main local waste management company.

The team discussed current climate change mitigation strategies with the Director of the Department for Climate Change and Energy Transition of the Regional Government. This department has recently introduced a new law on climate change mitigation and energy transition. Additionally, we spoke to the future Director of the institution that would be responsible for implementing this law. Furthermore, a local researcher specialising in climate change and energy law was interviewed. The researcher aims to link the island’s initiatives around climate change mitigation to initiate synergies.

**Making Biochar**

While staying in Mallorca, we got some practical experience in making biochar together with the Circle Carbon team. This opportunity was used to learn about the internal stakeholders’ perception on the challenges and potential strategies of the Circle Carbon initiative.

**Workshop and presentation**

At the end of the stay, the team facilitated a workshop for internal and external stakeholders. The aim was to present key findings of the research as well as to learn about the internal perspectives on challenges within the current business model. The workshop was a first step to
align visions of the team members of Circle Carbon and generate ideas on the next strategic steps. It made the team aware of current gaps and areas for improvement in order to develop a replicable business model.

**External findings**

Understanding the local context is crucial for biochar initiatives as their success will depend on their ability to identify the local potential for feedstock supply as well as for customers. The stakeholder interviews conducted on Mallorca gave valuable insights on the local structures including political situation, culture, societal structure, climate challenges and more.

**Momentum for climate change action.** The Balearic Islands are already facing immediate effects of climate change. Therefore, the political awareness for the need of mitigation strategies is perceived as rather high. The regional government introduced a recent law on climate change and energy transition. A mandatory carbon registry for local enterprises is part of the implementation plan. Even though binding reduction targets are not to be expected in the near-future, they could stimulate the need for carbon sequestration in the future.

**Need for soil restoration.** Soil degradation and water scarcity are widely recognized as the main challenges for agriculture on the island, this was highlighted by several actors. We were told that organic matter in the soil is on average below 1%. The implementation of large scale water management systems lacks financing and agricultural products from Mallorca cannot compete with industrial mainland production. In order to decrease Mallorca’s dependence on food imports as well as to preserve the landscape in a changing climate soil improving practices are necessary. Urban planners as well as researchers see potential to improve agricultural land use on the island.

**Dominant importance of tourism.** Tourism is Mallorca’s largest industry. It influences policy and decision making around energy, land use, waste management and infrastructure investments. Job opportunities on the island are dominated by this sector. Very few people work in other sectors, like agriculture.

**Individualistic society.** According to several informants, the Island of Mallorca has a markedly *individualistic society*. Striving for ‘the common good’ may not be prevalent. This view was presented as being rooted historic phases of occupation and the
influx of immigrants to the island as a result of mass tourism. The need to create business strategies around simple offerings delivering benefit to the individual was highlighted.

**Locked-in waste management.** The main current practice for managing agricultural residues and organic cuttings is the open burning on the fields. This includes no cost and therefore no incentive for behavioural change for the farmer. The Municipalities and most gardening companies transport residues to the local waste management company that accepts organic waste, other than palm fronds, without an extra charge. Long-term contracts with the local authorities assign responsibility and right for waste treatment on the island to this company. Informants reported on its strong influence and protective attitude in the past.

**Internal findings**

Internal perspectives on the current activities at Circle Carbon were captured both in discussions and interactions with employees over the period of the field study, and then more formally during a workshop involving most of the company team members.

The workshop was structured around four key aspects of the SBMC: vision, value proposition (or offerings), customers and key activities. In order to develop a sustainable business model these need to be firstly identified and secondly linked. For us as well as for the participants, the workshop has helped to visualise the state of the company that currently still explores various business opportunities. The main areas worth focusing on, in order to progress and delineate a concrete business model, have been identified. Ideas for potential next steps have been generated.

![Image 8. The workshop at Circle Carbon](image)

**Sharing the same vision.** In order to learn about the team’s vision and warm up the workshop, participants were asked two questions: 1) *What is Circle Carbon for you?* 2) *If Circle Carbon is on the newspaper headlines in 5 years from now, what would you like the headline to be?*

The result underlined the strength of a shared belief in an organisation driven by a purpose to add value to the planet and society. Another key finding is that food security and healthy soils were the main impacts envisioned as a future result of the company operations.

**Strong focus on social value proposition and community.** Three questions were asked to identify how the value for customers were perceived: 1) *What does Circle Carbon currently offer?* 2) *What value does it bring to the customers?* 3) *Why does that value matters?*

The outputs provided evidence that the main focus was on the social value for the customers followed by environmental value. Among the social values mentioned were for example promoting good living, community
building, changing behaviour and improving human health. Environmental values mentioned were for example CO2 sequestration and climate change mitigation. Notably, a factor given little focus by the workshop attendees was on economic values and the concrete product offered to the customer.

**Bridging the gap between values and customers.** In the third exercise the focus was on identifying customer groups. Two questions were asked 1) **Who can benefit from Circle Carbon’s products and services?** 2) **What barriers does Circle Carbon need to overcome to reach them?** Potential customers were grouped into categories and possible constraints in delivering value to the customers were discussed. The results of the discussion provided an evidence of a general focus on the agriculture and educational sector. The discussion revolved around farmers in particular, and how they could benefit from Circle Carbon’s products. The second group in focus was the education sector, focusing particularly on spreading knowledge and teaching people about biochar and its benefits for soil enrichment and carbon sequestration.

**The importance of identifying and prioritizing key business activities**

The final focus of the workshop exercise was on key activities for delivering value to the customers. First all kinds of activities were brainstormed. Second the activities were organized into a process flow where the customer is the final reaching point. Lastly the key activities were categorized to determine the flow direction and facilitate a discussion on possible constraints within the flow. The result confirmed that the focus was on developing activities for social value with less focus on activities driving economic value. The visionary approach from the participants resulted in more focus on the purpose of the company and less focus on more detailed subjects such as the production process and customer contacts.

![Image 9. Hands-on experience](image)

**Recommendations**

The research findings were compiled in order to provide Circle Carbon with tangible recommendations. These give advice on how to move forward on the journey of developing a scalable and replicable business model for biochar on Mallorca.

**Empower a successful team**

Even with a highly motivated team such as the one currently working at Circle Carbon there are challenges for management. Skills and knowledge ought to be captured in a structured manner to ensure that the team has the ability to drive the expected expansion. This would include a strategy for continuous capacity building to empower the current team as well as a strategy for knowledge transfer to future team members.
Drive demand for biochar

The problems that biochar can help to address are recognized and prioritized on Mallorca. Soil quality, water shortage, sustainability issues and renewable energy are clearly recognized by, and discussed among stakeholders. A key challenge however, is that biochar is not an established product yet and the potential benefits of using biochar as a solution is not common knowledge. Education of the customer seems to be done successfully on the premises of Circle Carbon and credibility for the product could be strengthened further by establishing independent demonstration sites together with partners. The results could be communicated to key target groups as a proof of concept connecting the value proposition with the actual customer needs.

Stabilise feedstock supply

A key limitation to the production potential of Circle Carbon is feedstock supply. A steady supply of suitable biomass is necessary to ensure production volumes can meet the expected increasing customer demand when growing the business. The current collaboration with local businesses that drop off biomass can be expanded and a supply system established. The system could include documentation of sources and a database of suppliers within the zone of capture. There is also a potential in collection of quality biomass that is currently being burned by farmers. Investing in own means, such as a small or medium sized truck for pick up of biomass at farms could be worth investigating. To further expand partnerships around feedstock supply would help achieving a steady supply and low cost production strategy. A systematic approach to this is recommended. The decision tree (Figure 3) can be used to systematically explore local opportunities in the areas of feedstock supply and demand.

Optimise production

Circle Carbon is currently making biochar and has an engaged core team in charge of production. The production is taking place at the Circle Carbon premises and involves heavy manual labour and know-how from key people in production. However there are constraints with the current production methods that will make replicability and scalability challenging. Gathering knowledge from the current team to establish documented procedures would help overcome the challenge of knowledge transfer to new production sites and new employees. It would also help to ensure consistent production of high quality biochar in an expansive phase with new employees entering in production. Reducing the amount of manual labour by investing in machinery and making operations more repeatable would be beneficial for production at a bigger scale. Documentation of production activities and flow could also guide decisions around suitable new production sites when growing the business.
Figure 3. Decision tree for biochar initiatives: A guide to systematically identifying local feedstock supply and customer opportunities (our own illustration)
Delineate business model

As an agile startup striving towards success Circle Carbon continuously gains new knowledge and experiences. Experimentation with markets and opportunities drives the company forward. To identify key factors in successful experiences can help to establish what is to be scaled and which product to focus on in the short and long term. Once the potential markets and their scale are identified the necessary resources can be assigned to prioritised marketing and production strategies. Using a tool such as the Sustainable Business Model Canvas gives a visual overview of key factors in the business plan. These key factors is an extension of learnings from the above mentioned recommendations around value proposition, delivery and creation as well as economic factors for the business. When a successful business model is established it can be used as a recipe for future expansion and adapted to new markets.

