Sustainability and exploitation strategy

Deliverable D9.11 of the PlastLIFE-project

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PlastLIFE

The deliverable D.9.11
Sustainability and exploitation strategy

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Contents

Summary

The Sustainability and Exploitation Strategy has been compiled for the PlastLIFE SIP – project. The strategy uses a framework model where key focal points of sustainability and exploitation are used as steppingstones to the ultimate target of the project.

The PlastLIFE SIP -project is an EU-funded project that receives its core funding from the European Union's LIFE program. The project will last for seven years between the years 2022 – 2029. PlastLIFE tackles the plastic challenge by implementing the four objectives of the Plastic Roadmap for Finland: (1) reduce littering and other negative impacts caused by plastics, (2) refuse from unnecessary consumption of plastics, (3) increase recycling of all types of plastics and (4) replace fossil plastics with bio-based materials and/or other solutions.

In order for the ultimate targets of the Plastic Roadmap for Finland to be achieved, the PlastLIFE- project will need to have sustained and exploited results in the Finnish society. The way the project expects to pass on the knowledge, good practices and results gained from within the project pilots to other stakeholders i.e., policy and decision makers, companies, students and the general public, is through seven key focal points; knowledge creation, guidelines, policy processes, stakeholder cooperation, indicators, international co-operation and business model development & innovation.

Through these steppingstones, the project will have a significant impact on the Finnish society (business, research, legislation) as well as abroad (European Union legislation, international trade and NGO's for example).

These seven focal points provide a tightly knit strategy which targets the entire plastics value chain which is crucial to tackle the circular economy of plastics challenge.

The "Overview"-table provides a detailed list of concrete actions that are to be demonstrated in the project. These actions are key results that exemplify the seven key focal points. The Overview-table also highlights the designated target groups whom the project recognizes will benefit from the results. These target groups cover the myriad of stakeholders from which plastics value chain is comprised of and which the project aims to have contacted at the end of the project.

THE PLASTLIFE-PROJECT WILL have a significant impact through seven key focal points with which the knowledge, good practices and results will be sustained and exploited in Finland, the European Union and globally.

The PlastLIFE project

The global production of virgin plastics has increased 20-fold since the 1960s. Despite the many benefits of plastics, they cause major environmental and health problems. There is an urgent need for global transition into a safe and sustainable circular economy of plastics.

PlastLIFE tackles the plastic challenge by implementing the four objectives of the Plastic Roadmap for Finland (PRfF, 2019 - 2031): (1) reduce littering and other negative impacts caused by plastics, (2) refuse from unnecessary consumption of plastics, (3) increase recycling of all types of plastics and (4) replace fossil plastics with bio-based materials and/or other solutions. These objectives are achieved through nine work packages designed to directly respond to the measures proposed by the PRfF.

PlastLIFE identifies and implements safe and sustainable solutions for plastic production, consumption and recycling, and develops policy tools and reliable indicators sustaining and up-scaling the results beyond the project. The 17 project beneficiaries and stakeholder networks bring together all the most relevant actors needed for the change.

Together with the complementary measures, PlastLIFE aims at the full implementation of the PRfF in all geographical regions of Finland by 2035. The project has set ambitious quantitative targets for increasing recycling, reducing littering and demand for primary fossil-based plastic, mobilising funding as well as achieving a measurable change in the mind-set of the Finnish public, industry and decision-making.

The PlastLIFE and PRfF implement the EU and global plastics and circular economy strategies, action plans and targets. The project supports the targets of the LIFE programme by facilitating the transition into sustainable, circular, toxic-free, energy efficient and climate-resilient economy and by helping to improve the quality of the environment and natural resources such as soil and water that are increasingly polluted and harmed by plastics.

