Grant Agreement number: 101037031
Project acronym: FRONTSH1P
**Project title:** A FRONTrunner approach to Systemic circular, Holistic & Inclusive solutions for a new Paradigm of territorial circular economy
**Type of action:** Innovation Action (IA)

# REGIONAL ROADMAP: FRIESLAND PROVINCE, NETHERLANDS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# Table of Contents





This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# Table of Figures



# Table of Tables





This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# Abbreviations

CCRI - Circular Cities and Regions Initiative
CE – Circular Economy
CEAP - Circular Economy Action Plan
CpEAP – CircuPuncture Economy Action Plan
CSS – Circular Systemic Solutions
CTC – Circular Territorial Cluster
ICT - information and communication technologies
LAP – Local Activity Place
LR – Lodzkie Region
NGO – Non-Governmental Organisation
RCT - Regional Cluster Team
SAT – self-assesment tool
SLOM – Stowarzyszenie Łódzki Obszar Metropolitalny (Lodz Metropolitan Area Association)
TRL - technology readiness level



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# STAGE I: ANALYSIS OF CONDITIONS




This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# 1 Stage 1: Analysis of Condition

## 1.1 Designation of the Region

The province of Friesland (also known as Fryslân) is one of the twelve provinces located in the Netherlands. Friesland is the largest province of the Netherlands, but the least densely populated. Friesland ranks low on economic indicators, but high when well-being indicators are reviewed. Nevertheless, there is a unique blend of societal well-being and targeted economic strengths. The main drivers for economic growth within this ecosystem are the scale, short communication lines, the presence of industrial chains and the "so-called "Frisian DNA". The power of this DNA is the ability to form a community, partly driven by shared own language and deep-rooted traditions. The culture is characterized by involvement, reliability and loyalty.


*Figure 1 Friesland is located in the Northern part of the Netherlands (source: Britannica)*

One of the goals of the region is to be a European frontrunner concerning circularity. There is a commitment to an integrated approach where supply chains are closed, and waste no longer exists. Everyone is invited to participate in and initiate circular initiatives. There is a large focus on a pragmatic, action-oriented approach, which can be best summarized by the Frisian saying "Best Genôch", which loosely translates to "good enough". Friesland has been pioneering toward a circular economy for a while now, where the focus is to become one the most circular region of the world. Due to the so-called "Frisian Model", a strong foundation has been built. This model is powered by a Triple Helix of business, government and academia. The association Circular Friesland plays a central role in aligning these different perspectives and promoting the collective learning process.

This transition is pursued at the regional scale. The regional scale is ideally suited for accelerating the circular economy. Nevertheless, a lot of initiatives do not stop at the border of Fryslân. The Frisian model has replicated to other neighbouring provinces of the likes of Groningen, Drenthe and recently Utrecht. These provinces have established a similar association, each with their own



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

identity and approach. Specifically, the Province of Groningen and Drenthe have strong ties with Friesland in terms of collaboration.

Overall, the Frisian economic agenda focuses on six key sectors:

1. **Water Technology:** This sector has an important contribution to the broad prosperity of the province. More than half of the water technology employment is based in Friesland, which accounts for 2.600 jobs. With the WaterCampus, Friesland has an important knowledge institution that contributes to innovating and connection.

2. **Agrifood:** This is not only limited to the primary sector agriculture, but the entire chain. It also involves the supplying and processing industries, as well as wholesale, retail and knowledge institutions. Compared to the other parts of the country, this sector is less intensive. The sector comes with the challenge to properly reward circular entrepreneurship and recognizing societal added values. In 2023 there were 31.040 jobs in the sector.

3. **High Tech Systems & Materials (HTSM):** This is a cross-disciplinary sector which is characterized by mostly small, specialized companies. The Frisian HTSM has over 3.500 companies, employing a total of at least 20.600 people. The driving force behind the sector in Friesland is the Innovation Cluster Drachten (ICD).

4. **Circular Materials:** This sector can be subdivided into three different parts: greening, reuse and reducing material use. In Friesland, there is a strong focus on setting up biobased value chains, reuse and circular plastics. In the recycling sector, there are 3.000 jobs. The companies that have potential to apply the circular materials contribute 18.700 jobs to the Frisian market.

5. **Maritime Technology:** Within Friesland, there is a specialisation in yachtbuilding and regular shipping. The sector prefers to operate on the scale of Northern Netherlands, instead of just Friesland. Within Friesland, 5.600 people are working in the sector.

6. **Tourism & Hospitality:** Within the hospitality sector, there are 6.750 companies. The added value per job is relatively low, but the added value of the sector can be better expressed in terms of its contribution to wide prosperity.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031


*Figure 2 The Frisian Economic Agenda Blue Delta (source: Innovatiepact Fryslân)*

In Friesland, circularity does not have one rigid definition. Instead, the region built its foundation on adaptable design principles, which are also known as the "Seven Pillars of Circular Economy". This model serves as a guiding practical tool for business, policymakers and communities. Using this tool, the abstract concept of circularity can be translated into concrete actions that can be applied across different sectors and regional contexts.

The seven pillars are defined as follows:

- **Materials:** It is crucial that raw materials are reused at a high level as long as possible, to minimize negative impacts on nature, biodegradable materials are used as much as possible.
- **Energy:** energy supply from sustainable sources is vital for the circular economy. This includes energy from the sun, water, and wind and other green energy sources. This ensures a system that is clean, reliable and future-proof.
- **Water:** This pillar aims to minimize the use of fresh water and maximize the recovery of energy and nutrients from water. Pollution of aquatic ecosystem must be halted as well.
- **Biodiversity:** When designing products and services, biodiversity should be kept in mind. Preserving biodiversity is essential for maintaining a planet with regenerative capabilities that can sustain life in the long term.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

- **Society & Culture:** The goal is to have a thriving society with self-restoring and regenerative capabilities. This must by a society for everyone, with respect for every culture. Different ideas and perspectives are valued for the resilience and inclusiveness of the system.
- **Health & Wellbeing:** The impact of harmful and toxic substances should be limited. If such substances are used, it is done in a controlled way. This ensure that there is no unnecessary exposure and economic activities do not pose a threat to human health and well-being.
- **Value:** The classic definition of value is broadened. Besides financial value, it also includes social and environmental value. The economy becomes a tool for realizing social and environmental value, which cannot be expressed in monetary terms.

