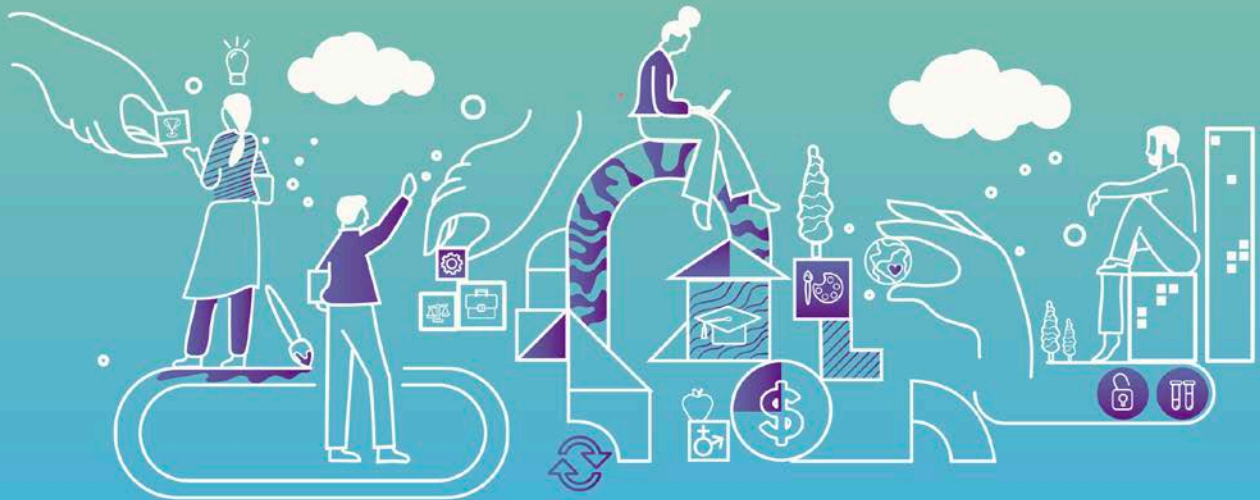




## Building Self-Sustaining Research and Innovation Ecosystems in Europe through Responsible Research and Innovation



Deliverable Title: D3.2 Future scenarios for RRI implementation in R&I ecosystems of the three territories.

Work Package: WP3 Stakeholder Engagement

V2.1.1

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Description of the deliverable (3-5 lines)	The co-creation stakeholder workshops in the three territories have created various futures / scenarios for the defined thematic focus in each territory. These developed futures are described including the applied methodologies and the process.
Key words	Stakeholder engagement; quadruple helix, R&I ecosystems; scenario development technique; cross-impact analysis; morphological analysis; scenarios.

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## DEFINITIONS & ACRONYMS

Foresight	Foresight is a systematic, participatory, medium-to-long-term process of gathering intelligence and building visions for the future. Various methods and tools exist for conducting foresight analysis.
Morphological analysis	Morphological analysis is an approach to solving problems in the context of complex, non-quantifiable systems. The approach focuses on reducing a complex system to a limited number of distinct configurations or scenarios. It is suitable in situations where causal modelling and simulation do not function well or at all.
Prosumer	An individual who is both a consumer and a producer. The term was coined by Alvin Toffler in 1980.
R&D	Research and Development.
R&I	Research and Innovation.
RRI	Responsible Research and Innovation.
STEEP	Socio-cultural, technological, economic, ecological, and political influences.

# EXECUTIVE SUMMARY

Developing scenarios for the future in co-creation stakeholder workshops supports the implementation of RRI into territories. Foresight in combination with stakeholder engagement is a foundation for accomplishing concrete strategies and action. When considering an innovation ecosystem, the developed strategies are more successful if the stakeholder group includes representatives from all branches of the quadruple helix: industry and business, science and research, public administration, and civil society. There are various methodologies for carrying out foresight analysis. In SeeRRI a scenario approach is applied, because it is well structured and offers the possibility for engaging the stakeholders in complicated analyses. Each of the territories in SeeRRI have innovation ecosystems. The actors in these ecosystems come from industry and business, science and research, policy and government, and civil society. Our stakeholder co-creation practices are diverse and Inclusive, anticipative and reflective, open and transparent, and responsive and adaptive to change. Thus, the implementation takes all the essential RRI process dimensions into account.

In each of the three SeeRRI territories, B30 in Spain, Lower Austria in Austria, and Nordland in Norway, a foresight process together with relevant stakeholders representing the quadruple helix was performed. Each territory defined a thematic focus. The stakeholders in each of the three territories developed four scenarios. Thus, twelve SeeRRI scenarios were created. The present deliverable, D3.2, explains the foresight methodology used in SeeRRI and presents the outcomes of the workshops in the three pilot territories, including the scenarios that were developed in each.

**Table 1.** *Thematic focus and scenario overview*

Territory	Thematic focus	Scenarios
B30	Zero waste and circular economy	Knowledge society – circular economy
		Flexible growth/de-growth and responsible prosumers <sup>1</sup>
		Big brother 2084
		The new creative techno-hippie-society (sharing economy)
Lower Austria	The plastic sector	Everything will be okay
		No rules just profit (fat industry)
		Happy World and Greta laughs
		World without plastics
Nordland	Responsible coastal management	Thriving, open economy
		Diversity and sustainability
		Loss of control
		Closed, self-sufficient ecosystem

<sup>1</sup> Alvin Toffler coined the term "prosumer". A prosumer is an individual who is both a consumer and a producer.