Conclusions

Biochar has been used and forgotten throughout human history. It is ready for a big come-back today as its application offers promising solutions to big challenges of our time, like climate change, food scarcity and soil degradation. Multiple examples from around the world show how biochar is used. However, concrete business cases are highly context specific and finding replicable models remains a challenge. We could not identify an existing business case similar to the one analysed.

In order to scale or replicate a business model, it firstly needs to prove its local viability. Therefore, an understanding of the given context is crucial.

In the context of Mallorca, an island shaped by the tourist industry and dry summers, biochar promises to tackle many problems at the same time. Our research showed that a momentum for initiatives around climate change and sustainable agriculture is present on the island. The current strategy by the regional government is a shift towards a more resilient island, less dependence on food imports and the tourist industry.

The current state of the start-up company Circle Carbon was analysed. Then, first steps initiated on the way to specify an economically sustainable business model.

Circle Carbon saw the agricultural sector as their main potential customer group, which was supported by the project results. Agricultural practices need to be altered, which involves uncertainties and risks for farmers. Due to long traditions of agricultural practices and an individualistic society this seems to be particularly challenging in the context of Mallorca. Winning the trust of the local farmers and showing ‘what is in it for them’ will be key if local agriculture is to be a customer segment.
This can be done by winning over local key influencers in the farming community and creating a showcase for the benefits of biochar in local farming practices.

More potential customer groups can be explored in the future. With an increased focus on climate change mitigation by the local and regional government, biochar as a carbon sink might for instance gain importance. A systematic approach to identify customers can help to develop targeted communication strategies.

As a start-up company in an early development stage, key factors of the business model are still developing. Circle Carbon has shown that there is potential for a worthy business idea around biochar on Mallorca. By systematically streamlining and delineating operations, the goal of a scalable and replicable business model for biochar could be fulfilled.

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Impact Investment
Ascent Rift Valley Fund
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The Team

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Measuring the Unmeasurable
Developing an Impact Framework for the Ascent Rift Valley Fund

By Tamsin Ekkel, Lisa Heldt, Elizabeth McNamee & Joonas Söderholm

Introduction
Small-and-medium-sized enterprises (SMEs) play a major role in the sustainable economic development of emerging markets [1]. In East Africa, for instance, SMEs account for up to 90% of business activities and 50% of jobs [2]. Regulatory pressure and markets are driving businesses to improve their environmental and social performance. However, SMEs often suffer from insufficient access to financing and technical support which restricts them from growing in an environmentally and socially responsible way [3].

At the same time, investors are increasingly considering environmental, social and governance (ESG) metrics in their investment decisions or are specifically targeting their funding to projects that promise to generate positive impacts for the environment or local communities [4,5]. These investors mainly include development finance institutions (DFIs), foundations and pension funds that invest either directly or indirectly through asset managers and impact investment funds [6]. To date, these impact investments are estimated to have reached a total volume of $502 billion [6].

The Client
Our client, the Ascent Rift Valley Fund (hereafter ‘Ascent’), seeks to bridge the SME funding gap by raising money from DFIs, family offices and pension funds to invest in high-potential SMEs in East Africa. Ascent’s mission, to have a positive impact on their investee companies, is showcased in their investment approach which aims to maximise returns of investee companies and improve their ESG and financial performance through their inputs which include:

- Capital
- Business development support
- Hiring an ESG manager
- Developing ESG-policies and action plans
- Active board participation.

Through their inputs, Ascent empowers their investee companies to grow financially and substantially improve their ESG performance which creates wider positive impacts within local communities. After the investment period, Ascent aims to sell their ownership to strategic buyers who will maintain high-level ESG practices and continue developing the investee companies. With their current fund, Ascent channels funding from European DFIs, family offices and pension funds to eight SMEs operating in different
industries (healthcare, manufacturing, consumer goods distribution and financial services) in Uganda, Ethiopia and Kenya (see Figure 1). Currently, Ascent is looking for investors and investee companies for their next fund that will be operational in 2020.

Why measure impact?

Ascent’s investors are increasingly focusing on ESG metrics and impact in their investment decisions. In order to substantiate and quantify expected and realised impacts, they use multiple frameworks and tools which outline the pathway and rationale of how their funding is expected to contribute to the more abstract ultimate impacts. Consequently, investors increasingly expect impact measurement frameworks to be used by their fund managers, such as Ascent, to provide a logical explanation of why, how and how much impact their investments generate.

While Ascent already has a sound approach to improving ESG performance and reporting in their investee companies, they aspire to improve their systematic tracking, managing and steering of wider positive impacts of their investments on the environment and communities (see Table 1).

Having a more standardized approach is considered valuable to better understand and measure Ascent’s impacts as a basis for more substantiated management and communication of impact. This is becoming particularly relevant now as Ascent is in the process of exiting their first investee companies and searching for investors and investee companies for their next fund. It would be an asset for Ascent to be able to substantiate its track record of making sustainable impact in and through investee companies.

Table 1: ESG & Impact Definitions (derived from interviews)

<table>
<thead>
<tr>
<th>ESG</th>
<th>Impact</th>
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<tbody>
<tr>
<td>Mitigating risks and liabilities in investee companies through the integration of environmental and social governance in decision-making</td>
<td>Creating positive economic, social and environmental value</td>
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How can Ascent measure impact?

Theory of Change

Fundamentally, impact measurement frameworks build on the concept of theory of change. This is a method for explaining how and why a specific intervention leads to desired change in a given context [7], i.e. in this case a narrative that explains how Ascent’s inputs contribute to wider environmental and social impacts by outlining
causal relations and intermediate steps [8]. By making explicit the intermediary steps that lead from inputs to final impacts (see Figure 2), the theory of change helps to establish how investors contribute to environmental and social change.

**Task and Objectives**

Based on the ambitions of Ascent, our objective was to create an impact framework that provides a clear picture of the impact of Ascent’s inputs on its investee companies and the surrounding environment and region. The impact framework consists of a theory of change and an Excel tool which together enable Ascent to qualitatively and quantitatively outline their impact.

The theory of change is the qualitative narrative of Ascent’s impact on its investee companies and answers the question: *which impacts has Ascent created in and through its investee companies, and how?* The Excel tool is the quantitative part complementing the theory of change and answers the question: *how much impact has Ascent had in and through its investee companies?*

The impact framework builds the basis for Ascent to:

- actively steer their investees’ ESG performance and impact;
- transparently communicate Ascent’s impact to current and potential investors; and
- inform strategic decisions on future investments.

**Methodology**

Key phases and subsequent methods of this project are outlined in Figure 3. This gives an overview of the steps taken to produce the final deliverables for Ascent.

Research was conducted in both Lund and Nairobi over a four-week period. Background and contextual information was gathered through an extensive literature review and interviews with 12 members of the Ascent team, three DFIs (Norfund, OeEB and FMO), and six investee companies as well as two site visits in Kenya. The literature review, interviews and site visits provided vital information for all phases of our project.
NAIROBI, KENYA

Our findings were prioritised and condensed in a materiality analysis, which is a way to prioritise information based on stakeholder perceptions. This information was used to develop a theory of change for Ascent and one of their investee companies. We worked closely with Ascent during the process with regular check-ins and progress meetings to validate our work.

The Impact Framework

The impact framework created for Ascent to accurately capture and visualise their impact consists of three building blocks: impact themes, theory of change and metrics.

Impact themes reflect what impact is important and represent the backbone of the framework and the theory of change. They outline the ultimate effects of Ascent’s investment and are presented in the last column in the theory of change in Figure 5. The literature review yielded a broad spectrum of impact themes which were then clustered and condensed through a materiality analysis.

Six impact themes emerged as material to Ascent (see Figure 4): Job Creation, Regional Economic Development, Improved Livelihood, Gender Equality, Climate Stability, and Natural Capital. These themes and their definitions were then validated by Ascent (see Table 2).
Table 2: Ascent’s Impact Theme Definitions

<table>
<thead>
<tr>
<th>Impact Theme</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Creation</td>
<td>Creation of permanent and temporary employment.</td>
</tr>
<tr>
<td>Regional Economic Development</td>
<td>Increased regional economic development through a company’s operations, e.g. by creating new jobs and providing tax revenues for the government.</td>
</tr>
<tr>
<td>Improved Livelihood</td>
<td>Provision of critical services for wellbeing, e.g. food, water, shelter, and enhancing health, education and improved equality.</td>
</tr>
<tr>
<td>Gender Equality</td>
<td>Equal rights, opportunities and treatment of women and men.</td>
</tr>
<tr>
<td>Climate Stability</td>
<td>Global efforts to curb the Earth’s temperature rise, e.g. GHG emissions.</td>
</tr>
<tr>
<td>Natural Capital</td>
<td>Natural resource use, emphasising preservation of natural resources and circular solutions.</td>
</tr>
</tbody>
</table>

Theory of change connects the impact themes represented in Figure 4 to Ascent’s investment by outlining and explaining the intermediate steps through which Ascent’s inputs make an impact. The theory of change consists of several phases (see Figure 5), beginning with a problem statement, i.e. a short description of the problem Ascent faces and aims to solve with its inputs [9,10]. In Ascent’s case the problem statement represents Ascent’s mission: to make East Africa an attractive investment destination. Inputs are Ascent’s contributions to its investee companies, e.g. capital, ESG policies and board participation. These inputs lead to outputs, i.e. short-term activities in the investee companies directly in the control of Ascent such as increased employment. Outcomes are medium-term consequences of outputs. They are influenced by Ascent but cannot be controlled directly, e.g. an outcome resulting from increased employment would be ‘increase in local income’, because the salaries paid by the investee companies are channelled to the families in the local households. Lastly, impacts are long-term changes in society which Ascent strives to create, represented through the impact themes. The theory of change leans on our assumptions e.g. that investee companies support Ascent’s views and that they are successful in hiring more employees. These assumptions are presented between columns in Figure 5.
East Africa is not an attractive investment destination.