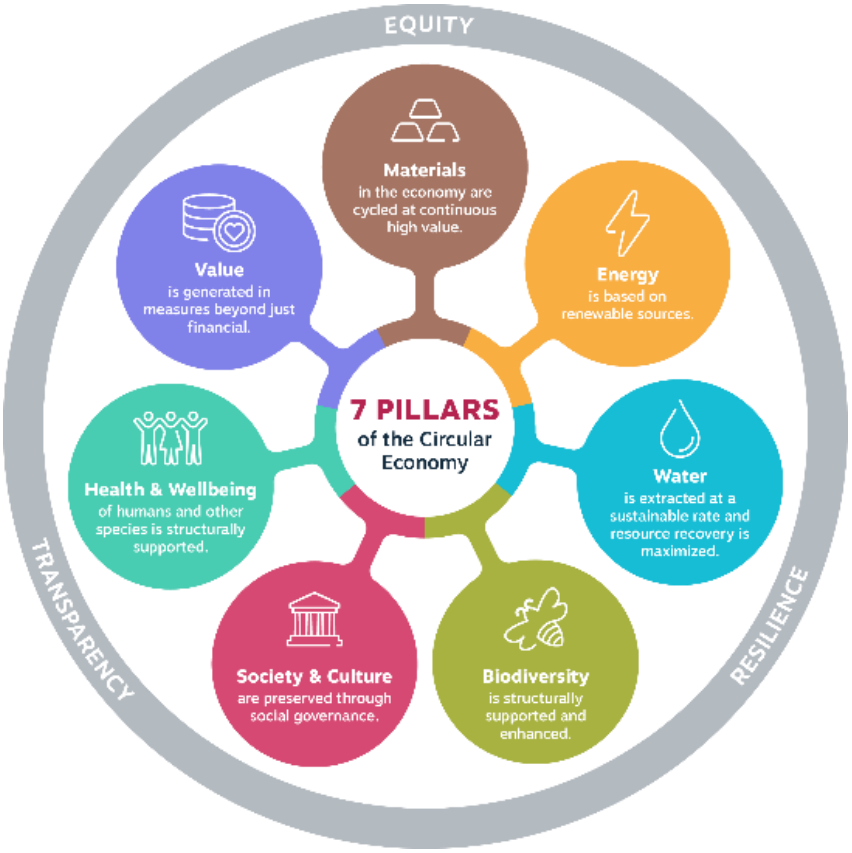


*Figure 3 The 7 Pillars of a Circular Economy (source: Circular Friesland)*

The strength of the model is it allows for flexible use, by also considering regional characteristics. Nevertheless, there is still alignment with the broader circular economy goals. The model has been applied by several companies in the region to make conscious decisions that benefit a circular economy. Additionally, the seven pillars form the backbone for the association's program and the regional strategy. The focus is on specific tipping points, which include activities to set up new value chains, create ownership for relevant stakeholders and connect the region with national and international policy and funds.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

## 1.2 Identification of Key Resources for implementing circular economy activities (including the establishment of indicators)

### 1.2.1 Plastics and Rubber

The strategic direction of Circulair Friesland is rooted in the "Transitie-Doe-Agenda Kunststoffen", which loosely translates to Transition-Action Agenda Plastics (Veele, 2020). With this agenda, the association wanted to inspire the Frisian sector to embrace circularity for plastics. Within the province of Friesland a collection and processing infrastructure has been established via a plastic sorting installation. It is able to handle the largest share of plastic packaging in the Netherlands. Friesland benefits from a unique mechanical sorting and recycling infrastructure operating at an international level. The region boasts a strong knowledge and innovation ecosystem, with the facilities ranging from advanced laboratories to pilot plants. A leading example is the National Test Centre for Circular Plastics (NTCP), where pilot-scale testing can simulate how household plastic waste behaves during sorting and washing processes. These insights contribute to more effective recycling and drive innovation toward fully recycled plastics. Overall, the Netherlands is one of the leaders of Europe in terms of recycling post-consumer waste.

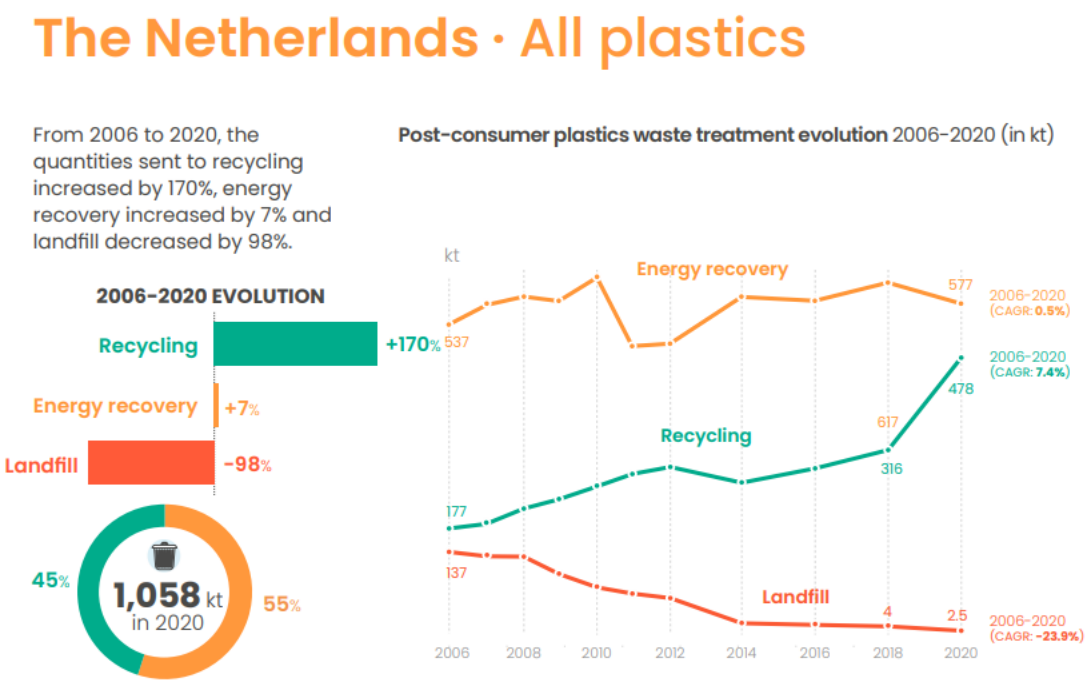


*Figure 4 The recycling quantities for the Netherlands (source: Plastics Europe)*

Circular Friesland emerged from a material flow analysis of the province carried out in 2015. Within this analysis 5 themes were selected to be investigated. One of this theme's was the plastic value chain. In that time, there was still a lot of room for improvement. Recycling was done by an "open loop". In other words, collected plastic was crushed towards granulate, instead of



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

new products. Furthermore, a lot of the biggest recyclers' capacity was outside of the province. The analysis showed the opportunities to be more circular as a province and companies started to have the desire to share their waste streams as feedstock and create (new) products.

After the establishment of the association a lot of developments have been made. Starting in 2019, Circular Friesland and its members have put their signature under the Plastic Pact, which is an agreement to use less plastic, reuse more plastic and make new plastics more recyclable. Furthermore, in 2020 the province had joined the national programme VANG, which aimed to reach 75% waste separation. Furthermore, the Frisian municipalities collaborated to realise closed feedstock loops. As part of the Frontsh1p project, we have been working on updating the "transitie-Doe-agenda" to set a clear focus within the new, Northern collaboration.

An extensive analysis has been performed to classify the companies of Friesland that are active in the sector (Kamminga & Hamstra, 2024). This resulted in a number of clusters, of which the major ones are textiles, rubber, composites, construction plastics, coatings, packaging, foils, injection moulding, waste processing/EOL.