The scenarios describe both desirable and undesirable futures. Undesirable futures create awareness of actions needed to reduce their likelihood of occurrence. The discussion of less desirable futures stimulates innovation for meeting the implied challenges and raises possibilities for addressing the challenges with actions. Since the engaged stakeholders represent the full spectrum of quadruple helix organisations, a broader awareness of the future is created. The analysis of the twelve scenarios provides a foundation for deriving concrete consequences and measures for each territory. Possible measures have been developed and are listed in the respective chapters.

In addition to the concrete results and outcomes for the territories achieved by this approach, the workshops yielded secondary benefits for the engaged stakeholders, who created new networks, gained knowledge about their regional ecosystem, and practiced thinking out of the box to develop a more nuanced view of their region. In general, the stakeholders were energized by the workshops and expressed a renewed commitment to responsible and sustainable innovation.

# 1 INTRODUCTION

The SeeRRI project contributes to self-sustaining innovation ecosystems in Europe and, in particular, in the three pilot territories of the project: Nordland in Norway, B30 in Spain, and Lower Austria in Austria. In each of these three territories a foresight process was conducted. The engaged stakeholders developed futures for a specific thematic focus in each of these three R&I ecosystems. The stakeholders developed these futures in a co-creation process. The responsible research and innovation (RRI) approach plays a central role in these processes.

There is no unique definition of an R&I ecosystem. The SeeRRI deliverables D2.1, D2.2, D3.1, and D4.1 have already elaborated this background. The following summary presents innovation ecosystems in the context of the applied foresight process. In this report, the concept of “innovation ecosystem” is used interchangeably with “innovation system”.

An innovation system consists of actors and their interaction with one another. The entirety of private and public organisations and individuals contribute to building an innovation system by their activities and interactions, including the creation and diffusion of new technologies, new products, and new knowledge (see Fischer et al., 2001). For instance, Freeman defines an innovation system as “... the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify, and diffuse new technologies.” (Freeman, 1987).

Knowledge interactions – all types of knowledge flows – are crucial for the performance of the innovation system. Universities, research organisations and companies are the major actors in the majority of innovation systems. Thus, knowledge interactions between them play a central role in stimulating and sustaining the knowledge flows within a research and innovation ecosystem. An innovation system is an open system with growing dynamics and complexity. This is because of differentiation of actors, specialisation of organisations, the increasing dynamics of socio-economic and socio-technological systems, the growing complexity of socio-economic and socio-technological systems and of society, and the acceleration of the interdependences with actors around the globe. Innovation systems are complex systems (see Fischer et al., 2001). Innovation ecosystems are by definition “self-organizing and complex systems”, and as such are potential platforms for radical innovations and niche development (Rinkinen, 2016, p. 53).

*We consider each of the three innovation ecosystems of the territories in SeeRRI as a complex system with a level of dynamic interaction between all actors within the system.*

The actors in such an innovation ecosystem can be categorized into four types, collectively known as the **Quadruple Helix**: industry & business, science & research, citizens & civil society, and government & policy. The interlinkages and collaborations among these actors of the R&I ecosystem generate and create innovation, products, economic success and conditions for living and doing business.

*The engaged stakeholders in the SeeRRI foresight process represent the Quadruple Helix. In each of the three territories, representatives from the Quadruple Helix co-created the future scenarios for their chosen thematic focus.*

The European Commission defines **Responsible Research and Innovation (RRI)** as an approach to research and innovation which anticipates the potential societal implications of R&I and seeks to align it with the interests of society. The concept of RRI has already been discussed in several other SeeRRI deliverables, including D2.1, D2.2, D2.3, D3.1, and D4.1. While there are different ways of breaking down the components

of RRI, in this deliverable we focus on the four “process dimensions” of RRI as defined by the EU research project RRI Tools: Diversity & Inclusion; Anticipation & Reflection; Openness & Transparency; and Responsiveness & Adaptive Change.<sup>2</sup>

Since the foresight process in SeeRRI is itself an R&I activity, it was essential to design the process in such a way as to align it with the process dimensions of RRI. Thus, the applied procedure is diverse & inclusive, anticipative & reflective, open & transparent, and responsive & adaptive to change. See Figure 3.

Various methodologies exist for performing foresight analysis. Accepted foresight methodologies include expert panels, gaming and modelling, roadmapping, Delphi study, and scenario techniques. The SeeRRI project applies a tailored scenario technique combined with a stakeholder co-creation process that takes RRI process aspects into account.