**Capital**
- $ Investment
- Trainings & strategic guidance
- # Trainings

**SMEs** are crucial for economic growth but lack funding in East Africa.

The main problem sought to address: Contributions of Ascent to investees.

**Sphere of control.**
- Short-term products or services of completed activities.
- Sphere of direct & indirect influence.
- Long-term change in society or target group.

**ESG guidance, planning, monitoring & enforcement**
- # ESG Policies
- Active participation on board level
- Ascent employees on board

**Active participation on board level**
- Provide contacts & expand network
- Increase revenue
- Create new skills and knowledge
- # training hours/ employee

**Stakeholder engagement**
- Satisfied employees employee surveys
- Increased household income = increased community assets
- $ total labour costs/employee; revenue from outside of city centre
- Business partners increase their economic activity (upstream and downstream) e.g. by increased amount taxes, employees and revenue
- Increased government income = higher spending on public services (e.g. education & health)
- $ corporate taxes & other taxes
- Improved access to 'basic needs goods' (e.g. medicine)
- Improved efficiency in natural resources (water, waste, wastewater) 
- Amount of: water, waste & wastewater; (amount of energy/electricity used)/revenue
- Decreased GHG emissions # emissions

**Theory of Change for Ascent Rift Valley Fund (ARVF)**

- Capital is allocated efficiently
- ESG policies are successful
- Investee company management supports vision
- Companies are successful
- Trainings are effective
- Macroeconomic & political stability

**ASUMPTIONS:**
- Direct change in organisational systems,
- Changes in governance structures,
- Changes in organisational culture,
Metrics are a central element of the impact framework that enable Ascent to quantify its contributions as visualised in the theory of change (see Figure 5). Impact itself is difficult to measure since large-scale societal changes such as regional economic development depend on a variety of factors and are difficult to quantitatively attribute to a single fund. However, outputs and outcomes have causal relationships with the impact themes and are more directly controlled by Ascent. They therefore represent useful proxy indicators that are more readily available and quantifiable, still giving an approximation of Ascent’s impact. Thus, metrics, e.g. number of employees, were established to measure outputs and outcomes of Ascent’s inputs (see Figure 5).

When selecting suitable metrics, interviews and site visits at the investee companies helped to validate them and understand if these were relevant and feasible to collect. Validation was crucial since the accuracy and reliability of data substantially depends on whether the investee companies see value in diligently measuring a certain metric, whether they have the knowledge and means to measure it, e.g. calculating Scope 1 greenhouse gas emissions, and whether they find it relevant in the local context to begin with.

After consulting the investee companies, the metrics were incorporated in an Excel tool to facilitate the collection of data from investee companies, aggregate and monitor this and provide quantitative insights on Ascent’s impact. The Excel tool’s functionality encompasses a dashboard (see Figure 6), theme-specific sheets (see Figure 7), company-specific sheets and reporting templates. The dashboard has visualisations of key metrics on the fund level that can be filtered by company or country, and viewed in absolute terms or normalised by million $ invested. The impact theme- and company-specific sheets provide more comprehensive, nuanced insights into additional figures beyond the key metrics. The reporting templates facilitate data collection and monitoring.
Impact on the Ground

Ascent entered investee company I in 2018 with a majority stake and three out of five board seats. Ascent has provided capital and technical support to the company, hired an ESG manager and implemented an environmental and social action plan.

With Ascent’s inputs, investee company I was able to hire 65 new employees and increase their revenue. Additionally, after Ascent’s investment, investee company I introduced employee safety measures such as hardhats, and created a HR-policy aiming to increase female employment.

These outputs had positive outcomes in the company and the society such as higher local income, employee satisfaction and workplace equality.

Ultimate impacts of Ascent’s inputs were therefore job creation, regional economic development, gender equality and improved livelihood.

After Ascent’s investment, investee company I identified that due to its improved ESG performance and workplace safety, its employees were more efficient and productive. Additionally, their high ESG performance enabled them to attract a large multinational company as a client. These benefits convinced the initially sceptical management of investee company I to support Ascent’s ESG approach.

Lessons Learned

When developing the impact framework, it became evident that multiple aspects should be considered, ranging from wider impact measurement principles, to industry-specific characteristics down to aspects that are specific to Ascent and their investee companies. There are limitations to this impact framework, and understanding them enables the creation of a more comprehensive, tailored impact framework over time. Many of the impact measurement challenges we encountered in our task are not specific to Ascent but are, as we learned from our literature review and DFI interviewees, challenges that the wider impact investment and measurement field faces.

When researching Ascent’s impact framework and theory of change, we noticed that the industry lacked a single agreed-upon framework or indicator set, instead consisting of a spectrum of individual approaches. Therefore, we developed our own framework based on our research, tailored to Ascent’s needs and its investors’ specific approaches. Having one common approach could streamline and strengthen the comparability and exchange between institutions, and it was positive to learn from one of our interviewees that a harmonised Joint Impact Model co-developed by various DFIs like CDC, FMO, Proparco, BIO, AfDB and FinDev together with Steward Redqueen is under development and to be published in 2020.

Perhaps the most fundamental limitation relates to the difficulty of quantifying contributions on the broader impact-level i.e. reducing large-scale societal change to a single metric. Doing so is costly, requires substantial assumptions and runs the risk of
oversimplifying and distorting the impact. Establishing if and to what extent a specific entity, like Ascent’s fund, contributed to large-scale impact is even more challenging. For this reason, we use output and outcome metrics as more reliable and readily available proxies, as do most impact frameworks reviewed.

On a practical level, there can be trade-offs between comprehensiveness and practicality. It is a challenge to ensure that impact measurements are based on meaningful and sufficiently granular data while keeping in mind the feasibility regarding data availability and reporting burden for Ascent’s investee companies. Discussions with investee companies provided some valuable insights and surprises. For instance, we expected that collecting metrics beyond existing ESG reporting requirements may encounter resistance and reporting fatigue. However, when talking to investees’ ESG managers, they were in fact willing to expand their accounting. They had positive experiences with ESG reporting when this was introduced by Ascent, since the metrics and template were useful and helped them to inform and improve their ESG performance.

Ascent invests in SMEs in multiple sectors. In order to provide a holistic view of Ascent’s impact and make different companies comparable our impact framework included only cross-sector metrics that can be applied to all investee companies. However, sector-specific metrics could provide additional insights and a more differentiated picture of Ascent’s impact, but would make aggregation at fund-level more complex.

Further, before going to Nairobi our team was not fully aware of the East African context. Therefore, having an on-site period and the opportunity to conduct site visits and speak to the local investee companies helped tremendously in understanding the situation on the ground and correcting the assumptions made while conducting desktop research remotely from Sweden. As an example, our definition of local was interpreted differently in Kenya as it was in Sweden. Kenya consists of around 47 tribes and local is often considered as within tribal boundaries instead of consisting of a geographical area. Therefore, we had to alter our impact themes and metrics and use regional rather than local in our definitions.

Explicitly defining these challenges and their meaning enabled the creation of a more comprehensive impact framework. Understanding them will serve as the foundation for the future improvements of the impact framework.
Moving Forward

This project developed an impact framework for Ascent that explicitly links their inputs, outputs, outcomes and impact themes and that quantifies their contributions and facilitates reporting and monitoring through an Excel tool. This will enable Ascent to gain a better qualitative and quantitative understanding of their impact, to communicate this to current and potential investors, to track and proactively steer its investee companies’ impact and engage them on the topic.

To ensure that Ascent can use the impact framework to its full potential, the following steps are considered useful:

- Assigning responsibility for the implementation and continuous development of the impact framework within Ascent and, ideally, creating a feeling of ownership by that person;
- Training relevant staff, e.g. ESG managers, internally and at investee companies, about impact, required reporting and measures to drive impact to create an understanding and culture;
- Integrating the framework into Ascent’s processes, e.g. due diligence considerations, to align requirements;
- Further adjusting and tailoring the framework, particularly metrics, to the investee companies;
- Defining impact targets for each investee company and the fund as a whole to steer impact performance;
- Including additional metrics since those in the current framework are largely based on metrics that Ascent collects to date. Further metrics could provide meaningful insights, and some are readily available at investee companies and can thus be integrated starting from the next reporting period. Aspirational, more complex metrics could be added in the longer run.