*Table 1 The challenges and stregths of each plastic cluster*

| Cluster | Challenge | Strength |
|---|---|---|
| Textiles | Recycling Difficulty | Multidisciplinary |
| Rubber | Reuse Difficulty | Chemical Resistance |
| Composites | Recycling Difficulty | Lightweight |
| Construction Plastics | Long Life Span (Nature Pollution) | Durable |
| Coatings | Poor Recycling Opportunities | Increases Lifespan |
| Packaging | Recycling Difficulty | Efficient |
| Foils | Recycling Difficulty | Protection |
| Injection Moulding | Use of Recyclage | Flexibility |
| Waste Processing / EOL | Contamination | Close Loops |

Given the developments outline above, it is clear that Friesland has made significant progress in the recent years towards a more circular plastics chain. There is a strong ambition and a solid foundation, active participation between stakeholders and extensive knowledge and experience with plastics across various sectors. At the same time there are still some important challenges that need to be addressed and although challenging, this also offers strategic opportunity. It is therefore a logical a timely choice to introduce a dedicated focus on CSS plastics and rubber within the Frontsh1p project. This focus enables the region to build on the established strengths, address the remaining gaps, and accelerate a transition towards a fully circular plastic economy in the Northern part of the Netherlands.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

## 1.3 Characterization of the region through the prism of the identified resources

### 1.3.1 Management of Plastic & Rubber Waste (CSS4)

The last couple of years, the region has made developments to increase the number of recycled plastics, develop biobased plastic, and reduce the number of used plastics altogether. All plastics have inherent value and should be treated as nutrients within a circular economy. While the aim is to design plastics for reuse, recycling, and added value without harming human health or the environment, most plastics are still not engineered for high-quality recycling due to technical and chemical limitations. A robust technological infrastructure is essential, including separate closed-loop systems for biodegradable and non-biodegradable plastics, ensuring that materials retain their quality and value throughout the cycle. Finally, awareness and responsibility among consumers, producers, and governments are crucial. Everyone must contribute to reducing litter, separating waste correctly, and promoting knowledge-sharing and education to enable high-quality recycling. According to Omrin (2023), the plastic house-hold waste was 17 kg per person per year. The amount of post-collection plastic has been increasing year over year from 19.681 tonnes in 2021 to 22.343 tonnes in 2023.

To accelerate the transition to a circular plastic economy, it is essential to scale up best practices in the production and development of high-quality recycled and alternative materials. This includes improving the perception and understanding of recycled plastics and emerging material, such as biobased and biodegradable plastics, through scalable proof-of-concept projects. All this contributes to the reduction of CO2 emissions and is being addressed in the following projects:

**Plestic Ready**

The main objective of this project is to enhance and accelerate the earning capacity of the circular plastics sector in the Northern Netherlands through a multidimensional approach. This integrated strategy not only supports economic development but also contributes to environmental quality, public health, education, and regional well-being. The approach is designed to accelerate the phase-out of fossil-based resources, reduce raw material consumption, and promote responsible use of materials throughout the value chain. By building a coordinated scaling strategy, the project fosters long-term impact, including increased knowledge development, strengthened regional ecosystems, and improved conditions for entrepreneurship and business establishment in the circular plastics sector.

A key element of the project is the introduction of the plesTic Readiness Level—a conceptual framework that assesses the maturity of circular plastic innovations across all relevant



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

domains, including technology, regulation, logistics, and social acceptance. This framework identifies the barriers to market introduction and outlines the steps needed to scale innovations effectively and sustainably. Through targeted R&D projects, new sustainable business models and value chains are created. These efforts also contribute to broader regional development by enhancing education and skills, valorising scientific and applied knowledge, strengthening support structures, and increasing engagement with governments and international networks. In this way, plesTic Ready supports the ambition to position the Northern Netherlands as a Centre of Excellence for circular plastics with the potential for global impact.

**Care2Change**

The healthcare sector in the Netherlands is responsible for approximately 7% of national $CO_2$ emissions, 4% of total waste, and 13% of raw material consumption. A major challenge lies in the sector's high carbon footprint and minimal reuse of materials, leading to significant waste volumes—much of which, due to strict regulations, must be incinerated. Plastics play a critical role in this issue, as hospitals rely heavily on single-use plastic products for hygiene and safety, contributing substantially to both emissions and non-recyclable waste streams. In response, all hospitals and knowledge institutions in the Northern Netherlands are joining forces in an ambitious initiative to create a $CO_2$-neutral and fully circular healthcare sector. This project is among the largest and most impactful circularity efforts in the region and aims to serve as a blueprint for other hospitals in the Netherlands and across Europe. Beyond reducing environmental impact, it also seeks to unlock new revenue models through circular innovation, with plastics as a key focus area for redesign, reuse, and high-quality recycling.

**Wad van Waarde & Wad Gaat Om**

In the north of the Netherlands lies the Wadden Sea region—a place where salt and fresh water merge, the horizon shifts, and land and sea continuously trade places. This UNESCO World Heritage Site is rich in biodiversity, natural beauty, and cultural life, but it also faces serious challenges: plastic pollution, microplastics entering the sea, pressure from global shipping routes, declining biodiversity, and increasing economic demands. Achieving a plastic-free Wadden region is a complex challenge, too large for any one party to solve alone. Only through joint effort and systemic change can we protect this extraordinary region and ensure its future as a thriving, sustainable landscape.

To address these issues, the *Wad van Waarde* project was launched with a dual mission: to build a local, sustainable value chain connecting (young) farmers, designers, students, entrepreneurs, and makers—and to create circular, locally produced alternatives to plastic products. These products aim to replace current plastic items and ensure they no longer end up polluting the sea. Building on this, the follow-up project *Wad Gaat Om* takes a broader, system-based approach. It focuses on both curative and preventive actions: cleaning up existing plastic pollution while preventing new plastic from entering the region. The program integrates product innovation,



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

education, circular value chains, behavioral change, and collaboration across governments, businesses, knowledge institutions, residents, and visitors.

**X-Lives**

The goal of X-Lives is to promote the transition to a circular and resource-efficient economy. Within X-Lives, Dutch and German partners in North Rhine-Westphalia collaborate as part of the EU Interreg VI programme to stimulate circular innovations in the field of polymer, fiber, and mineral materials. This project includes activities such as the recycling of polymer materials, sustainable production processes, the processing of recycled materials into new products, and the use of renewable raw materials in material cycles. This also applies to fiber composites such as glass and carbon fiber reinforced plastics. The project offers opportunities to support circular innovations through targeted funding (via vouchers) and by embedding innovations into circular business models.