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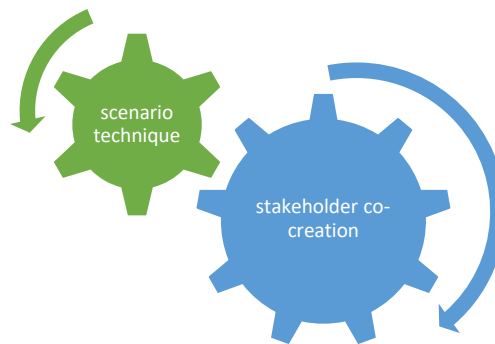
<sup>2</sup> <https://rri-tools.eu/policy-makers>

## 2 METHODOLOGY

A foresight process systematically develops different futures, i.e. future possibilities or scenarios. Typically, a time frame of approximately 10 to 20 years into the future is considered. The development of future scenarios leverages the viewpoints of all stakeholders who are affected by the topic of the process. There are various methodologies for forward-looking processes, e.g. anticipatory thinking protocols such as Delphi method, back-casting, cross-impact analysis, future workshops such as futures imagining, simulation and modelling, and visioning.

These methodologies are not necessarily mutually exclusive. Furthermore, the scenario technique includes a set of analytical and creative methods.

The SeeRRI project applies a tailored scenario technique combined with a stakeholder co-creation process. The scenario development technique takes RRI aspects into account and establishes a close link to the stakeholder co-creation process.



Source: Own representation (AIT, Center for Innovation Systems & Policy)

Figure 1: The nexus of scenario technique and stakeholder co-creation in SeeRRI.

The SeeRRI approach involves working with the most relevant stakeholders, who have a direct interest in the topic at hand. It uses a very structured and clear procedure for the work with the stakeholders. Performing a scenario procedure within a stakeholder co-creation process is challenging. The complexity of the process can make it difficult to communicate the details of the procedure effectively to the participants in a short time. It is crucial to keep the stakeholders engaged and involved. This requires a person with strong networking skills in the relevant territory and a well-prepared and structured procedure.

### 2.1 The stakeholders

The stakeholder selection process is described in detail in deliverable D3.1. In order to establish a sustainable R&I ecosystem, it is vital to engage the most relevant stakeholders. Stakeholder engagement is the process by which an organization or a project involves people who may:

- be affected by decisions,
- may support or oppose the decisions,
- be influential in the project or within the affected community,
- hold relevant official positions,
- be affected in the long term.

Stakeholder engagement is a key condition for sustainability, society, ethics, etc. as well as for long-term economic success.

In the scientific literature, there are many contributions to stakeholder theory. Freeman and Mitchell, Agel, and Wood describe stakeholders as follows: A stakeholder is “any group or individual who can affect or is affected by the achievement of the organization’s objectives” (Freeman, 1984). Stakeholder theory attempts to articulate the following fundamental question in a systematic way: which stakeholders deserve or require management attention, and which do not? (Mitchell, Agle, and Wood, 1997). In deliverable D3.1 we outlined three criteria for identifying relevant stakeholders in SeeRRI: the stakeholder’s **power to influence** the innovation system; the **legitimacy** of the stakeholder’s relationship with the innovation system; and the **urgency** of the stakeholder’s claim to the innovation system (Mitchell et al., 1997).

The SeeRRI foresight methodology – the combined approach of stakeholder co-creation and scenario technique – combines smoothly with the RRI process dimensions. As noted previously, the methodology is purposely designed to be aligned with these dimensions. Figure 3 elaborates on the interlinkages.

RRI process dimensions	How the foresight process in SeeRRI aligns with the RRI process dimensions
Diverse & inclusive	<ul style="list-style-type: none"> <li>• A wide range of actors and interest groups are involved from an early stage of the process of R&amp;I practice, deliberation, and decision-making. The stakeholders in the workshops represent all strands of the quadruple helix and address this dimension.</li> </ul>
Anticipative & reflective	<ul style="list-style-type: none"> <li>• Anticipation and reflection is an inherent part of the foresight process. Foresight means anticipating futures. Starting with a context analysis the stakeholders reflect on the current situation and make projections into the future.</li> </ul>
Open & transparent	<ul style="list-style-type: none"> <li>• The engaged stakeholders are representatives from the quadruple helix, creating their own futures. Therefore, the approach is transparent. It is also open, because (a) the engaged stakeholders bring back their experiences to their every day work, and (b) in the best case media are represented in the stakeholder group in the foresight process and so the results are published at least in media in the territory.</li> </ul>
Responsive & adaptive to change	<ul style="list-style-type: none"> <li>• This foresight approach starts with the context analysis and develops futures in successive three workshops in each territory. Hence, each step responds to the outcome of the preceding step and workshop. Thus this approach demonstrates both responsiveness and adaptiveness to change.</li> </ul>

Source: Own representation (AIT, Center for Innovation Systems & Policy).