Implementing the impact framework and continually improving it can enable Ascent to create a sound foundation for measuring and managing its impact, while tending to the needs of its key stakeholders such as investors and investees.

Final Remarks

Ascent aims to create a positive impact in East Africa by investing in SMEs and helping them improve both their ESG and financial performance. Through this investment approach, Ascent prepares investee companies for the anticipated increase in regulatory and market pressures on improving environmental and social business practices. With their current investee companies, Ascent has been able to showcase that the ESG practices they introduced are not just compatible with financial growth but can in fact...
drive it, even in industries that are traditionally ‘dirty’ such as manufacturing concrete products. Better management of ESG topics has enabled their investees to reduce risks, cut costs, create added value and stand out from the competition. These efforts are recognized by key stakeholders such as multinational clients, employees, local communities, investors and strategic buyers, leading to extended contracts, new investments, improved employee morale and increased company value.

The impact framework enables Ascent to further strengthen their position by clearly communicating the positive impacts created and their synergies with economic performance. Considering the major role SMEs play in East African economies and employment, Ascent’s vision of making the region an attractive investment destination could substantially increase investments to the region, thereby boosting impacts like job creation, regional economic development and improved livelihoods. Creating understanding and ownership of the impact concept within investee companies could be critical to ensure that their ESG and impact work continues after Ascent’s exit and could help attract like-minded investors or buyers.

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Norfund, ESG Advisor; Senior Economist Communication and Strategy, 16 October 2019

OeEB, Senior Manager Investment Finance; Senior Manager Impact Reporting; Impact Measurement Officer, 17 October 2019

Investee companies (anonymized for confidentiality)

Investee Company I, ESG Manager, Chief Operating Officer, 25 October 2019

Investee Company II, Head of Supply Chain and Logistics; Head of Strategy, Business Development and IT; Head of Human Resources and Chair of ESG Committee, 22 October 2019

Investee Company III, ESG and Quality Manager, 24 October 2019

Investee Company IV, Managing Director; ESG Manager, 25 October 2019

Investee Company V, Compliance and Quality Assurance Director, 25 October 2019

Investee Company VI, General Manager; Head of Human Resources, 25 October 2019

Images 13 & 14: Elephants at Amboseli National Park

Image 12: Giraffes at Nairobi National Park
PET Bottle Collection
Asian Development Bank
Team Kazakhstan

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Ракмет, Спасибо, and Thank you!

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Lifting the Carpet

Improving PET Bottle Collection in Kazakhstan

By Ahra Jung, Daniel Reinemann, Fynn Hauschke, and Kajsa Wimmerström

“Governments used to ignore waste, it was something to be swept under the carpet and be forgotten about; but now, the carpet is overflowing”

(B. McCarthy, interview, October 16, 2019)

The above certainly rings true for Nur-Sultan, a city which became the capital of Kazakhstan in 1997, and has tripled in population since, going from around 320,000 to over a million people. Today, the city generates over 800 tonnes of waste per day and is home to the country’s only landfill fulfilling international standards.

There are environmental and human health costs to improper waste disposal and while recent steps that Nur-Sultan has taken are positive, they are insufficient to deal with the magnitude of the problem. A key strategy to reduce waste going to landfills is to increase recycling. A Deposit Refund System (DRS) for single-use beverage containers is one effective method to ensure the collection of high-quality material in large volumes as a feedstock for recycling.

A DRS involves placing a deposit on each container in the system. The consumer pays this deposit when purchasing beverages and is reimbursed when returning the empty container once the product is consumed. Several upper-income countries have a DRS in place and most achieve collection rates upwards of 80%, with some even close to 95%. To this end, Nur-Sultan approached the Asian Development Bank to begin a process to assess whether a DRS would be feasible in the local context.

Rather than to exclusively address the appropriateness of a DRS, the task assigned to this group was to explore possible alternatives to a DRS and to provide examples of effective alternative systems of collecting single-use beverage containers. The decision was made to focus on PET bottles as they represent a large proportion of the beverage container market in Kazakhstan.

This report begins by presenting the research approach, followed by a description of the current situation in Nur-Sultan. Then, three alternatives to a DRS are detailed: a mandatory extended producer responsibility (MEPR) system based on the example of Spain, a voluntary extended producer responsibility (VEPR) system...
Research Approach

This report is the product of a five-week research project consisting of three phases: a two-week preparatory phase in Lund, a two-week fieldwork phase in Nur-Sultan, and a one-week follow-up phase in Lund.

The preparatory phase focused on identifying and describing viable alternatives to a DRS with a focus on their performance regarding the collection and recycling of PET bottles in terms of quantity and quality, success factors, and challenges. Desk research and expert interviews were conducted in order to collect and validate data. A list of the interviews can be found at the end of the report.

The fieldwork phase provided a better understanding of the current system for the collection and recycling of PET bottles and the feasibility of the explored alternatives in the local context. Throughout the stay, consultations with major stakeholders were held. In parallel, field visits to several sites with importance for the waste management system in Nur-Sultan, such as a sorting facility, collection centres, recycling plants, and a sanitary landfill, were conducted.

Upon the return to Lund, the preliminary findings were reviewed in light of the feedback received during stakeholder consultations. The final results were then summarised in this report and presented at the International Institute for Industrial Environmental Economics (IIIEE).

The Situation in Nur-Sultan

Policy Context

In Kazakhstan, waste management is regulated by the Environmental Code (2007), currently under review; and the Programme of Modernisation of Municipal Solid Waste Management 2014–2050. This plan includes specific targets for advancing waste management practices on a national level.

As part of their move towards sustainable waste management, Kazakhstan has adopted an ambitious framework to implement extended producer responsibility (EPR) under the Environmental Code. Initially, only covering vehicles and their components in 2016, this has been expanded rapidly to electrical and electronic equipment as well as packaging waste in 2017. As a result, a single private, non-profit producer responsibility organisation was established. This organisation collects recycling fees from producers and uses them to finance projects and programmes targeting the collection and recycling of waste.

Although not all provisions under the EPR framework have been put into practice, waste management practices have improved and it has redefined the collection and recycling system. One of the most important provisions yet to be implemented is the collection of fees by the EPR Operator from packaging producers.

Collection and Recycling of PET Bottles in Nur Sultan

In Nur-Sultan, consumers have three general options to dispose of PET bottles: the green container for mixed waste; the yellow container for all recyclables including plastic, glass, metals, paper and cardboard and electronic equipment; or to return it to one...
of the approximately 30 collection centres. Collection centres buy PET bottles and other recyclable materials and then resell these to recyclers. In addition, other initiatives collect PET bottles separately at larger institutions; however, these are believed to be rather insignificant and were not investigated further. A simplified model of the collection and recycling system for PET bottles in Nur-Sultan is presented in Figure 1.

![Image 2: A yellow container for recyclables in Nur-Sultan.](image2.png)

The separate collection of recyclables and mixed waste began in June 2018. During the first six months of operation, 3% of all collection was recyclables collected in the yellow container and 97% was waste in the mixed waste container. In the first ten months of 2019, the share of material collected in the recycling containers has already increased to 25%. Both types of containers are collected by Clean City NC, a private company working on a five-year contract tendered by the EPR Operator. Waste is collected at bring-points, 100% of which are equipped with yellow containers; however, interviewees estimated that the bring-points only cover around 75% of the city.

Both types of waste go through separation at a facility on the outskirts of Nur-Sultan. The capacity of the sorting plant is 300 000 tonnes/year and includes screening drums, magnetic separation, and manual sorting. Currently, the plant is able to separate somewhere between 7-11% of the total amount of waste sorted.

The materials are then sent to different facilities for recycling. Some of the PET and HDPE is taken by a recycling plant on-site that produces plastic granulate and flakes. Currently, post-consumer recycled material is not allowed to be used in food packaging by law. This prevents any high-grade bottle-to-bottle recycling plants, which re-
NUR-SULTAN, KAZAKHSTAN

cycle PET bottles back into beverage containers with the same purpose, from existing.


The remaining 89-93% of waste is sent to the neighbouring sanitary landfill. While this landfill is supposed to fulfil the required standards for a sanitary landfill, the leachate treatment plant was not operational during the site visit. Furthermore, of the two landfill cells, only the newer one is equipped with a system for collection and flaring of landfill gas.

Image 4: The sanitary landfill in Nur-Sultan.

The described collection and treatment system is financed via two primary sources. The first is a monthly fee on citizens of KZT 200 (EUR 0.46) paid directly to Clean City NC. The second one is a recycling fee paid by packaging producers to the EPR Operator that is supposed to cover the extra cost for the collection and treatment of packaging waste; however, this fee is not currently collected. Interviewees claimed that this is likely due to the resistance of certain large producers. As a result, the collection and treatment are cross-financed from other recycling fees that the EPR Operator receives for vehicles and their components.