## 1.4 Analysis of barriers to implement circular economy or green transition solutions

The transition to a circular plastics economy faces persistent challenges that hinder large-scale implementation. While demand for recycled plastics is growing, systemic barriers across the value chain continue to limit progress. These barriers affect not only the production and processing of recycled materials but also their market uptake. The most pressing obstacles include:

**Economic competition from low-cost virgin plastics**
**High capital (CAPEX) and operational (OPEX) costs in recycling**
**Lack of robust and efficient waste collection infrastructure**
**Fragmented and complex regulatory landscape**
**Limited quality and recyclability of current plastic waste**
**Insufficient market demand and lack of launching customers**

The following sections elaborate on each of these barriers,

One of the key reasons that influence the implementation of circular plastics is the large influx of virgin plastic and the accompanying financial viability. Virgin plastics remain significantly cheaper than recycled alternatives, due to the low production costs in mostly China and the United States. Investment in circular infrastructure is risky and capital-intensive (CAPEX), while operational costs (OPEX) such as energy and labor are high in comparison and are not always recovered by returns. As a result, recycled plastics struggle to compete economically, which leads to reduced demand. This instability has caused financial instability within the recycling industry, which causes a lot of them to fill for bankruptcy. In recent years, the Netherlands lost 1/3 of its recycling



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

capacity and a major recycler in Friesland has also filed for bankruptcy (Blue Cycle). Moreover, the market lacks sufficient launching customers willing to adopt and pay for circular products. Without mechanisms like true pricing that internalize environmental costs, circular business models struggle to become sustainable.

Another challenge is the lack of robust infrastructure. Collection systems are often small-scale or fragmented. Additionally, long distances between collection and processing sites make logistics economically unviable, as transport costs outweigh the value of the recycled material. Additionally, contamination and mixing of plastic types during collection further reduce recyclability, complicating material recovery and sorting. This is partly caused by poor separation between technical and biological waste streams. Municipalities also have different policies regarding the collection systems, either opting for "bronscheiding" (source separation) or "nascheiding" (post-separation).

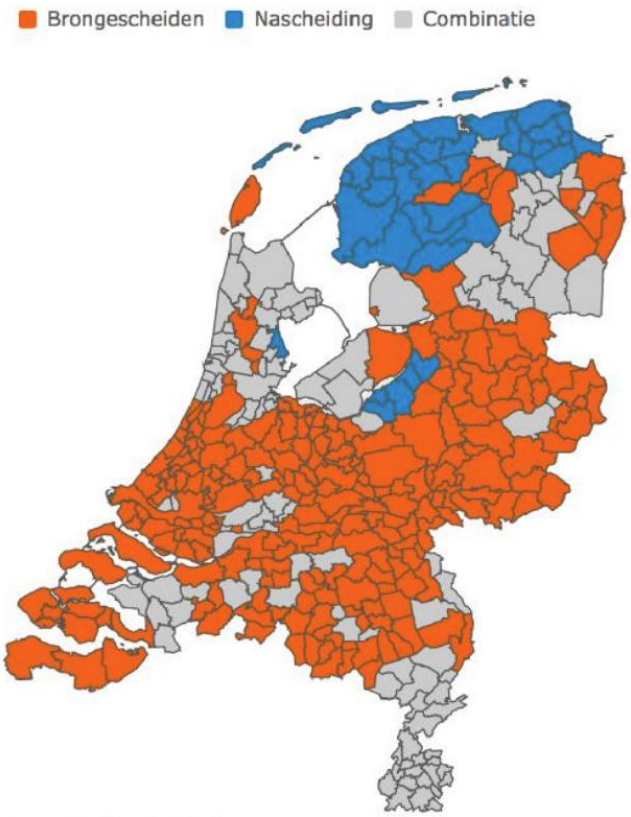


*Figure 5 An overview of source separation and post-separation waste policies for different municipalities in the Netherlands (source: Nedvang)*

The demand for recycled plastics has been larger than the supply, but inconsistent and fragmented regulation significantly hamper the progress made. European legislation like the PPWR, REACH and the SUP is increasing the demand for recycled content, but it also introduces complexity. The end-of-waste status and chemical safety requirements prevent broader adoption of recycled materials. Additionally, the quality of recycled material is not up to par. Originally,



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

plastics were not designed with recyclability in mind. Many materials are composed of complex blends or multilayered structures. Most of the plastic waste in the Netherlands is hard to recycle (foil or mixed content). According to Plastic Europe, in 2022 only 11.2% of the produced plastic in the Netherlands was circular. The sector has set new ambitions for 2050 to no longer use primary fossil fuels. Yet, due the current consumptions patterns, the demand for plastic will only increase. Alternatives like bioplastics, while promising in theory, are faced with scepticism due to inconsistent waste handling performance and end-of-life uncertainty.

## 1.5 Identification and analysis of the stakeholders (including existing networks and connections between them)

As part of the Frontsh1p project, we have invested in the strengthening of ties by working together on the topic of circular plastics. One of the most important cross-border collaborations is Greenwise Circular Plastics. This is an initiative where the Northern knowledge institutions collaborate with Northern companies, governments, students and citizens on challenges in the circular economy. Furthermore, there are other organisations working to accelerate the transition towards a circular plastic economy, like Chemport Europe and SUSPACC. Both cluster organizations have strong research and development opportunities.


*Figure 6 A depiction of the ecosystem on Circular Plastics (source: Greenwise Campus)*

The ecosystem is comprised of several companies, government bodies and knowledge institutions. As part of the Interreg Europe project *Plastix*, the province of Fryslân is actively working to accelerate the circular transition of plastics on a regional level. By facilitating knowledge exchange across the entire circular plastics value chain, the province aims to



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

strengthen the innovation capacity of SMEs and promote cross-regional collaboration. A key contribution is the development and deployment of a benchmark tool—originally created under the Interreg *Replace* project PLASTIX —now tailored specifically to circular plastics. This tool enables regions to compare performance, identify areas for improvement, and leverage each other's strengths.

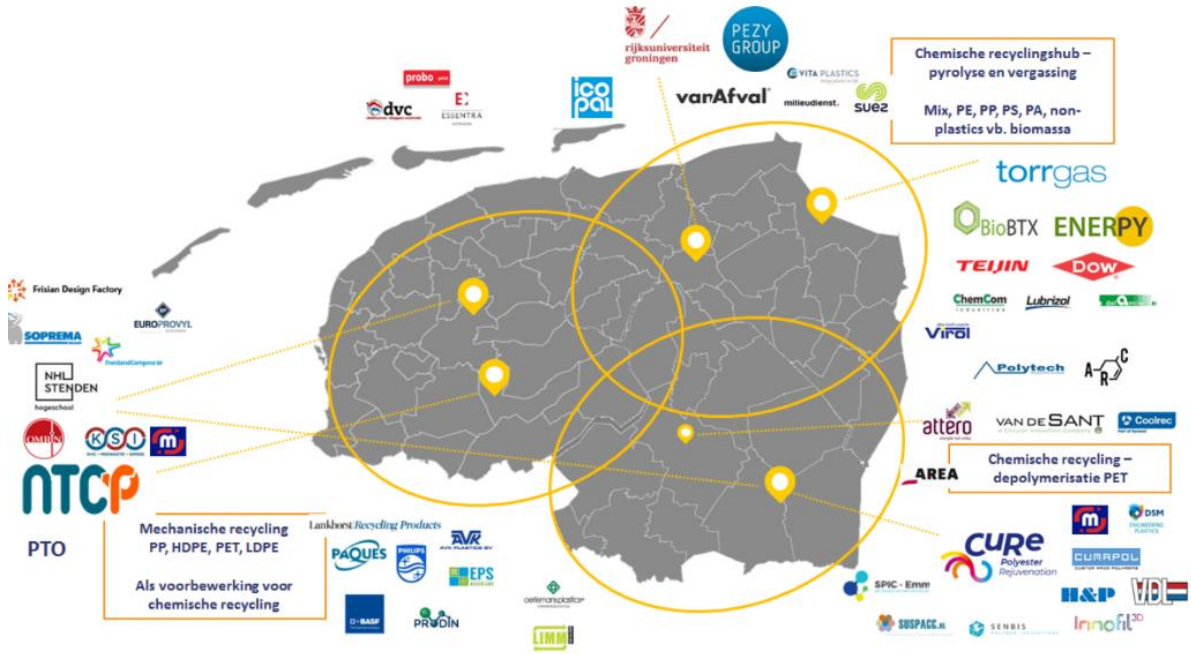


*Figure 7 Companies present in the ecosystem (source: Transitie-Doe-Agenda Kunststoffen)*