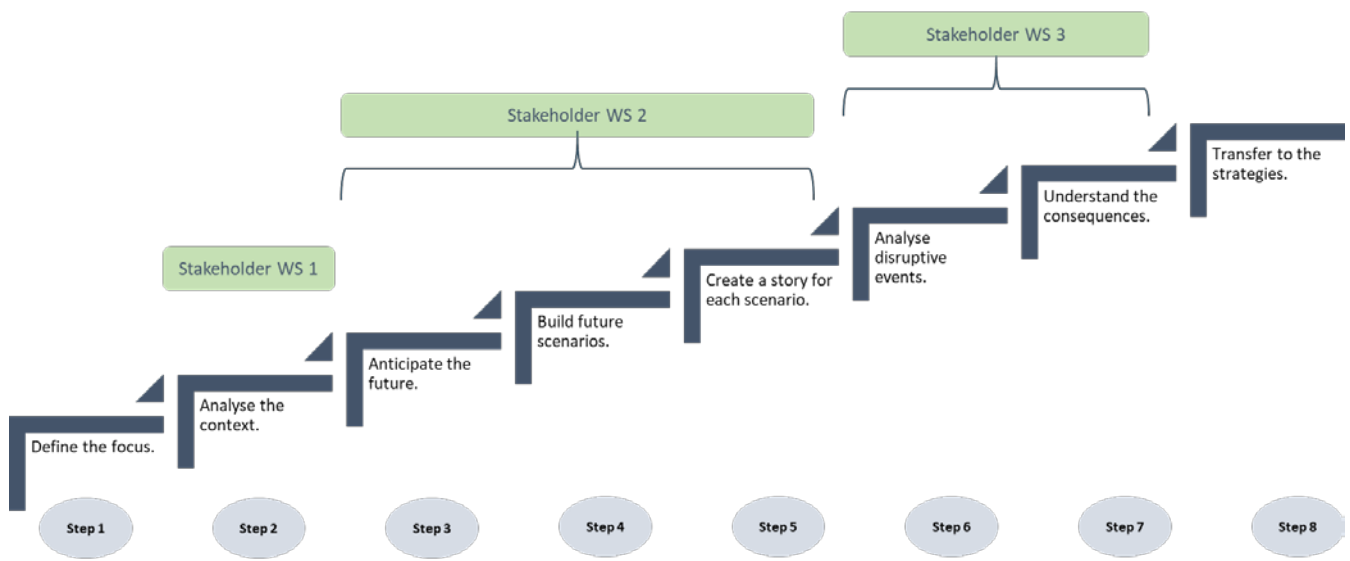
Figure 2: Interlinkages between the RRI process dimensions and the foresight process.

## 2.2 The scenario technique

Scenario technique, which is also called scenario planning, scenario thinking, scenario analysis, or scenario development, is a strategic planning method. The method combines known facts with key driving forces identified by considering social, technical, economic, environmental, and political (STEEP, see **Table 1**) trends.

Scenario technique develops a broad acting space in a structured and analytical way. The further apart the extreme scenarios, the wider the possibility space for actions, and the greater the resulting awareness of the participants of the situation they are facing.

The following figure (Figure 4) represents the eight steps of our foresight process.



Source: Own representation (AIT, Center for Innovation Systems & Policy).

Figure 3: Scenario development process in the SeeRRI project.

### 2.2.1 Define the thematic focus

The first step in the scenario development is defining the thematic focus, which is an overall strategic aim: “What are we doing this for?” To ensure that the work has a significant impact, several perspectives are important. One perspective is to limit the scope of discussion and define its starting point and topic. Although the focus of our project is the innovation ecosystems of the three territories in general, a further narrowing down to a concrete thematic orientation has the advantage that it can target the particular needs and problems of a stakeholder group more precisely. When stakeholders are personally affected by the thematic focus, they will be more engaged in the co-creation process.

Defining and scoping the thematic orientation is always a challenge, and SeeRRI was no exception. In all foresight projects, this step is the most challenging one, because it depends on the current trends and

challenges in industry, business, politics, and research. It is also strongly linked to persons and networks from the particular innovation ecosystem carrying out the work in SeeRRI.

The thematic focus is a text of approximately 200 to 300 words. It should be precise and clear to the stakeholders. The stakeholders should comprehend the idea thoroughly so that they can contribute and co-create future scenarios.

## 2.2.2 Analyse the context

The thematic focus is embedded in the context of the innovation ecosystem and is part of the territory. The analysis exposes the drivers, influences, and forces which may impact the focus issues positively. It also looks at what may hinder or hamper progress on the issues.

The crucial question here is how to find the appropriate level to describe this context. Strong stakeholders could push the discussion in a specific direction because of their background and experience. To counteract this, a well-designed structure is needed. This structure should cover all perspectives from the whole innovation ecosystem. However, there is a danger. If the thematic focus embedded in the R&I ecosystem is analysed on too high a meta level, the analysis will provide only general statements. A focused and specific analysis on the systems level is needed.

If the thematic focus is precise and described concisely, the context analysis works well with the STEEP approach. See also Deliverable D3.1, where various approaches are presented. For readability we repeat the following paragraph.

*The STEEP analysis is often conducted by firms to get a detailed overview on what external factors determine the trends. It also helps to predict what might happen in the future. STEEP is basically an acronym which stands for Social, Technological, Economical, Environmental, and Political. It is also known around the world as PEST, PESTEL, PESTLE, STEPJE, STEP, STEEPLED, and LEPEST.” (PESTELAnalysis.com)<sup>3</sup>*

Since foresight methodology is more frequently applied to policy strategies, such structures are adapted to broader systems, such as innovation systems (see for instance Havas, A., et al., 2017). There seems to be no consensus on a unique definition of the PESTE or STEEPLE approach. Variations on the interpretation of the “E”s in the acronyms are common. Most literature refers to “environment”; however, recent publications use “ecology”. Minkinen uses the PESTE method and explains that this acronym stands for political, economic, social, technological, and ecological (see Minkinen, 2019).