Current Challenges

The current collection system faces several significant challenges. One being that recyclables are collected in the same container, which leads to a lower quality of materials once separated, particularly of PET bottles. This is exacerbated by the low level of awareness among the local population and results in wrong sorting. Although the EPR Operator could not provide information on the impurity rate or false throws in the yellow container, during field visits, its content was found to be of low quality. This was also apparent in the rather low efficiency of the separation plant as well as in the contamination evident in the sorted PET bottles.

Image 5: The Content of a yellow container in Nur-Sultan.

Another commonly discussed issue is the use of two parallel systems for collecting recyclables in the form of collection centres and a container for recyclables. While there seems to be a consensus among most actors that the informal sector is rather
significant in the country, this system has led to people “stealing” from yellow containers and bringing materials to collection centres that pay for them. Although the “stealing” of materials is not as common for PET bottles due to their low material value, this problem illustrates the potential inefficiencies of having two parallel systems.

Image 6: PET bottles sorted out and compacted at the separation facility in Nur-Sultan.

Image 7: A collection centre in Nur-Sultan.

Mandatory EPR System: A Case Study of Spain

The first explored alternative is a mandatory extended producer responsibility (MEPR) scheme that arranges for the collection of single-use beverage containers without a DRS. In these systems, PET bottles are collected together with other plastic packaging in one container. Spain has effectively implemented this system and it is used here as an example to illustrate a MEPR system.

Spanish law obliges municipalities to collect household waste, but it mandates that industry pay the full extra costs for the separate collection of packaging waste and its treatment. In order to fulfil their responsibility, the obliged actors from the packaging value chain created two private, non-profit producer responsibility organisations (PROs): Ecovidrio, for glass packaging, and Ecoembes, for other packaging. They collect funding, cooperate with local authorities, and ensure recycling in a cost-efficient way. The organisations are financed through a licensing fee on the packaging put on the market, as well as by selling secondary raw material.

In this system, there is no separate collection specifically for PET bottles. Packaging is separated by material with paper in the blue bin, glass in the green bin, and plastic in the yellow bin. In addition, organic and mixed waste are collected separately in the brown and grey bin respectively.

Image 8: Separate collection of packaging waste at a bring point in Bilbao, Spain.

Points of collection include at kerbside and bring points. The plastic packaging, including PET bottles is then transported to separation plants and from there to recycling facilities. In total, about 70% of the total packaging material is collected separately in this way. The remaining 30% is collected in the mixed municipal solid waste stream.
This fraction is usually treated at mechanical biological treatment (MBT) plants, where a certain amount of packaging and PET bottles can be separated and recovered in recycling facilities.

This kind of system enabled Spain to climb in rank to 9th among EU countries in terms of plastic packaging recycling, currently standing at 47.9% [2]. These achievements are made possible by a strong legal framework and its enforcement, provided for by the national government on the one hand and EU regulations including mandatory minimum collection and recycling targets on the other.

Interviewees highlighted that the system is financially stable and organises the collection of PET bottles at a lower cost than a DRS. In fact, Ecoembes argues that a mandatory DRS system would lead to costs 11 times higher than the current system [1]. The Spanish system also provides a rather easy solution for consumers, because all plastic packaging waste is collected in a single container and does not require them to bring back bottles to retailers or vending machines like in a DRS.

While the MEPR system is relatively successful in terms of the quantity collected and recycled, this is at the expense of recycling quality. Consolidating PET bottles with other packaging in the yellow bin contaminates them, complicating separation and recycling, increasing the associated costs. Therefore, most recycling happens in the form of down-cycling, meaning that high quality materials, such as PET bottles, are recycled into lower quality products, such as fleece or plastic film.

The final problem with MEPR schemes like the one in Spain, is that they are not effective against littering. These systems rely heavily on consumer awareness with little additional incentive to collect or separate waste. One interviewee argued that under
such a system, there is a theoretical collection limit of 85% of plastic packaging, although as the actual results in Spain show, this is often not met in reality.

In order for a system similar to the one in Spain to be effective in Nur-Sultan there must be clear obligations for the industry in the form of targets and stringent enforcement from the government. Second, the system requires strong efforts with regard to education and awareness creation. This includes both civic education in schools and awareness creation among consumers through campaigns. This is crucial to increase separation and decrease the amount of packaging ending up in the mixed waste fraction as well as false throws in the packaging containers. Finally, there need to be additional measures against littering. This is a particular concern for PET bottles because they are often consumed on the go and the system provides no incentive for waste collectors to pick them up.

Voluntary EPR System: A Case Study of South Africa

The second investigated alternative is a Voluntary Extended Producer Responsibility (VEPR) scheme. In several upper-middle-income countries like Mexico and South Africa, systems for the collection and recycling of PET bottles are set up by industry and participation is voluntary. In the following section, South Africa will be used as a case study to detail VEPR systems.

Under an umbrella PRO for packaging waste set up by the industry association, several PROs for specific packaging waste exist. The PROs collect fees from companies in the respective value chain and use them to financially support collection and recycling projects and programmes.

PETCO is a non-profit organisation whose members include actors from the PET bottle value chain which collectively control 90% of the market. It is financed by a voluntary levy on PET resin and grants. PETCO does not own any collection or recycling facilities, instead it provides direct financial support to large-scale recyclers to promote cost-efficient and high-quality recycling. In addition, it also funds marketing and awareness creation for consumers as well as training and equipment for collectors. PETCO assumes no role in the collection of materials, the organisation of the collection system is entirely based on market conditions.

Due to the limited implementation of the municipal waste collection system, the PETCO system heavily relies on existing informal collectors. Post-consumer PET bottles are mainly collected by informal collectors on the streets, beaches, riversides, and from landfills. At the same time, formal and semi-formal collection happens at kerbside collection points or larger institutions like airports where PET bottles are frequently separated at source. Collected bottles are then sold to buy-back centres.
and transported for recycling to the facilities contracted by PETCO.

![Figure 4: Schematic illustration of the collection and recycling system for PET bottles in South Africa. Material flows refer to PET bottles specifically.](image)

![Figure 5: Recycling rate for PET bottles in South Africa 2005-2017 (prepared based on PETCO, 2019).](image)

The industry and the government mutually agreed on targets with respect to PET bottle recycling. By 2022, PETCO aims to recycle 70% of post-consumer PET bottles. The system relies on self-monitoring and reporting and there are no consequences for the failure to meet targets.

Since its implementation, the system has led to significant improvements regarding the recycling rate of PET bottles in South Africa. According to PETCO, the recycling rate increased continuously from 2% in 2000 to 65% in 2017. In 2017, 93,235 tonnes of PET bottles were collected for recycling, of which around 38% was used for food-grade recycling, 58% was recycled into fibre, and 4% into flakes for further processing [3].

![Image 10: Containers for PET bottle collection provided by PETCO.](image)

The high rate of food-grade recycling demonstrates one of the main advantages of this system: the selective collection of PET bottles leads to low levels of contamination. At the same time, the system has rather low collection costs because PETCO does not pay for setting up the collection system although they do donate equipment such as trolleys and trucks, which only account for around 5% of its total expenditures. Furthermore, the system provides a strong incentive to collect littered bottles.

There are, however, several disadvantages. The system only focuses on a single material and on what is valuable. As such, it is
not a holistic approach to waste management. PET bottles only account for 17% of all plastic packaging waste and merely 4% of all packaging by weight [4].

The reliance on the informal sector for the collection and associated poor working conditions lead to health and safety concerns that are seldom addressed. The reliance on the informal sector also leads to the risk that the system will stop functioning if the country becomes more affluent and the collectors have alternative economic opportunities.

If such a system is to be considered in Nur-Sultan, it will be important to address two critical factors. First, this kind of system is only feasible when the industry is united and motivated to address the underlying problem. It is necessary to ensure high participation and collaboration in order to set up an effective recycling system. Second, while setting collection and recycling targets in collaboration with the industry enhances achievability, performance needs to be monitored and mechanisms need to be in place to ensure accountability.

**Reverse Vending Machines**

The final proposed alternative is one where reverse vending machines (RVMs) are used for the collection of PET beverage containers without a DRS. Instead, other incentives are used to motivate individuals to return beverage containers.

While the exact organisation of the system can vary, all of these arrangements share some general characteristics. First, there are one or more private or public sponsors that contribute to the capital cost, operational cost, and incentives. In addition, there is usually a second organisation that is responsible for the machines, including monitoring, operation, and maintenance. This involves regular emptying of the machines and the transport and sale of the material. In the examined case studies, this was usually facilitated by municipalities or waste management companies contracted by municipalities.

Once the machines are in place, consumers return their bottles to the machine and receive a compensation in return. This may be in a direct and tangible form, such as a bus ticket or minutes for a phone subscription; or it can be intangible as part of a bonus-point system on a mobile phone app. After a certain amount of points are collected, the consumer can exchange them for rewards from participating organisations. Such rewards could include coffee, cinema tickets, or a discount on a utility bill.