For knowledge institutions, an example within the circular plastics transition is NHL Stenden, specifically through its professorship in Circular Plastics. The mission of this research group is to drive the shift toward a future-proof plastics economy in the Northern Netherlands. By developing sustainable materials and processes, the professorship contributes to reducing resource dependency and environmental impact. Their approach is rooted in biomimicry, drawing inspiration from the planet's own natural systems to create responsible, circular solutions. While knowledge institutions, regional governments, and companies often have limited influence over structural barriers in the plastics chain, they play a crucial role in advancing innovation. NHL Stenden exemplifies how applied research can help bridge this gap by translating ecological insights into tangible, scalable technologies for industry and society.

## 1.6 Engagement of stakeholders

The association functions as a strategic engagement route for small and medium-sized enterprises (SMEs), acting as a platform that brings together businesses around shared goals and long-term interests. Key activities include facilitating networking opportunities, supporting collaboration across value chains, organizing relevant events, and coordinating targeted lobbying efforts. Visibility and positioning of SMEs within broader regional and national agendas are



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

actively pursued. All efforts are business-driven, with initiatives shaped by the practical needs and insights of the companies involved. The association is composed of and supported by companies that not only participate but also contribute to the co-creation of activities and strategies. By operating from the perspective of the business community, the association ensures that its initiatives remain aligned with current and future economic realities.

In addition to supporting internal collaboration, the association represents its member companies in external forums and advisory bodies. Participation in these gremia allows for direct input into policy development and strategic decision-making at various levels. Lobbying efforts focus on putting relevant topics on the political and institutional agenda, particularly in areas such as applied research priorities and the design of education and training pathways. Through this approach, the association bridges the gap between businesses, knowledge institutions, and government bodies, creating an ecosystem where SMEs can thrive, innovate, and remain competitive in an evolving economic landscape.

In the table below, an overview can be found of members of VCF that are active in the plastics and rubber sector.

| **Company** |
|---|
| Boxo |
| Caparis |
| Cup-Concept |
| Europrovyl |
| EPS Nederland |
| Happy Cups |
| Indu-Con |
| Infoframe |
| Lampe Technical Textiles |
| Lankhorst |
| Nedcam |
| NNRD |
| Omrin |
| Pyrasied |
| Soprema |
| UPPACT |
| ZONklaar |

*Figure 8 An overview of the members of the VCF*



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

## 1.7 Analysis of the supply value chain

In the plastic supply chain, Friesland plays a key role in the recycling stage. After plastic products are discarded, the waste is collected and carefully sorted to separate recyclable materials from non-recyclable ones. In Friesland, advanced sorting facilities and technologies help maximize the recovery of valuable plastics. The recyclable plastics are then thoroughly washed and shredded to prepare them for further processing. This cleaned and shredded material forms the basis for high-quality recyclate or raw material that can be reused in new plastic products. Friesland's strength lies in this part of the chain, where efficient sorting, washing, and shredding ensure that as much plastic as possible is given a second life, contributing to a more circular economy.

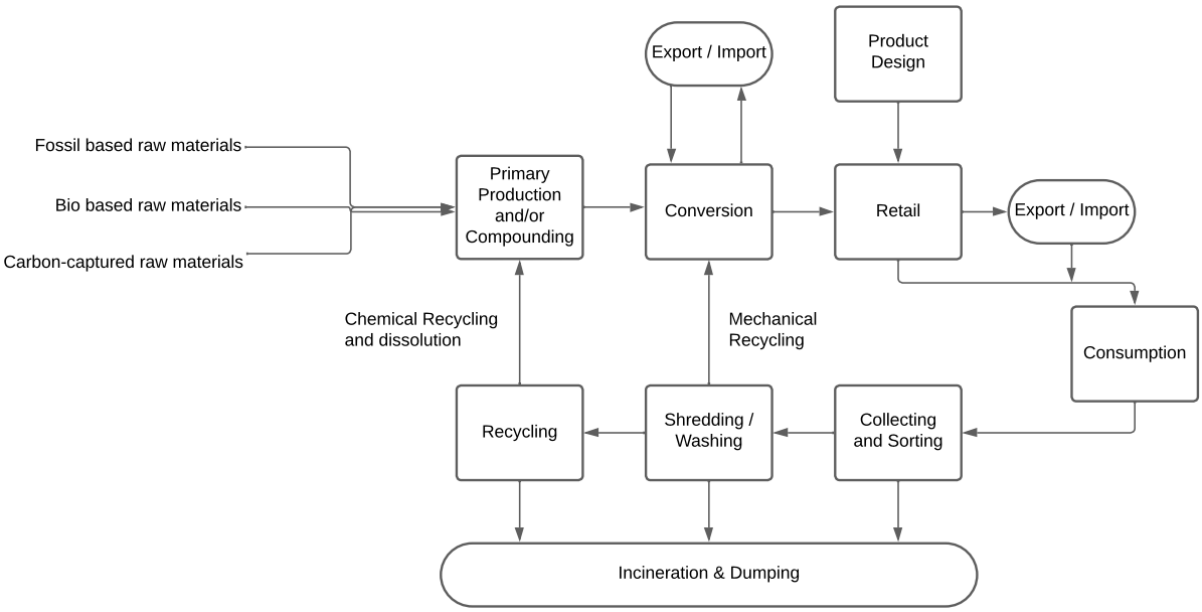


*Figure 9 A schematic representation of the plastic value chain (source: adapted from TNO)*

Research has shown that the following 5 application groups are most promising in Friesland. Each topic has a different place within the plastics value chain, which is shortly addressed in the table.