Focal points of sustainability and exploitation

In this report, we understand sustainability and exploitation to mean the planned and strategized actions taken to ensure the continuation of project results. By prioritizing these actions, the project results will be sustained for future use and exploited outside the project pilots as well. These sustainability and exploitation actions are means with which the project can influence the dissemination and eventual use of its results within the life cycle of the project itself. By design, these actions have to be the communicative and disseminative means that the project can enact with its own designated resources. The PlastLIFE SIP project has a separate strategy for project replication which targets means with which to implement good practices and project results outside the framework of the actual project environment and infrastructure.

This strategy presents the sustainability and exploitation actions through seven strategic focal points; knowledge creation, guidelines, policy processes, stakeholder cooperation, indicators, international co-operation and business model development & innovation. Through these seven key focal points we build a tightly knit strategy which targets the entire plastics value chain from a holistic and comprehensive standpoint to tackle the circular economy of plastics challenge.

Knowledge creation

The PlastLIFE SIP will create knowledge that relies on testing, piloting and research.

The sustainability of the project is ensured by the WP3 partners strong long-term research emphasis on natural phenomena, including the topics of PlastLIFE. With a strategic focus on circular economy and research dating back for more than 10 years, JyU-Chem will continue the work related to utilisation of plastic adsorbents after the project. Active communication and networking during the project will ensure close collaboration with partners and possible end-users of the results, enabling widespread use of the results as well as continuity of the project. Potential users of the adsorption research results are especially producers of adsorbent materials and operators of industrial and municipal wastewater treatment facilities.

Alternative solutions and knowledge network (**WP6**) integrates toolkit elements and research insights in activities aimed to activate sustainable R&D processes in companies. The toolkit will be further refined and applied in subsequent research projects at Aalto University, Department of Industrial Engineering and Management. The systematic activities for disseminating findings through seminars and workshops will bring the toolkit available to companies focused on sustainable material development and plastic product manufacturing, and opportunities for one-to-one workshops will support the adoption of toolkit elements in companies. This part of work is done in collaboration with Muovipoli.

Guidelines

The work package for *Reducing the health and environmental impacts of plastics* (**WP3**) will provide better understanding of risks and new guidance for risk assessment. This risk assessment of plastics intended for recycling will be utilized in a framework describing the steps needed in assessment work leading to safer recycling, cleaning up process or rejection of the material for chosen waste streams such as demolition plastic waste or agri-plastics. WP3 will provide data for standardisation processes. SYKE is active in standardisation and represents Finland in many technical committees, and Prof. Tiirola (JyU-Bio) (member of the WP3) is also member of the CEN/TC 230/WG 28 committee. Therefore, we are able to offer knowledge achieved in PlastLIFE-project for standardisation processes.

Under-utilised raw materials from side products will be used in WP6 for developing new kinds of packaging material, biobased adhesives and coating to replace fossil ones. Design, customer experience and storytelling will be an important part of the implementation of the new innovations. Standards and regulation will be challenged to meet the new kind of solutions and end-product properties. Companies' business models need to be updated for biobased solutions and customer awareness need to be increased with targeted dissemination and storytelling to create customer pressure to the market. Recycling needs to be supported and organised as well as the reuse of raw material. After the project the new material prototypes developed and found suitable for their purpose as a part of packaging will be scaled up together or by the companies. Already during the project some manufacturing companies and package users (companies, package users, consumers) will be contacted and discussed for potentiality of the materials and their scale-up. Also, a new project (e.g., Horizon Europe (HEU), Circular Biobased Europe joint undertaking (CBE JU), Business Finland (BF) Research to business) could be formed for the further development, e.g., modification of the material recipes to further improve the materials, and scale-up. Larger production of the selected materials is necessary for the testing of their performance in authentic environment of use, e.g., storage and transport and reuse as package, and recycling. However, the manufacturer itself could be also a rather small company, because the utilisation of side streams demands flexibility, which could be too demanding for very large industries. Based on the SCORE work the open database on environmental profile data of different primary packaging materials will be publicly available also after PlastLIFE by project partner Luke.