Since SeeRRI is about R&I ecosystems and responsible research and innovation (RRI), we prefer to use the term “ecology” and not “environment”, because “environment” could also be understood as “surroundings”, which would be misleading in this context.

The core structure of the context analysis in SeeRRI is given by these five categories:

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<sup>3</sup> PESTLEAnalysis.com is the property of Weberience LLC. <https://pestleanalysis.com/what-is-steep-analysis/>

1 Socio-cultural (S)

2 Technological (T)

3 Economical (E)

4 Ecological (E)

5 Political (P)

The thematic focus is investigated for influencing factors in each of these five categories. The factors that drive, influence, force, impact, affect, hinder, or hamper the considered topic are collected and analysed according to the STEEP structure.

Depending on the thematic focus, an initial list of 50 to 90 influencing factors can be collected.

The sources for such influencing factors are:

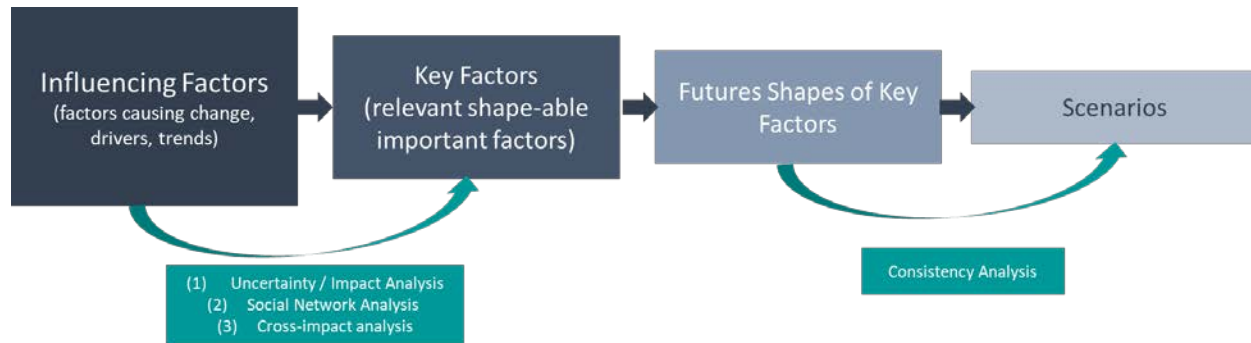
- Scientific literature and studies in the context of the thematic focus;
- EU project data in the context of the thematic focus;
- Expertise of the stakeholders working for the thematic focus.

The long initial list of influencing factors is subsequently reduced to “key” factors, i.e. the strongest, most significant forces and drivers impacting the ecosystem. Various studies and experiences show that reducing the variety of influencing factors to approximately ten key factors is practical and reasonable (see also Steinmüller, 1997; Gaßner & Steinmüller, 2009; Von Reibnitz, 1992). These ten key factors should ideally have a high impact and be shape-able in the sense that they can potentially be influenced by regional actors’ decisions and activities.

The comprehensive context analysis for creating a long list of influencing factors is necessary for participants to develop an overview of the broader environment. When stakeholders discuss this wider context, they learn and are inspired to create ideas for possible futures. The approximately ten key factors build the basis for shaping the future scenarios.

The following figure (Figure 5) represents the reduction of the complexity of influencing factors up to the step of scenario development. The methods “uncertainty / impact analysis”, “social network analysis”, and “cross-impact analysis” are not described here. These methods are well known in the fields of business and (innovation) management. The consistency analysis is discussed in section 2.3.4.





Source: Own representation (AIT, Center for Innovation Systems & Policy).

Figure 4: Reduction of complexity of influencing factors.

### 2.2.3 Anticipate the futures

For each chosen key factor, extreme projections are formulated, which should be as distinct as possible. The time frame is approximately 20 years ahead. The timeframe should be long enough so that stakeholders are forced to think a little “out of the box”. These future shapes build the basis for scenarios. The better the different futures of each key factor are described, and the more disjoint the future shapes of each key factor are, the clearer the different scenarios will be.

Each future shape needs a short description so that it can be communicated to all stakeholders.