*Table 2 General remarks on the 5 application groups (source: Kamminga & Hamstra, 2024)*

| Topic | General Remarks |
|---|---|
| Coatings | Water-based paints are a more sustainable alternative to traditional paints, which often contain high levels of volatile organic compounds. However, microorganisms can affect the shelf life of water-based paints. They are mainly in the production/conversion phase of the supply chain. |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

| | |
|---|---|
| Construction Plastics | Plastics are essential in construction due to their versatility. Sustainability depends on high-quality recycling and using renewable raw materials for new construction plastics. Construction plastics are produced either from virgin or recycled polymers and processed into building products, spanning from raw material sourcing and recycling (upstream), through production (midstream), to end-use in construction (downstream). |
| Composites | Composites are hard to recycle because they combine multiple materials. Vitrimers offer a solution by acting like thermosets in use but thermoplastics during recycling and can be bio-based. Research into bio-composites using bioplastics and natural fillers is growing, especially in Northern Netherlands. Composites span production, use, and critical end-of-life phases. |
| Rubber | The rubber industry is decades behind the plastics industry when it comes to sustainability. It is often assumed that rubber cannot be recycled often or not to a high standard. The Northern Netherlands has a large presence in the rubber industry. The recycling infrastructure for rubber is still limited, so the sector mainly operates within production and use phases. |
| Water Plastics | Friesland is a frontrunner when it comes to water technology, with Leeuwarden as Capitol of Water Technology. Application are mainly targeted on downstream phases. |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# STAGE II. RESOURCES MISSIONS AND CSSs




This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# 2 Stage 2: Resources & Missions Selection

In recent years, Friesland has made significant strides toward creating a more circular plastics chain. The region combines a strong ambition with a solid foundation, marked by active collaboration between stakeholders and deep expertise across various sectors of the plastics value chain. At the same time, key challenges remain—challenges that, while complex, present important strategic opportunities. Against this backdrop, it is both logical and timely to introduce a dedicated focus on CSS 4 for plastics and rubber within the Frontsh1p project. This focus allows Friesland to build on its existing strengths, close critical gaps, and accelerate the transition toward a fully circular plastics economy in the Northern Netherlands. For a more extensive analysis, we refer to part I.

## 2.1 CSS Definition

Plastics are versatile synthetic materials derived primarily from polymers. They are widely used across sectors such as construction, packaging, healthcare, textiles, and water technology due to their durability, lightweight nature, and adaptability. In the context of circularity, plastics are increasingly viewed not as disposable materials, but as valuable resources that should remain in use through reuse, high-quality recycling, and responsible design. In Friesland, the focus is on maximising recyclability, using renewable raw materials, and developing innovative alternatives such as biobased or biodegradable plastics to reduce environmental impact across the full lifecycle. For a larger deconstruction, we refer to Part I.

Rubber refers to elastic polymer materials, both natural and synthetic, that are essential in a wide range of applications—from industrial products to consumer goods. Compared to plastics, the circular transition for rubber is at an earlier stage, with recycling technologies and infrastructure still developing. The sector faces unique challenges, including the assumption that rubber cannot be effectively or repeatedly recycled and the limited availability of high-quality recycled rubber. In Friesland and the wider Northern Netherlands, efforts are underway to address these gaps, exploring new recycling methods, reuse strategies, and innovations in material design to bring rubber into the circular economy.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# STAGE III. CHALLENGES




This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# 3 Stage 3: Challenges

One of the main strategies for the association Circular Friesland for closing loops and generate circular resources, and adressing the challenges associated with plastics and rubber is the **CIRCO method**. The CIRCO methodology is a practical and action-oriented approach that helps companies and designers transition from linear to circular business models. CIRCO is built on the principle that circularity starts with design. By rethinking products, services, and business models, organizations can reduce waste, extend product lifespans, and create added value through reuse, remanufacturing, and recycling. At the core of the CIRCO approach are three main circular design strategies:

1. **Design for Inner Circles** – prioritizing reuse, repair, and refurbishment to keep products in use longer.
2. **Design for Cascading** – enabling materials and components to be reused in new applications after their initial use.
3. **Design for Pure Material Flows** – ensuring that materials remain identifiable and separable to facilitate recycling.

CIRCO offers structured training programs, known as Tracks, that guide participants through a three-step process:

1. **Inspire & Learn** – Introduction to circular economy concepts, case studies, and relevant design principles.
2. **Business Modeling** – Identifying circular opportunities and reshaping the business model to support them.
3. **Implementation Planning** – Developing a concrete roadmap to prototype and implement circular solutions.

CIRCO has empowered thousands of professionals across industries—from manufacturing to construction, consumer goods, and services—to embed circularity into their innovation processes. It supports collaboration within value chains, enabling companies to co-create sustainable solutions with suppliers and customers. In an era of increasing environmental and economic challenges, the CIRCO methodology provides a clear path forward—combining design thinking with sustainable business innovation to build a resilient, circular future.

**PlesTic Readiness Level**

Furthermore, within the project Plestic Ready, a new conceptual framework addresses the complex challenges of introducing sustainable polymers and their products on a successful and economically viable scale: the *plesTic Readiness Level*.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

While technical development and innovation are essential, they are only part of the equation. Barriers to implementation can also arise in areas such as legislation and regulation, logistics, or social acceptance, to name just a few. In order to advance innovations in a sustainable way and move toward a closed-loop plastics economy, it is critical to identify the specific obstacles that hinder the transition from innovation to market introduction.

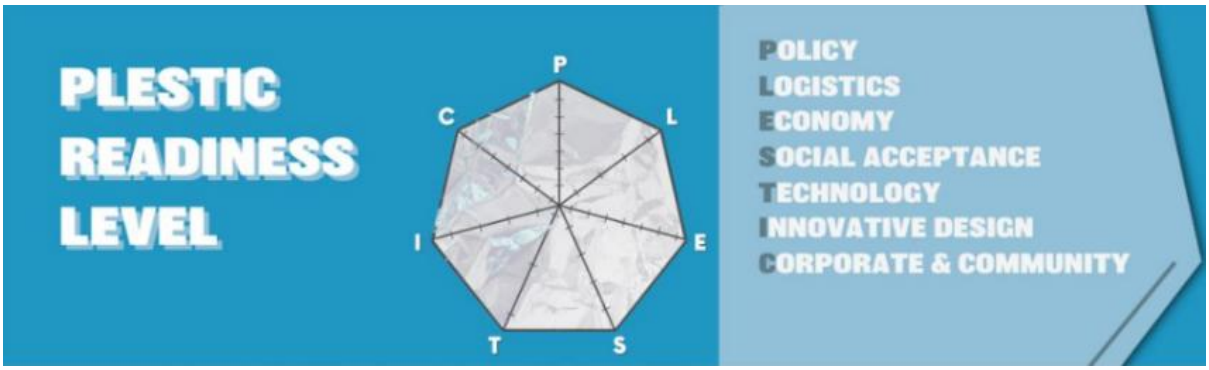


*Figure 10 A visualisation of the plesTic Readiness Level. Each lettre stands for an element of the equation.*

The plesTic approach assesses the level of 'maturity' or market readiness of an innovation across all domains relevant to plastics. It provides insights into what is needed to further advance the innovation toward commercialization. Whereas the well-known *Technology Readiness Levels (TRL)* measure the state of technological development, the *plesTic Readiness Level* offers a more holistic view—taking into account the broader context necessary for successful market entry of sustainable plastic solutions.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# Stage IV. ACTION PLAN




This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

# 4 Circular Economy Action Plan for Friesland Province

The Dutch province of Friesland and the Circular Friesland Association have the ambition to create a circular economy in which plastics are used in a sustainable way to support and strengthen society and to spare the environment as much as possible. This ambition can be made more concrete with the help of the *Trais Materialis*:

- Reduction of material use
- Sustainable implementation of residual material use by means of the use of recycled material and/or biobased material, including design for recycling
- Streams containing virgin material are used as efficiently as possible and designed for recycling

Friesland has specific strengths which position it well to develop circular solutions. At the same time, the regional economy is characterized by a lot of SMEs that often lack the capacity, knowledge or investment to make the transition from linear to circular business models. Collaboration does exist through networks such as the Circular Friesland Association, but broader participation and more effective matchmaking are required to unlock systemic change. Targeted awareness and training programs are needed to help both entrepreneurs and citizens recognize the benefits of circular practices in everyday life and business operations.