![Image 11: An example of a reverse vending machine.](image-url)

RVMs have been trialled in cities around the world including Beijing (5,000 machines), Istanbul (100), Warsaw (10), and Rome (3). In Beijing and Istanbul, the system focused on subsidising public transport while both Warsaw and Rome have linked apps which granted Eco-points.

The reported success of each case has varied. The capacity of the best available technology is about 2,300 bottles before it must
be emptied. The limits to the capacity of these machines is important because it is dwarfed by the number of beverage containers put on the market every day. The difference in magnitudes between the capacity for takeback and the need for takeback prevent this system from functioning as a stand-alone intervention and relegate it to being a complement to a holistic waste management system.

This conclusion has been supported by other experts who have added that the implementation of RVMs in the absence of a DRS, often lead to initial enthusiasm among consumers, collectors, and implementing organisations but are not sustainable in the long run. The research has identified at least 16 examples of such systems that have either been discontinued, stalled, or never went live.

There were multiple obstacles identified that render many of these projects unsuccessful. Above all is the high installation and operational costs as well as the need to cover the cost of the consumer incentive. Revenues from the sale of collected material alone are not able to cover these costs, leaving the system dependent on external funding.

Another obstacle is that the idea of returning a larger amount of bottles to RVMs may not be culturally accepted and there could be stigma surrounding it. Several anecdotal stories from Kazakhstan mentioned that the people who would return these bottles would be people facing homelessness and that business owners would not want them, and therefore these machines, near their businesses.

The machines may also be subject to vandalism. This is particularly the case if located outdoors, which necessitates the implementation of protective measures leading to additional costs. Finally, the success of an RVM scheme is highly dependent on the type and level of incentive, and experts have highlighted the need for these to be culturally adapted to truly motivate the target population. Determining such a type and level may prove difficult for decision makers.

While the above shows that effectively implementing RVMs in a non-DRS context is challenging, there are a number of benefits to this alternative. The most important benefit is the high-quality material output. By design, RVMs drastically limit the amount of contamination. However, ultimately, this is only meaningful if there are recycling facilities that can recycle PET bottles at a high level.

Another benefit of RVMs is that they address littering in that they provide the incentive for consumers and collectors to hold on to, or pick up bottles. RVMs are also relatively easy to deploy, because they do not require the establishment of an entire DRS. Finally, their high visibility in public spaces provides ample opportunity...
to use them to raise awareness among consumers on the importance of recycling.

If Nur-Sultan would consider this alternative as one part of a larger strategy to collect PET bottles, there are some important points to consider. Firstly, sufficient funds for associated costs would need to be secured. Various case studies have shown that collaboration with industries may provide sponsorship possibilities. Second, one would have to find an incentive that people respond well to in the local context and motivates them to use the service. Finally, one would have to think about suitable locations with a high enough circulation of people, where machines would not be subject to vandalism.

**Success Factors**

In order to ensure the success of any of the proposed alternatives, it is important to consider that separate collection is essential in ensuring a high quality of material. It reduces treatment costs, increases the recyclability of the material, and provides a higher material value.

Separate waste collection at source is the most meaningful measure to increase the quality of not only PET, but also of other materials which could be recovered and recycled. RVMs by their very nature ensure that PET is segregated from other materials and this is one of their biggest assets. VEPR schemes also strive to separate PET from other waste streams earlier on in the process of reducing contamination. A MEPR is dependent upon people separating their waste without a financial incentive. The better that waste is sorted, the higher the quality output will be.

In order for a separation system to be effective, it requires public participation. Many times, the team did not notice a significant difference between the mixed waste and recyclable waste. Better information sharing and awareness-raising of how the system works will be essential to changing this situation.

However, it is likely that these problems do not solely arise from a lack of awareness as two anecdotal stories made clear. One story focused on the fact that people did not want to sort their waste because they knew it would generate value for the waste company. Many people expressed an aversion to doing something which would help a private company but that they would not benefit from. One way to alleviate people’s concerns could be to highlight the environmental benefits of waste sorting and recycling.

A second anecdotal story focused on a problem noticed in Nur-Sultan’s current separate collection. Several people have adamantly declared that they have seen Clean City NC collect waste from both the mixed waste and recycling bins in the same truck. People will not contribute to a system if they believe that their work will not matter. Ensuring proper training of the waste collection personnel and convincing people this practice is not carried out will be crucial to get the population to support any new system for recycling.
Conclusion
As has been shown, there are alternatives available to Nur-Sultan for collection of PET bottles beyond that of a DRS. Three possible alternatives have been presented here: the Spanish MEPR scheme, the South African VEPR scheme, and an incentive-based RVM scheme. These systems all have their own advantages and disadvantages and will need to be adapted to the local context. While the path forward is still being determined, it is clear that waste can no longer be an issue swept under the carpet in Nur-Sultan.

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Sustainable Consumption in Västernorrland

Conquering Nordic Consumerism

By Natalie Gravett, Emma Johnson, Evgeni Petelin & Sofia Wiman

Introduction

It is commonly recognised that unsustainable patterns of consumption contribute to the climate crisis. Material consumption worldwide has increased significantly since the 1970s, resulting in a growing burden on the environment [1]. In the case of Sweden, consumption-based emissions have increased since the 1990s to such a degree that any improvements in production-based emissions during the same time period have been negated [2]. Consumption-based emissions should be halved by 2030 in order to prevent climate breakdown [3].

Wealth in terms of high levels of disposable income is an important factor in contributing to unsustainable consumption [3]. While cities in Västernorrland may not have the highest levels of income in Sweden, it still has a high GDP per capita compared to the rest of the world. The problematic relationship between wealth and unsustainable consumption was reflected in many of the interviews conducted for this project, particularly with waste management organisations who firsthand see the amount of waste produced. One interviewee from MittSverige Vatten och Avfall made a statement that captured this societal issue well: “We’re doing too good in a country to [the point where we] throw away wrapped stuff” [42].

While this reflects a complex societal problem, individual behaviour still plays a critical role in supporting sustainable consumption. While individual consumers will not be able to change this system on their own, they have the power to alter demand [3]. By changing their shopping habits to buy less, and to choose more sustainable alternatives when needed, consumers can send a signal to businesses that traditional business models need to change or risk extinction. This will require a change in individual consumer behaviour towards sustainable consumption patterns. Sustainable consumption here implies primarily reducing absolute consumption and secondarily shifting towards sustainable alternatives [3].
The Client

Västernorrland has seven municipalities and a population of 246,000 people [4]. The county’s population is ageing, with almost one quarter of the people being 65 years or older [5]. The county is sparsely populated and aside from the urban parts of Sundsvall, the whole county is considered rural [6].

As mandated by the Swedish Government, Länsstyrelsen Västernorrland (County Administrative Board) was tasked with creating a regional strategy to help reach national energy and climate goals [7]. Länsstyrelsen Västernorrland chose “sustainable consumption” as one of its five focus areas, with “behavioural change” as an accompanying sub-area [2]. The other four focus areas are on electricity, fossil-free transport, a strong bioeconomy, and sustainable construction and real estate. These sectors are out of scope since there are already existing initiatives to address these. The ambition to target sustainable consumption with a focus on behavioural change set the direction for this project since it requires new proposals to initiate policy and action.

The Challenge

This project aims to provide a solution to unsustainable consumption, while considering other societal issues such as struggling city centres and an ageing population. Västernorrland has struggled to keep local businesses alive due to online shopping trends, large shopping malls, and depopulation of the region. Although Länsstyrelsen’s priority has highlighted promoting sustainable consumption, it must also encourage local businesses and more social city centres. Proposed solutions to address these issues should include existing social and sustainable initiatives in the region to help strengthen their work and to provide a more relevant and coherent solution. The main objective of this project has been to identify and examine the viability of sustainable consumption initiatives that would encourage behavioural change in the region.

Methods

Methodologically the project consisted of seven main steps (Figure 1). The pre-study first included four steps focusing on creating a short-list of solutions for consumer behaviour change in the region.

The on-site research included steps five and six focusing on case study analyses, 14 stakeholder interviews, and a micro-survey of residents to assess interest in the short-listed solutions: Share Space and ECOmmunity mobile application.

The case study analyses focused on 31 cases for rental initiatives, and 9 cases for sustainable mobile apps. Interviews were conducted with 10 experts who run these initiatives. The stakeholder interviews included representatives from Länsstyrelsen and Region Västernorrland.
municipalities, waste-management companies, non-profit organisations, and libraries. The micro-survey of 521 residents was collected with proportional representation of all seven municipalities and age groups from 16 to over 65 years old.

To conclude stage six, a workshop was conducted with regional stakeholders to discuss the project findings including their interest and potential future involvement. The final step seven focused on identifying anticipated outcomes, success factors and critical elements for proposed solutions.