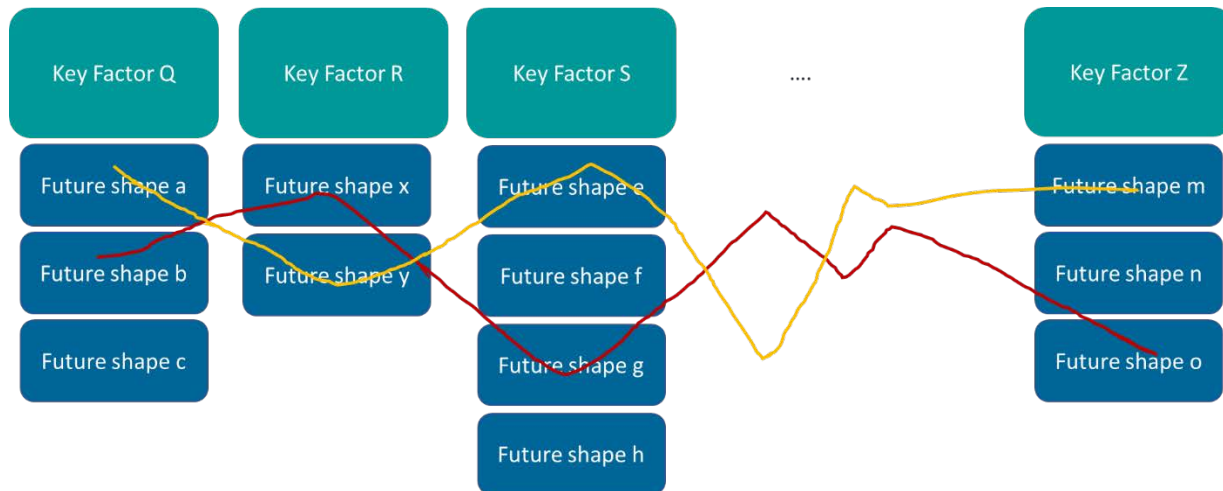
Desirable *and* undesirable futures should be considered. The space or range between the scenarios should be as wide as possible. We have observed that scenarios which are not desirable generate a high potential for innovation and new approaches.

### 2.2.4 Build future scenarios

Several methodologies can be used to create meaningful and consistent future scenarios. One common methodology is intuitive and holistic. By contrast, there are systematic analytical methodologies, usually supported by software tools. Such tools also calculate the number of all possible scenarios. In a case of 10 key factors with three different future shapes each there are  $3^{10} = 59,049$  possible scenarios.

Our work with stakeholders leverage an intuitive holistic approach using morphological analysis of the key factors and their future shapes. Morphological analysis was designed for multi-dimensional, non-quantifiable problems where causal modelling and simulation do not function well or at all. Fritz Zwicky developed this approach for dealing with seemingly non-reducible complexity (Zwicky 1969), see Figure 6.

The design of this figure facilitates fitting the different future shapes to each other. One future shape of each key factor is selected, and then the selected future shapes are joined by a horizontal transversal line. With each line, we get a “bundle” of future shapes. This bundle must be consistent and logical. Each bundle is the basis for a scenario.



Source: Own representation (AIT, Center for Innovation Systems & Policy).

Figure 5: Morphological box.

In Figure 6 there are two possible scenarios indicated. Our experience shows that two to four distinct and consistent scenarios (bundles) are possible under the discussed conditions (10 key factors with 2 to 4 disjoint future shapes for each).

### 2.2.5 Develop a story for each scenario

The bundles of future shapes (one from each key factor) give us the core content of a scenario. In this step, each scenario gets a name and is described in a paragraph. Other techniques used here include creating an imaginary headline of a newspaper in 20 years, creating a hashtag, or developing a story of a family or fictional person in the scenario.

### 2.2.6 Analyse disruptive events

The stakeholders analyse possible disruptive events using specific questions and templates in order to design measures and actions.

The last two of the eight steps go beyond this deliverable. They are part of deliverable D3.3, “Measures and strategies for RRI implementation in R&I ecosystems”. However, for the sake of completeness they are included below.

### 2.2.7 Understand the consequences

Inside the core team of each territory, a workshop with specific questions focuses on concrete consequences based on the scenarios. The common aspects are highlighted.

## 2.2.8 Transfer to strategies

Based on the detected consequences, the team formulates strategies for mitigation of threats and exploitation of opportunities. The strategies are developed together with territorial leadership figures, since a thorough understanding of the context is critical.



## 3 RESULTS

This chapter describes the co-creation work with the stakeholders in the three SeeRRI territories and explains the scenarios developed in each of them. The results are structured according to the requirements stated by the territories. Hence, B30 created scenarios using a different structure than that used by Lower Austria and Nordland.

### 3.1 B30

#### 3.1.1 Thematic Focus: Zero Waste

The thematic foci of B30 within SeeRRI are “Zero waste and circular economy”.

The goals are:

1. To change the current production and consumption model to one based on the green and circular economy in order to capture the potential social, economic and environmental benefits of this transformation, benefiting from local resources and articulating effective responses to socio-economic problems in the territory. Within this shared framework, the SeeRRI project focuses on the challenge of promoting the transition of the B30 industrial territory to the circular economy by articulating a shared agenda with the goal of zero waste generation.
2. To change mindsets and increase the interaction between quadruple helix players. Research and innovation are linked to complex ecosystems that involve the different players in the quadruple helix (government, academia, companies and civil society), as well as flows of people, ideas and financing that generate multiple interactions. Accordingly, the traditional concept of R&D&I as a linear process has been replaced by the idea of dynamic interaction with many different input points and feedback loops and a multidirectional information flow.

#### 3.1.2 Key factors

The key factors are presented using the STEEP structure and a short description.