This Action Plan sets out the concrete steps and actions that will guide Friesland's transition to a more circular economy. It is to be seen as the successor of the present so called *Transitie-Doe-Agenda Kunststoffen*. This builds on ten years of experience and projects in Friesland and signals our continued commitment to developing circular plastics solutions in the years ahead. The focus for plastics is on maximising recyclability, using renewable raw materials, and developing innovative alternatives such as biobased or biodegradable plastics to reduce environmental impact across the full lifecycle. The circular transition for rubber is at an earlier stage, with recycling technologies and infrastructure still developing.

## 4.1 Action Plan for CSS 4

| **CSS 4 Plastic and Rubber** | |
|---|---|
| **Acting as a platform that brings together businesses** | |
| **Key Actions** | ▪ Facilitating networking opportunities<br>▪ Supporting collaboration across value chains<br>▪ Organizing relevant events |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

| | |
|---|---|
| **Responsible Parties** | VCF, Greenwise Campus, CGD, SUSPACC |
| **Indicators** | ▪ (Networking) events organized<br>▪ Collaborations and matchmaking between businesses present at these events |
| **Lobbying efforts** | |
| **Key Actions** | ▪ Putting relevant topics on the political and institutional agenda<br>▪ Coordinating targeted lobbying efforts<br>▪ Bridging the gap between businesses, knowledge institutions and government bodies<br>▪ Lobby's on biocyclate and biobased topics, this is in collaboration with NVCE, Chemport and the Northern provinces<br>▪ Actively contributing to the correct framing and branding of circular plastic products by setting up and/or participating in (national) partnerships<br>▪ Create a European wide playing field for plastics<br>▪ Approaching private financing providers to close the funding gap |
| **Responsible Parties** | VCF, Chemport, Provinces, NVCE, Greenwise Circular Plastics, CGD, SUSPACC |
| **Indicators** | ▪ Improved perception and understanding of recycled plastics and emerged material, such as biobased and biodegradable plastics, through scalable proof-of-concept projects<br>▪ Collaborative lobby statement<br>▪ Northern provinces implement the lobby statements/narrative<br>▪ National/European level politics implement the narrative which has an impact on the Clean Industrial Deal on the European level |
| **Continuing development of the circular plastics ecosystem** | |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

| | |
|---|---|
| **Key Actions** | ▪ Collaboration for improving and strengthening biobased applications, mechanical and chemical recycling and product design<br>▪ Scale up best practices in the production and development of high-quality recycled and alternative materials<br>▪ Create an ecosystem where SMEs can thrive, innovate and remain competitive in an evolving economic landscape |
| **Responsible Parties** | VCF, Chemport, Greenwise |
| **Indicators** | ▪ Greenwise Circular Plastics<br>▪ Projectplans from PlesTic Ready, Care2Change, NNLvC2.0, PlastiX, WadGaatOm<br>▪ The collaboration between the 7 partners of the PlesTic Ready consortium is focused on developing the PlesTic approach and thus strengthening and improving the ecosystem |
| **Facilitating knowledge exchange** | |
| **Key Actions** | ▪ Strengthen the innovation capacity of SMEs and promote cross-regional collaboration<br>▪ Developing a methodology to make circularity measurable |
| **Responsible Parties** | VCF, knowledge institutions |
| **Indicators** | ▪ Dozens of companies collaborating with research institutions<br>▪ Valorization<br>▪ Number of new recycling techniques implemented<br>▪ Volume of biobased polymer production and applications developed |
| **Innovations** | |
| **Key Actions** | ▪ The National Test Centre for Circular Plastics has been initiated in Heerenveen, ensures that the mixed flows of plastic are maximally recyclable which increases the potential for recycling<br>▪ Further development of recycling techniques, both mechanical, chemical and thermochemical |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

| | |
|---|---|
| | ▪ Developing innovative collection structures and logistical systems that contribute to maintaining the quality of plastics<br>▪ The further development of biobased polymers production and processing as well as the development of applications to boost the supply<br>▪ Actively helping regional governments to create market demand through circular procurement |
| **Responsible Parties** | VCF |
| **Indicators** | ▪ Establishment and activity of the National Test Centre for Plastics in Heerenveen<br>▪ Circular procurement by regional governments contributes to growing the market share of circular and biobased plastics in Friesland. |

### 4.1.1 Noord-Nederland Verdient Circulair

Noord-Nederland verdient Circulair is a program in which entrepreneurs in the three northern provinces of the Netherlands (Groningen, Friesland & Drenthe) are encouraged to pursue more circular business practices. We achieve this by removing existing barriers and forging new connections between stakeholders, thus forming clusters. Within the program partners organize events focusing on knowledge sharing, tools, networking and workshops. This allows entrepreneurs to gain relevant knowledge and information, meet new network contacts and discover where and who can help with specific questions.

**Actions part of the Noord-Nederland verdient Circulair program**

**Activation and development programs for SMEs**

- CIRCO has developed a training program for organizations and individuals who can and are entering businesses.
- CIRCO supports entrepreneurs and creative professionals to (re)design circular products, services and business models.

**Strive for better coordination of activities in the northern CE innovation ecosystem**

- To strengthen networks, supply chain collaboration and the innovation ecosystem, we are activating and organizing several value chains in line with the *Transition Agenda Plastics*. We are identifying frontrunners and other companies in these value chains and bringing them together in a series of Roundtable sessions.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

**Develop a monitoring system which gives insights into the circular developments in the northern region**

- Several monitoring systems are being developed to map the transition to a circular economy. The northern provinces, with the help of Metabolic, are developing a methodology to monitor the progress of the transition in the northern Netherlands.
- *Rijksuniversiteit Groningen* will conduct the first monitoring and will report this by the end of 2022.

**Develop an approach to stimulate circular purchasing**

- VCF will experiment with stimulating circular procurement in two semi-public sectors: healthcare and education. Organizations within these sectors will be invited and challenged to engage in circular procurement.
- Also experimenting with establishing circular procurement in the private sector focusing on the plastics chain in the northern Netherlands as structured within The Clean North/Chemport Europe.
- We are mapping the SME landscape for biobased and circular plastics and organizing several workshops to bring SMEs and the industry together. We are also using the input from SMEs to further shape the northern Netherlands proposition.

**Communication, lobbying and PR**

- The project is supported by a wide variety of partners and stakeholders. These parties all have their own communication channels; the goal is to bundle these channels and add an overarching channel to achieve broad awareness and strong lobbying.

**<u>Expected results of the Noord-Nederland verdient Circulair program</u>**

**CIRCO-Tracks**

- The Circular Friesland Association operates the CIRCO-tracks and entrepreneurs and organizations build more circular products/business models.