Policy processes

The results of the *Support and inspiration for the process of Plastics Roadmap for Finland* (WP7) are used for revision of PRfF. The results of the entire project are channelled to policy processes via WP7 with active dialogue. Also, valuable practical experiences on arranging transition arenas in connection of sustainable plastics transition are gathered. These results may raise interest internationally but also nationally in corresponding transition management work in other domains. The analyses provided by WP9 are taken to the refinement of the PRfR in task 7.1, development of policy proposals in task 7.2 as well as to the plastics networks in Finland and abroad.

Sustainability of the impacts of *Littering and consumption of plastics* (**WP 2**) will be maintained through developing management and policies. The compilation of the most effective management actions to reduce releases of harmful plastic litter will be used for promoting regulations to combat littering of the environment. The results of the report of the effects of macroplastics on Finnish fauna can be used to prepare management actions to reduce the harmful effects of plastics on fauna. This could be accomplished e.g., via the national Program of Measures of the Finnish Marine Strategy or HELCOM Regional Action Plan on Marine Litter (marine fauna). A monitoring system for entanglement/ingestion of litter by marine fauna, recommended by the EU Marine Strategy Framework Directive, may also be developed based on the results of the pilot study.

The developed analytical methods and data on accumulation of harmful substances on WP3 can also be utilised in various other sectors, such as evaluation of environmental impacts of recycled plastics and relevant decision making.

Stakeholder cooperation

The work within PRfF is going to continue after the project. Therefore, there is need for trialled tools and managing efforts that can boost the process. A frontrunner network is established for transition arenas that can be used also after the project in PRfF work and elsewhere. The complementary measures and funding will ensure the full implementation of the PRfF. These will engage the plastics industry in changing the entire plastics value chain into a sustainable value chain (through new industrial innovations for replacing fossil-based plastics with recycled or renewable materials) and enhance the safe circular economy of plastics for the wellbeing of humans and the environment.

Regarding *Littering and consumption of plastics* (**WP2**) the aim is to increase public awareness, activate citizens and change behaviour to a more sustainable direction permanently. To achieve such a long-term change, special attention will be directed to involving children and youth through environmental education, novel ways of integrating art and education, engaging students in working with design-solutions and promotion of responsible and aware citizenship. The Clean Beach Sponsor School Program that is at the moment mostly concentrated in the urban southern parts and Baltic Sea coastline will be spread to rural areas and cities located by the lakes and rivers in Central, Eastern, and Northern Finland. The program will be maintained by the beneficiary Keep the Archipelago Tidy (KAT) also after the project. In addition, activities targeting at strengthening citizen commitment such as events, campaigns and litter monitoring will be continued after the project enhanced by the experiences gained during PlastLIFE. The online guide and mobile app used to communicate harmful environmental and health effects of different plastic types and litter items will be maintained and further developed by SYKE after the project. The app can be further developed for various purposes of environmental monitoring as well as engaging citizens in collecting data and encouraging them to care for the environment.

Recovery and processing of plastics waste for recycling (**WP4**) has company-based tasks on recycling and products made of recycled as well as biobased raw materials. Work among these will continue after the project, providing sustainable products for customers. In principle, the operating models developed in T.4.2 are repeatable in any of the region of Finland. The transport distances are long and population density very low in North Karelia. The project will start improvements in the operating models that are economic and ecologically sustainable in North Karelia and these may be replicated in other Southwest Finland regions.

Plastics in construction & demolition and agriculture & horticulture (**WP5**) will implement a plastics-related action, which is included in The City of Helsinki's Roadmap for Circular and Sharing Economy. The progress of the actions in the roadmap are monitored by a specific monitoring tool, Circularity Watch. Similarly, the results on task 5.1. will be documented and reported in Circularity Watch. The actions in the roadmap will be updated every few years, based on progress and arising needs. The updated actions will be formed i.e., to support further research and implementation of good solutions and learnings which have been achieved through previous work. Accordingly, the city will utilise the roadmap to help sustain and develop further the useful outcomes of task 5.1. Sustainability of the activities will be supported also by extensive communication and training of the city staff throughout the project. In another task, the practices of construction and demolition waste utilisation in producing new products will be continued after the project by the construction companies and waste management companies related to the field. Practices will also be spread through city organisations which are collaborating in the case studies of the task.