**Table 2.** The key factors for “zero waste and circular economy” in B30.

Category	Factor	Description
Socio-cultural	<b>Education and training</b>	Education and training systems influence the behaviour and the social and environmental awareness of citizens, and their capacity to interact with the system in a responsible way. Building up knowledge and awareness for waste and circular economy.
	<b>Resistance to change</b>	The resistance to change is inherent to all transformation processes. The resistance can be caused by cultural, economic and psychological factors (fear, risk aversion, comfort, lack of awareness, etc.). Communication is the means to share information and to influence visions, perceptions, behaviours and attitudes of individuals and organisations.
Technological	<b>Industry structure in the territory</b>	The industrial and economic characteristics of the territory determine the trajectory of the transformation process. Is the industry structure

		in the territory sufficient for the objectives? How is industry connected to other actors?
	<b>Research and innovation</b>	The activities of R&I ecosystems measured by collaboration between firms and universities or research organisation, or patenting and scientific activities. Research and development is a promoter for the innovation and economic system.
	<b>Capacity for absorbing knowledge and technology</b>	The capacity of companies and public entities to absorb and implement knowledge and technology.
	<b>New technologies (big data, blockchain, IoT, AI) to address societal challenges</b>	Using the potential of new technologies to address societal challenges in new and more effective ways.
Economic	<b>Business models</b>	A business model is a system of interdependent activities within and across the organizational boundaries that enables the organization and its partners to create value and capture part of that value (e.g. by integrating recycling).  Which business models would generate economic, social and environmental value?
	<b>Skilled employees</b>	A lively R&I ecosystem requires highly educated people and skills and provides a foundation for welfare in the territory. Is there a deficiency of skilled workers?
Political	<b>Governmental support</b>	Governmental support through public policies promotes or hinders innovative initiatives (funding, innovative public procurement, etc.).
	<b>Legislation, standards and norms</b>	The legal framework regarding waste management can facilitate or hinder the progress towards the zero-waste objective.  The standards and norms regarding recycled materials can facilitate or hinder the progress towards the zero-waste objective.
	<b>Shared agendas</b>	These are agendas (route maps) that articulate, through a participatory model of governance, the collective action of various actors aimed at addressing a common challenge in the territory and the problems that this challenge may generate. These agendas are based on collaboration among public administrations, companies, civil society and academic institutions to understand and manage the challenges and problems within their territory from a holistic, dynamic perspective, bearing in mind the global context, long-term effects, and direct and indirect impacts.

### 3.1.3 Future shapes of key factors

Based on the 11 key factors the following future shapes were developed. All key factors got at least two future shapes. For three key factors, two future shapes were developed; for six key factors, three future shapes were developed; while for two key factors, four future shapes were developed. The following table contains the details of the future shapes for each key factor.

**Table 3.** *The future shapes of the key factors for the B30 case.*

Key factor	Future shape (i)	Future shape (ii)	Future shape (iii)	Future shape (iv)
Education and training	Market-driven education	Education system emphasising challenge-based learning and creativity	Online education system, flexible, tailor-made	
Resistance to change	Polarization due to social needs, no change	Too much change passivity, one actor controls	Continuous change by proactive young generation, diverse scenarios	
Industry structure in the territory	Intelligent city (clusters)	Industrial model revolving around virtual reality and digital technology	Nothing happens	Economic model based on de-growth and “prosumers”
Research and innovation	Business-oriented R&I	Social needs-oriented R&I	Emergency-driven global R&I	
Capacity for absorbing knowledge and technology	Small gap between big companies and SMEs (public help, access to education, tech democratisation)	Big gap between big companies and SMEs		
New technologies to address societal challenges	Technological democracy, RRI (perfect)	The society is excluded from the access to technology. Digitalisation divides into society and economic.		
Business models	Sharing (collaboration, competition, participation, symbiosis)	Service sector business models based on digitalization and visualization	Pay for use (services & public procurement)	
Skilled employees	Polarization in job skills	“All YouTubers” (jobs are based almost exclusively on digital skills)	Holistic shared knowledge	
Governmental support	Shared agenda as a methodology for policymaking	Technocracy: professional government aimed at economic development of territories	Horizontal government, closer to territorial stakeholders	Simplified bureaucracy regarding funding, payments in advance, indirect costs
Legislation, standards and norms	Technocracy “mafias” (groups of experts control the system)	Direct democracy, bottom-up		
Shared agendas	Open, digital and flexible administration, territory-oriented	Shared challenges, actions and solutions; articulation of shared agendas	Collective intelligence to solve problems	Open and accessible data

### 3.1.4 Morphological analysis

By means of the intuitive holistic approach, the stakeholders created four distinct scenarios. Figure 7 is a snapshot taken at the stakeholder workshop showing the “morphological box”.