**Circular Economy Round Tables**

- Circular Economy Round Tables on priority areas to identify new value chains and link ecosystem services.

**Monitoring system**

- A monitoring system for the transition to a circular economy in the northern Netherlands.
- A functioning Circular Transition Council for the northern Netherlands.

**Circular purchasing development**

- Experimenting with two (semi) public focused circular procurement and tendering processes.
- Experiment with one private-focused circular procurement and tendering process.
- Strengthening northern collaboration within the circular economy innovation ecosystem in the field of circular procurement and tendering for public and private parties.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

**Communication strategy**

- A marketing, lobbying and PR plan are developed. Corporate identity, website and the social media channels must be developed and continuously updated with content.
- Lobbying will be determined in close consultation with the Supervisory Board, the Transition Council and other stakeholders.

### 4.1.2 PlesTic Ready

The main objective of this project is to enhance and accelerate the earning capacity of the circular plastics sector in the northern Netherlands through a multidimensional approach. This strategy not only supports economic development but also contributes to environmental quality, public health, education and regional well-being. The approach is designed to accelerate the phase-out of fossil-based resources, reduce raw material consumption and promote responsible use of materials throughout the value chain. Each letter of PlesTic stands for a different relevant domain to the transition: Policy, Logistics, Economics, Social acceptance, Technology, Innovative design and Corporate/Community.

**Actions part of the PlesTic Ready program**

**Innovation projects**

- Business developers engage in discussions with knowledge institutions, companies and non-profit organizations to gather and develop relevant ideas, bring people together and put the idea on paper. The stimulator brings people together and facilitates the conversation to develop projects, stimulate collaborations and establish the chain.
- Develop and implement research and development projects. By encouraging organizations and parties, we are speaking with at least 30-40 organizations that initiate projects.

**Developing a model-based approach**

- Readiness levels are defined for each letter, to accelerate the market introduction of promising sustainable plastics technologies and materials. To develop this approach, several promising innovations will be analyzed using the PlesTic approach.
- Conducting an actor analysis and providing expertise and knowledge for developing and testing the PlesTic approach and further developing it into a usable tool.
- Organizing and conducting think tanks/round-table discussions on the letters of the plesTic approach.

**PlesTic projects**

- Stimulating, developing and implementing 15 projects using the various letters aimed at removing barriers and/or making other concrete positive contributions to accelerating and/or more successfully bringing promising technologies or materials in the field of circular plastics to the market.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

**Communication**

- Organizing events focused on internalizing the PlesTic approach at three regional locations throughout the project. The ambition is for at least one of these to be a large-scale, national event. This will bring people together, stimulate networking and provide opportunities for collaborative development of new projects.
- The targeted use of communication tools to disseminate the project's results. A dissemination and communication plan will be developed for this purpose.

**Expected results of the PlesTic Ready program**

**Increased knowledge development**

- 10-15 technical research and development projects. Both stimulating the parties and research and development projects have led to the creation of 10 new partnerships between companies and/or between companies and knowledge institutions.
- Systemically sharing knowledge about circular plastics and the PlesTic approach provides a framework and contributes to a uniform working method, allowing knowledge players and stakeholders to respond accordingly.

**PlesTic Readiness Level**

- A conceptual framework that assesses the maturity of circular plastic innovations across all relevant domains, including technology, regulation, logistics and social acceptance.
- Identifies the barriers to market introduction and outlines the steps needed to scale innovations effectively and sustainably.
- Supports the ambition to position the northern Netherlands as a Centre of Excellence for circular plastics with the potential for global impact.

**PlesTic projects**

- Three innovations were tested and (further) developed using the PlesTic approach at the end of the project.
- 15 projects are being carried out based on one or more letters from the PlesTic approach to gain extensive experience with the approach.

**Strengthened regional ecosystems**

- Three events were organized in the regions of Delfzijl, Emmen and Heerenveen. This regional distribution contributes to achieving long-term impact more quickly and strengthening the connection between these regions.

## 4.2 Monitoring & Evaluation

As part of the Noord-Nederland verdient Circulair program, a monitoring system is developed to systematically track progress and outcomes. Within the PlesTic Ready program, this monitoring



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

and evaluation framework is grounded in the Theory of Change. This ensures that activities are continuously linked to the overarching goals of the circular economy transition.

The system will be applied once or twice a year, providing structured moments to review progress, assess whether activities are on track and identify areas that require adjustment or additional support. This process is not limited to measuring outputs but also considers the broader impacts and systemic changes that the program seeks to achieve. By integrating monitoring and evaluation into the governance of this project, it ensures that decision-making remains evidence-based and adaptive. This supports transparency toward stakeholders, strengthens accountability within the consortium and fosters a culture of learning by sharing insights across the regional ecosystem. Over time, this will also enable benchmarking with other regions and contribute to a clearer understanding of effective pathways for circular economy development in practice.

Apart from this, the Circularity Gap Report Friesland provides an important starting point for monitoring. It shows how circular the province Friesland currently is and where the biggest opportunities lie. Plastics are one of the material streams highlighted, which means we already know what progress is needed. The report is not a monitoring tool itself, but it provides a strong basis that we can use to measure change. By combining these insights with the monitoring system from Noord-Nederland verdient Circulair and PlesTic Ready, we can make sure that the progress is not only tracked year-by-year but also connected to the bigger picture.

## 4.3 Risks & Mitigation

*Table 3 Risk and mitigation actions*

| Risk | Description | Mitigation |
|---|---|---|
| Pricing difference between virgin and secondary plastics | The pricing difference between virgin and secundary plastics continues for too long which means that companies who are investing in circular plastic solutions will go bankrupt before they are strong enough to sustain themselves | We mitigate this through lobbying with a focus on the reliability of policy on circular economy goals |
| Companies doing too many "stand-alone" innovations | There is a risk of companies not collaborating with other organizations within the region | We mitigate this by forming strategies together and organizing meetings to bring organizations together |
| Consortium collaboration | Misalignment of goals and lack of cohesion within consortium | Cooperation agreements signed at the project start; regular consultations; built-in monitoring & evaluation system |
| No or too low funding | There is a funding gap. Parties who need funding are often start-ups who | A new regional innovation strategy and influencing the |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031

| | | |
|---|---|---|
| | need cofinancing from private financing providers. There is a Mitch match between public and private funding. | subsidy instruments from the region. Looking at other European projects to make funding available and approach private funders. |
| Progress & Timeline | Delays in project execution or failure to achieve objectives | Clear governance; strong project/WP management; parallel execution of activities; adaptive monitoring and evaluation system |
| Embedding PlesTic in ecosystem | PlesTic approach is not embedded or sustained in the regional ecosystem | Greenwise Circular Plastics as structural vehicle; dissemination of knowledge; promotion of new business models to increase adoption |
| Young ecosystem players | Short project timeline may prevent newer actors from scaling up quickly | Stronger partners assist or temporarily take over tasks |
| Limited SME engagement | SMEs may show insufficient interest to join | Low-threshold entry points; outreach & promotion; active involvement in circular economy ecosystem rollout |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037031