The main users of the WP5 results of the agriculture and horticulture material studies and pilot activities of task 5.3 are private companies in waste handling and recycling industries, and horticulture and agriculture sectors in Finland and elsewhere in Europe. Either existing or start-up companies may utilise the results to plan plastics reuse and material recycling processes and related services, including making new products out of recycled plastics if they see enough business potential in it and can get financing for investments they may need. Farms and commercial gardens in Finland and in other EU countries can use

the results to improve their own waste handling. Agriculture and horticulture advisory organisations in Finland and in other European countries can benefit the results in their own communication.

The activities in WP5 will pave the way for new portfolio of market-driven methods capable to solve challenges related to plastic use in agriculture and horticulture. Communication and training materials on the sustainable use of plastics for farmers and students in the agricultural and horticultural sector will be available from open source to stakeholders. The educational material is intended to be made available as a module in a soil mobile app for farm and educational use.

The New Plastics Centre (NPC) network accelerated in the project has potential to continue and grow its activities after the project, having an important part in further activities and implementation of PRfF. Innovation processes activated and developed in the project will target for new sustainable business and products for international markets by business cases owned by companies after the PlastLIFE. The Model of Sustainable Materials Clinic created in the project is meant to continue as a permanent tool for activating new sustainable innovation processes of industry in the area of bio and circular materials.

Indicators

Sustainability, replication, and exploitation of project results (**WP9**) provides indicators to monitor the development of the transition to a sustainable circular economy of plastics in Finland. The indicators are developed and monitored in task 9.1. In addition, targets based on literature and monitoring data are identified. The impacts of the project and complementary measures are quantified in relation to the objectives of the PRfF and PlastLIFE SIP. The monitoring and targets developed can be adopted in the PRfF and other Circular Economy (CE) policies in Finland. The monitoring of the CE of plastics will also be strongly communicated with international professionals, and the latest developments abroad will be utilised in the development of the monitoring.

New, more useful knowledge on plastics streams in Finland is produced to identify the most crucial parts of the economy, where the policy actions need to be targeted to. The environmental impacts of the PlastLIFE SIP tasks are evaluated to support long-term decision-making. A holistic LCA framework is developed in a modular manner and reported transparently, both of which support an easy use of the results and a further exploitation of the modeling framework. The already available LCA-networks in Finland and abroad areutilised to disseminate the results (methodology, framework, and case study results). These new data fill gaps in knowledge and serve as a stepping stone for innovations as well as CE policy long after the project.

All the data produced in WP9 (and other WPs) is collected and thoroughly analysed at the end of each project phase. Strong communication activities are interlinked to the publication of the analysis reports.

Business and citizen surveys and barometers created, implemented and further developed in WP2 are meant for permanent tools for Finland to track and monitor the transition into sustainable circular economy of plastics. The aim is to develop and test these tools so that they can be used for monitoring the PRfF also beyond the timeframe of the project.

International co-operation

Work package for *Dissemination and communication* (**WP8**) promotes strong international co-operation and networking. Finland continues to be an active participant in various international agreements on

plastics (e.g., UNEA-5.2 Global Plastics Treaty and European Plastics Pact) (WP7). SYKE also actively participates in international exchange in the co-operation networks, such as the Nordic Council of Ministers and the European Environment Information and Observation Network (Eionet), where the project findings will be actively distributed to wider professional audiences.

Results of the project and knowledge accumulated in WP4 may be exported to other EU-countries. Some of the participant companies are targeting carbon neutrality by 2030. New raw materials for the production will be tested and used. For the companies the project will be a start for the journey towards carbon neutral and sustainable circular economy of plastic. The work started with this project will be part of everyday work after the project and the transformation done.