**Status Quo**

Providing suitable suggestions for Länsstyrelsen called for an understanding

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*Figure 2: Methods used to research sustainable consumption in Västernorrland.*
of Västernorrland’s context in three dimensions: citizen engagement, local actions by municipalities, and existing local initiatives towards sustainable consumption.

**Citizen Engagement**

In order to change their consumption patterns towards buying less, sharing and buying second-hand, consumers in Västernorrland need to have access to sustainability information. The micro-survey demonstrated that 83% of regional respondents believe that sustainable consumption information is accessible. Only 5% of respondents replied that information is not available. Generally, the older generations are more satisfied with the information available, with younger generations seeking more. Among the channels for sustainability information, webpages, advice from family and friends, and flyers were preferred. Digital solutions are generally most preferred as a source of information.

74% of respondents state that they are ready to change their shopping habits towards buying less, buying eco-labelled products, renting items and buying second-hand items if they have enough information. Although 65% of respondents state that they have never rented household items, 79% claim that they are ready to start renting tools, garden instruments, and sports equipment, indicating a significant market potential.

**Local actions by municipalities**

Municipalities in Västernorrland have different approaches to sustainable consumption. With the largest population in the region, Sundsvall has a particularly creative approach towards reducing consumer consumption and waste generation [43]. Together with the local waste management company and other public service companies, the municipality organises informational campaigns and projects addressing different target audiences through various sustainability campaigns [15, 44]. Municipal waste management companies actively collaborate with second-hand stores and rental services [42].

In Härnösand, the municipality’s priorities have 22 directions that include education on decreasing food waste, shifting to vegetarian diets, and general sustainability [32]. Within the region, only Härnösand has a set goal to reduce household waste by 25% by 2025. The local waste management company Hemab provides recycling-focused education through study visits and “recycle week” initiatives to reduce waste generation [21, 24].

The main challenge faced by municipalities in promoting sustainable consumption projects region-wide is the difference in waste management approaches in each municipality.

*Image 2: Interactive element of the workshop where participants selected desired features for the ECOmmunity App.*
**Existing local Initiatives**

The pre-study research and interviews showed that Västernorrland already has a significant number of initiatives for sustainable consumption in place. These include several second-hand shops (Erikshjälpen, Röda Korset); a Makerspace in Härnösand; the regional incubator BizMaker in Sundsvall, the combined social enterprise and second-hand shop Startpunkten in Örnsköldsvik and the sports equipment rental service Sportoteket in Sundsvall.

According to the interviewed representatives [22, 34], the second-hand and rental initiatives equally attract different age and income groups in the region. Motivations are mainly economic, but there is a growing share of the audience using the service due to environmental and social consideration, according to the manager of Erikshjälpen of the region [22].

The main challenges in developing these initiatives include:

- Lack of personnel and over-reliance on volunteers;
- Lack of funding;
- Initiatives linked to short-term projects and associated funding;
- Lack of collaboration with other organisations;
- Lack of knowledge to sustain functioning and funding of initiatives;
- Limited access to citizens.

Digital platforms especially Facebook and websites are considered as the main channels to distribute information about initiatives [22]. However, business representatives still considered a lack of access to citizens as a significant barrier for their development.

The results of the context investigation demonstrated that the potential proposed solutions for sustainable consumption in Västernorrland should (a) connect existing infrastructure and initiatives, (b) include information and physical aspects, (c) be accessible and affordable for citizens, (d) combine environmental and social components.

**Proposed Solutions**

The solutions provided to Länsstyrelsen include a physical (Share Space network) and digital aspect (ECOmmunity Mobile App). The mobile application seeks to bridge the information gap, whilst the Share Space is an alternative business model that requires a shift in the way people consume [8].

It is hypothesised that this combination would address the region’s concerns and provide a solution for both the ageing and younger populations, as it appears there are differences between how these demographics perceive sustainability and how they can best contribute as individuals.

Potential business models for the initiatives are analysed in order to determine who could feasibly pay for such services and costs to best benefit the region. While the initiatives are intended to be not-for-profit, they should have a business model in order to be self-sufficient after initial funding.

1. **Share Space**

After a detailed analysis of over 30 Library of Things and Tool Libraries from across the world, it was deemed that a Share Space network would be an appropriate proposal for the region.

The Share Space is proposed as a space where citizens of all ages can gather, primarily for renting household and garden tools, but also for workshops where community members can deliver seminars.
and offer opportunities for citizens to learn new skills. The space could facilitate discussions and social interactions amongst community members to promote a more active city centre. Many of the analysed Tool Libraries are designed to function in a similar fashion to a conventional hardware store, but offer renting instead of buying. What is proposed for this Share Space is more community-driven and broader than simply a place for renting.

**Anticipated Outcomes**

A Share Space network could provide the physical infrastructure for citizens to transition from purchase to rental models. Rental models reduce the environmental footprint of products as one item is rented by multiple users, rather than multiple users owning many items. This avoids environmental degradation caused by material extraction, and greenhouse gas emissions produced during the production and end of life stages in particular [9]. This model is particularly logical for rarely used items such as drills, sewing machines and garden tools, where individuals do not require daily access or ownership.

Aside from the reduced environmental impact, the Share Spaces offer opportunities to communicate environmental messages to users directly when visiting the space, informing them of ways to transition to more sustainable lifestyles outside of item rental. The Share Space network could also provide workshops that educate citizens and teach repair and reuse skills, thereby increasing the overall positive impact.

**Successes and Challenges**

The case study analysis provided details on the lessons learnt in terms of logistics (size, location, opening hours), financials (annual membership, rental fees, free access), promotion (different marketing strategies and digital platforms), legalities (liability, insurance), target audiences (donating, renting, teaching, volunteering) and organisation (volunteer-run vs paid employees).

From the interviews with Edinburgh Tool Library, SHARE Oxford, the online booking platform MyTurn, and a literature review, we determined a Minimum Viable Product for Västernorrland. Considering the long distances and limited transport infrastructure, it is recommended that Västernorrland develops a network of Share Spaces in different municipalities across the region, with the option to reserve, pick up and drop off items between places using the existing library bus in Härnösand and Sollefteå. The network could use a digital booking system to view and reserve items. This type of system can collect data on

**Image 4**: Sambiblioketet (Härnösand), a building combining a city library and other community services. A potential area for the Share Space.
renting trends and behaviour as well. It is essential that there is enough space to house the items, as well as to deliver creative workshops and seminars.

Depending on availability, it is envisaged that the region utilises existing municipal spaces such as Sambiblioteket and municipal libraries since they: are centrally located, embracing new roles, have high visitation across different demographics, municipally-owned spaces, and have been embracing sharing practices since their initiation. Although initial funding will be required to set up the Share Space network, the business model should ensure economic sustainability and self-sufficiency with an annual membership fee (reduced for pensioners, students, and the unemployed) that provides greater income predictability and member commitment, whilst reducing the administrative burden. The region should facilitate employment and allocate a network coordinator who balances the stock and analyses data.

Critical Elements

To implement this the following actions would be required:

- Determine space in the municipalities for the Share Spaces;
- Further user research to determine approximate membership numbers and annual fees;
- Develop an item list of what should be stocked within the Share Spaces;
- Engage with local businesses and individuals willing to provide classes and workshops;
- Complete a funding analysis to estimate the funds required.

II. ECOmmunity App

A mobile application was proposed as a relevant and necessary solution to Västernorrland as a form of digital infrastructure to deliver continuous information to citizens. Since the survey indicated that younger generations are demand more information in regard to sustainability, this solution is targeted to that demographic. The ECOmmunity app aims to connect the community while building a more engaged and long-lasting understanding of sustainability through behavioural change techniques. This solution addresses various consumption categories, can connect users in sparsely populated areas, and give leverage to existing initiatives and businesses working with sustainability.

While informational campaigns often are short-term and do not result in lasting impact, an app can continue to engage citizens in the long term.

Anticipated Outcomes

The ECOmmunity app aims to address four main issues associated with consumption:

- Lack of awareness of existing sustainability initiatives;
- Restricted and scattered information availability;
- Behavioural norms that restrict consumers from changing;
- High perceived costs and few perceived benefits of sustainable behaviour

By providing a regional smart map to highlight sustainable initiatives such as second-hand stores or sharing resources, aggregating sustainability information and news to make it accessible and consistent, gamifying sustainability and offering incentives to users to encourage sustainable behaviour, the mobile app can empower
citizens to use this information to make choices that support sustainable consumption. When people begin to make more sustainable choices in one aspect of their life and identify their values with doing so, this can lead to spillover effects, or a desire to participate in other sustainable behaviours since consistency is desirable [10].

Through this, the app will result in the following:

- Increased awareness and engagement with sustainability initiatives;
- Educated citizens that can make empowered choices;
- Normalised and consistent sustainable behaviour;
- Increased interaction and partnerships;
- Support of local green economy.