Material studies, and agro-plastic collection and recycling pilots conducted and reported in WP5, are results that can be replicated in other countries in Europe, especially in regions where agro-plastic material recycling and reuse is not yet fully organised or conducted in a systematic manner. The alternative solutions to replace black plastic in agriculture and horticulture are increasingly gaining interest in global markets. By demonstrating the recently patented liquid mulch solution, sharing the knowledge, engaging actors through value chain and co-developing approach towards flexible and sustainable multi-benefit solution we will provide internationally interesting concept for markets. Further research needs (beyond the scope of the project) aiming to develop concept and technology are expected, new patents will be filed when appropriate. According to project participant Luke´s protocol, their customer team will facilitate patent uptake by national and international industry/companies.

The criteria and recommendations for biodegradability developed in WP6 can be utilised in Finland and in other European countries. The criteria, recommendations and policy brief will be available at the webpage of PlastLIFE for public free of charge. They can be used as a basis for the development of voluntary based measures, standards or/and national or European legislation. The policy brief will be written for the decision makers together with WP3.

Business model development & innovation

To discuss, analyze and visualize existing business models and opportunities for business model innovation[1] for sustainable plastic management (see Dijkstra et al. 2020), members of the plastic value chain are invited to series of workshops arranged and facilitated jointly by **WP5** (UTU, Task 5.3.2) and **WP6** (Muovipoli and Aalto) experts. Key actors to be invited to workshops include members of the producer responsibility organisations (PROs). Their members typically comprise the whole plastic value chain, including plastic material producers and importers, plastic users, plastic waste handling and recycling companies as well as companies that are already using recycled plastics in their products. The PROs are key organisations enabling sustainable use of plastics, since they are responsible for organising the collection, handling and processing of used plastic materials either to recycling (and material re-use), or to energy recovery. At least 4 of the workshops to be arranged are focusing on horticultural and plant production (see WP5 Task 5.3.2 workplan). The workshops arranged in different parts in Finland (during PlastLIFE project) to enable wide stakeholder participation and in order to pay attention to spatial differences in terms of plastic use, management and existing plastic industry.

The toolkit for innovation and business model development (based on Business model canvas methodology, see Osterwalder & Pigneur 2010) is used in the workshops to visualize and discuss the present situation regarding plastic material management, the role & position of each actor within the value chain as well as collaboration among the actors. The methodology allows analysis of existing elements of

[1] Teece 2010; Boons & Lüdeke-Freund 2013

an organisation, its business model and potential for change to support sustainability and circular economy principles (inside-out approach) as well as comparison and benchmarking of existing business models (e.g. originating from other sectors) to one's own or to ideal type business models (outside-in approach) (Joyce & Paquin 2016). During series of workshops, specific issues regarding e.g. plastic material recovery, processing, product design for improved recycling of plastics and the use of recycled material in finished products that are either raising from the business canvas exercise, or that are raised by the actors themselves during the workshop are discussed. The systematic methodology helps the plastic value chain actors to identify and develop market-driven measures to better handle plastics.

The construction and demolition waste plastic recycling methods studied in the project (WP5) can lead to development of new business opportunities. The European targets for increasing recycling make it feasible to adopt similar practices in other European countries beside Finland.

Overview

Activity	Beneficiary	Target groups	Description
Plastic adsorbents	University of Jyväskylä	Producers of adsorbent materials and operators of industrial and municipal wastewater treatment facilities	Plastics materials will be utilized as adsorbents to recover inorganic and organic compounds to search for potential targets for utilizing the adsorbed and recovered materials and to find potentials processes where the recovered materials could be used as potential raw material sources.
Toolkit for innovation and business model development for sustainable plastics	Aalto University	Companies focused on sustainable material development and plastic product manufacturing	Toolkit for innovation and business model development for sustainable plastics will be developed, tested, and disseminated with new, practically applicable knowledge on the requirements of, and managerial tools for, sustainable innovation and business development to support the development and commercialization of sustainable plastics solutions in companies and inter-organizational networks. The target is that at least 20 industry actors (producers of bio-based and circular plastics, plastic product manufacturers) adopt ideas and elements of the toolkit in their innovation and business development activities.
Data for standardisation processes	Syke	Many technical committees, decision-makers	Syke is active in standardisation and represents Finland in many technical committees, and a consortium member (JyU) is also member of the CEN/TC 230/WG 28 committee. Therefore, we are able to offer knowledge achieved in PlastLIFE-project for standardisation processes.
New material prototypes	Luke	Manufacturing companies and package users	Already during the project some manufacturing companies and package users (companies, package users, consumers) will be contacted and discussed for potentiality of the materials and their scale-up.
Policy processes	Syke	The Plastics Roadmap for Finland	Syke participates in work of PRfF secretary.
Framework to assess environmental and human health risks of recycling intended plastics	Syke	Companies and manufactures, administration	Framework is applied when plastic material is considered to be recycled. The assessment will lead to safer recycling of plastics.