These outcomes can result in lower environmental footprint from consumption, local job creation and increased engagement in the sustainability community. This is supported through the survey conducted, in which 74% of respondents in Västernorrland stated they are interested in having a mobile application to learn about local sustainability information. Citizens were most interested in using an app to find more information about second-hand and local shops, and were also interested in learning about local events and workshops, as well as sustainable life tips. Respondents also listed certain app features that were important to them. According to these results, the app should be free and easy to use, designed well, have information updates, no adverts, and do not take too much memory.

**Successes and Challenges**

Various eco apps were initially examined, but two case studies of digital sustainable platforms were analysed in detail as they were deemed relevant to the region and on par with parallel research of using digitalisation to create behavioural change. Insight from the CEO of GreenApes and the Co-founder of Smarta Kartan showed that building a successful and sustainable digital platform should include: a) local specificity and involvement, b) committed governance from municipalities, c) citizen and local initiative engagement in the design phase, d) dynamic design and flexibility, e) continual marketing and promotion, and f) connection to institutional players in the region such as utility and transport companies [27,44].

Challenges for the ECOmmunity app are both in the development and maintenance elements, as well as the user engagement component. Challenges for app creation lay primarily within finding an allocated role for gathering information and updating content with the app, determining what organisation should be responsible, and securing maintenance funding for the
application. Challenges for user engagement are contingent on having enough funding for marketing, as well as sustaining user interest.

**Critical Elements**

Based on the understanding cultivated from the case studies, a minimal viable product for Västernorrland should include a smart map highlighting local sustainability initiatives and businesses, a formal information channel to provide local sustainability tips and news, and gamification features to encourage sustainable behaviour and app engagement. These elements should be comprised of other features that motivate behavioural change and encourage interaction. These features would help to inspire others, inform users of the potential impact of their choices, and normalise and incentivise sustainable behaviour through rewards while emphasising the benefit of the user's action to their individual values through certain behavioural change techniques as shown in Table 1 [11].

**Implementation**

Prior to developing the mobile app, the county must allocate structural responsibilities so that there is consistent drive to see the project through. This should include responsibility for: app management, tech development, and content curation and maintenance.

Engagement of citizens and local organisations is also key in order to assess what residents would like to see in their app and what should be on the sustainable map. Involving local sustainable organisations is necessary to gauge how they would like to use the app to promote their activities and how they can help promote user engagement.

<table>
<thead>
<tr>
<th>App Features</th>
<th>Behavioural Change Techniques</th>
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<tbody>
<tr>
<td>Visual feedback</td>
<td>Behavioural and outcome feedback, framing</td>
</tr>
<tr>
<td>Comprehension of impacts and benefits</td>
<td>Behavioural cost, reward approximation and shaping</td>
</tr>
<tr>
<td>Notifications and reminders</td>
<td>Behavioural substitution, habit formation</td>
</tr>
<tr>
<td>Community benchmarking and story-telling</td>
<td>Reflective capacity, social comparison, self-monitoring, social reward, self-role model identification</td>
</tr>
<tr>
<td>User challenges</td>
<td>Goal setting, commitment</td>
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<tr>
<td>Offering small rewards</td>
<td>Self-incentive, self-reward</td>
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Table 1: Relationship of mobile application features to Michie et al.’s (2013) behavioural change technique taxonomy.

The implementation phase should also set and allocate a budget to include funding for the technical development, maintenance, and for the continuous marketing and communication of the app. Strategic partnerships should be considered between the county, municipalities, and local businesses to pool funding resources to pay for app development.

**Value to Västernorrland**

This project offered value to Länsstyrelsen Västernorrland in multiple ways. Based on feedback from the client, the presented solutions provided fresh perspectives on how to approach sustainable consumption. The presented solutions are also customisable and flexible as new initiatives can be incorporated over time.

The mobile app has broader practical coverage than the sharing network, but can also contribute to the success of the Share Space by advertising the initiative and marketing workshops and events. It is
envisaged that the solutions together provide a comprehensive package to address sustainable consumption through different mediums, target audiences and behavioural change strategies.

The project enabled new connections to be made between the client and relevant stakeholders, expanding their network for collaboration. Lastly, citizen engagement was gauged, which had not been done previously.

**Co-benefits**

Reduced greenhouse gas emissions and material resource efficiency from consumption are the primary intended goals from the proposed initiatives. However, co-benefits are understood and factored into the selection of these proposals since there is a greater positive effect perceived than the direct benefits. Co-benefits are often defined as additional benefits resulting from one policy, or positive effects that a policy targeted at one objective may have on additional objectives [12]. The proposed solutions create co-benefits on both a social and economic level and are mapped out in Figure 4.

**Limitations**

Whilst a rigorous investigation was conducted, there are some components of the study that prevented the team from making more detailed recommendations to the client. Firstly, the micro-survey was conducted over a one-week period, hence only 521 responses were recorded. Whilst this was insightful to indicate demand for solutions and provided an idea of the citizens’ view, it was not statistically representative, and a more comprehensive study would have to be designed at a later stage.

The interviews and workshops indicated interest amongst various stakeholders and stakeholder groups within the region. However, behaviour is governed by more than intention [13]. From the on-site interviews, several stakeholders raised the concern that although they would like to be engaged in the proposed initiatives, they would need sufficient financial and human resources. Even though the main responsibility and coordination would lie with Länsstyrelsen, the perception of collaboration being arduous could hinder future progress.

Concerns have been raised in regard to the Share Space network competing against other businesses in the areas (e.g. hardware stores). This is viewed to be problematic as the solution would involve governmental stakeholders such as Länsstyrelsen Västernorrland and municipalities who are required to be unbiased and avoid competition disputes.
In a study of governmental authorities and county boards across Sweden, over 40% responded that they do not have the right conditions to contribute substantially towards national climate work [14]. One of these conditions is finances. Both the ECOmmunity App and Share Space network will require some initial investment, especially to market the initiatives and assign responsibilities and hire staff. Whether Länsstyrelsen applies a phased or complete solution package depends on available funding, thus only a theoretical implementation structure can be outlined at this stage. Whilst there are potential funding opportunities from the EU Regional Development Fund and European Social Fund, these funding routes cannot be guaranteed. Therefore, proposing solutions linked to uncertain financial capital has a limitation in that they are reliant on external decision-makers and require significant input for Länsstyrelsen.

Outlook

Behavioural change is needed to advocate sustainable consumption patterns. This can be addressed through the Share Space and ECOmmunity app, as they offer different pathways and target different audiences to normalise sustainable behaviour.

Looking forward, Länsstyrelsen should determine citizen and stakeholder interest, and use the project findings as the foundation for EU funding applications, as well as allocate formal roles and responsibilities for implementation. A communication strategy would also be essential to promote the initiatives.

However, a reflective infrastructure is still needed to support these initiatives. It is with optimism for the future that a shift to more sustainable individual demand in Västernorrland will result in a local green infrastructure and economy that will rise to reinforce these changes.

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Reflections

As the first batch to experience two full years in Lund, we have shown that we are anything but an experiment. We have embraced our own diversity, overcome adversity, and created new paths for different clients from all walks of life. In essence, the learnings in these reports demonstrate that although we are mindful of the past and future, Batch 25 creates sustainable solutions in context while living in the present. Now we share our reflections.

Team Portugal observed that while climate adaptation action varies based on local context, common factors of success are a gradual, collaborative approach in decision-making, transparency, and ongoing stakeholder involvement. This is a valuable lesson as more communities around the world embark upon their adaptation journeys.

From the incredible friendliness and determination of the people to the ever-changing agenda, Team Kaliningrad stayed surprised during its time in the Vishytynetskiy Nature Park. The project proved that an organised community of neighbours can preserve the spirit of a forest.

The main takeaway from Team Olives (Lesvos) is that even a close-knit and proud community can show a willingness to change. Traditions can be improved as long as the essence of that tradition is not compromised. Sustainable solutions can happen in the smallest of seaside villages and still make a large impact on the people who live or work there.

Team Mallorca got inspired by a passionate initiative, turning ideas into practice. Understanding local structures and connecting people is a key to overcoming barriers of private interest and tradition. Passion and a shared vision is needed to drive change.

Team Kenya was inspired to work with people who dare to take risks by investing in and improving ‘dirty’ industries to make positive social and environmental impacts. Visiting Kenya opened the team’s eyes as to how effective change can be made in a completely different cultural context, especially when commitment and a clear vision is in place.

For Team Kazakhstan waste separation-at-source became essential to sustainable waste management and superior to separation technology. Some view corporations with suspicion, others see them as beacons of accountability, embodying transparency. Depending on context, visions of success differ, and at times the leading example can be unexpected.

Team Västernorrland learned that challenges like rurality and an ageing population can be reframed as opportunities for community building and sustainable development. Business models are critical to ensure initiatives can stand alone. And as for sustainable consumption, it must be addressed in a holistic and systematic way, considering all infrastructural conditions.

As for the IIIEE, thank you for transforming us each day and allowing our class to accelerate others into the future. This moment has been real, the journey is now.
The International Institute for Industrial Environmental Economics in Lund.
Photo: Håkan Rodhe