Report of the effects of macroplastics on Finnish fauna	Syke	The national Program of Measures of the Finnish Marine Strategy or HELCOM Regional Action Plan on Marine Litter (marine fauna).	The results of the report of the effects of macroplastics on Finnish fauna can be used to prepare management actions to reduce the harmful effects of plastics on fauna.). A monitoring system for entanglement/ingestion of litter by marine fauna, recommended by the EU Marine Strategy Framework Directive, may also be developed based on the results of the pilot study.
A frontrunner network for transition arenas	Syke	The Plastics Roadmap for Finland	At least 3 transition arenas and at least 4 group discussions are arranged to map actors' interests on plastics policy to support the development of the PRfF.
The Clean Beach Sponsor School Program	Keep the Archipelago Tidy Association	Children and youth, rural areas and cities located by the lakes and rivers in Central, Eastern, and Northern Finland.	Clean Beach -program will be spread to new locations so that the program will cover most of the country.
The online guide and mobile app	Syke		The "Roskalähetti" mobile application will be communicated and utilized in litter awareness campaigns.
Roadmap for Circular and Sharing Economy	City of Helsinki	City staff	A plastic flow analysis of street and park construction has been done for the city of Helsinki as a diploma thesis of Aalto University. Based on the results of the survey, the planning guidelines for street and park construction in the city are to be modified in such a way that they guide to avoid unnecessary use of filter cloths.
New portfolio of market-driven methods capable to solve challenges related to plastic use in agriculture and horticulture	University of Turku	Members of the plastic value chain & Producer Responsibility Organisations (PROs)	The Toolkit for innovation and business model development will be applied to analyse existing business models and potential to innovate new ones.
The New Plastics Centre (NPC) network	Muovipoli	Companies, universities, research organizations, public bodies and the PRfF network.	The aim is to enhance co-operation between the participants, which is needed for new market and science-based material and product innovations.

Indicators	Syke	Experts, administration, stakeholders, citizens	Indicators are developed to monitor and analyse the transition towards sustainable CE of plastics. The indicator data and analyses serve data needs of many sectors and stakeholders: administration and policy development, business sector as well as citizens through impactful communication on the development and success of the transition.
LCA Framework, plastics accounting and input-output modelling	Syke	Experts, administration, stakeholders, citizens	Life cycle analyses and framework as well as plastics accounting and input-output modelling provides all sectors and key stakeholders with novel information on the development, effects, and sustainability of the CE transition of plastics. The results can be utilised in many sectors, including business (sustainability analyses and more sustainable products or services), administration (more effective sustainability policy) as well as citizens (more sustainable everyday choices).
Business and citizen surveys	Syke	Organisations and citizens	The surveys are developed to study awareness, preferences and attitudes towards plastics and alternative materials. They are meant to be permanent tools for Finland to track and monitor the transition into sustainable circular economy of plastics. The aim is to develop and test these tools so that they can be used for monitoring the PRfF also beyond the timeframe of the project.
Piloting recycling of construction and demolition waste plastics	LUT	Actors in construction and demolition sector	Piloting the reprocessed waste plastics products with analyzed properties. Reporting the properties of reprocessed materials. Calculating the environmental impacts of the developed recycling concepts.