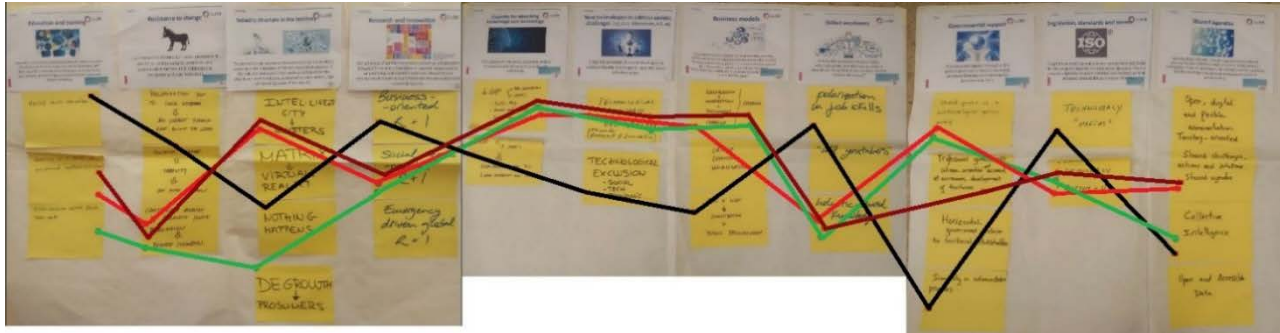


Figure 6: Morphological box from the B30 workshop.

The four scenarios are described below. The colour codes of the scenarios correspond to the colours of the lines depicted on the morphological box.

Table 4. B30 Scenario titles.

No.	Colour	Name of scenario
A	Red	Knowledge society – circular economy
B	Green	Flexible growth/de-growth and responsible prosumers
C	Black	Big brother 2084
D	Dark red	The new creative techno-hippie-society (sharing economy)

### 3.1.5 Scenarios for B30 “zero waste”

Each scenario is based on a bundle of specific future shapes of each factor. Each key factor is represented by one future shape in a scenario. Each scenario is elaborated by its title, the bundle of future shapes, headlines about the scenario in 2040, and a short story.

#### 3.1.5.1 Scenario A “Knowledge society – circular economy” (red)

##### Futures shapes of key factors

- Education and training – creativity
- Resistance to change – holistic vision opens to changes
- Industry structure – modern and interconnected industry
- R&I – social needs oriented
- Knowledge and tech – small gap between SMEs and big companies
- New tech – technological sovereignty
- Business – collaborative business models

- Skilled employees – holistic shared knowledge
- Governmental support – the government develops regulations and tools based on the shared agendas methodology
- Legislation – transparent and democratic regulation
- Shared agendas – shared challenges, actions and solutions, shared agendas

### Headlines in 2040

- Society with raised awareness, empowered and inclusive
- Transversal governance oriented to territorial challenges

### Story

In this world B30 consists of a **powerful and highly educated society which is aware of its social and ecological responsibility**. Education is based on creativity and has a very high value, since the power of the society comes from a high level of education and from the general knowledge of the people. This enables an increased awareness in the society of all the relevant aspects of a circular economy. All actors of a circular economy work together, society, facilitators, services, and government in order to fulfil societal needs. Such a creative and well-educated society is more open to change, as all are aware of the need for ongoing changes to stay innovative.

Research and innovation is oriented to social needs, and RRI aspects are well integrated into the production processes. Because of the high education level of society there are enough highly skilled people available in the labour market for a modern and innovative industry. This can be seen from the industry structure which is modern and interconnected. Small and medium enterprises (SMEs) are also highly innovative. So, the innovation gap between SMEs and big companies is rather small. Innovation is a matter of fact which leads to technological sovereignty in the region. Business models are mainly based on collaboration. In general, there is a high degree of collaboration between small and large companies and research organizations and also public authorities and civil society. Due to the high education level of the people it is relatively easy to collaborate between different actor groups as there is a steady growth of common understanding and language.

Because of the high education level of the whole society there is a shortage of unskilled people and a need for workers. A lot of jobs for unskilled people have to be filled by artificial workers and artificial intelligence. Less educated people from other regions or countries come to B30 as these jobs are well paid due to the shortage of workers. Therefore, a high number of refugees and other immigrants are integrated into society. This presents a challenge for the region and a split of the society is possible. Society is aware of this and significant efforts are made to integrate society and to raise the living standards for everybody.

The government also supports the societal values as it develops regulations and tools based on the shared agendas methodology, considering shared challenges, actions and solutions. Transparent and democratic regulations are implemented as agenda-setting and regulating works bottom-up.

### 3.1.5.2 Scenario B “Flexible growth/contraction and responsible prosumers” (green)

#### Future shapes of key factors

- Education and training – online education, flexible and tailor-made
- Resistance to change – continuous change, diverse scenarios



- Industry structure – contraction (de-growth) (prosumers)
- R&I – social needs oriented
- Knowledge and tech – small gap (big companies/SMEs)
- New tech – technological democracy
- Business – collaboration/cooperation
- Skilled employees – holistic shared knowledge
- Governmental support – the government develops regulations and tools based on the shared agendas methodology
- Legislation – direct democracy, bottom-up
- Shared agendas – collective intelligence

### Headlines in 2040

Sharing, collective intelligent, direct democracy, connectivity, flexible growth

### Story

In this world, B30 consists of a very flexible and highly collective intelligence in the society. This is established through a very good and flexible education system building a holistic knowledge base in society. There is a high transparency of information, society, and policy.

People prefer to live in the countryside with their own gardening and planting. They mostly work online. Higher education, regional life, regional products, responsible mobility and good consumer manners are very high values of society.

Continuous change is a matter of fact. Societal needs are tackled by co-designing diverse scenarios and promoting flexible education to achieve growth only where needed (responsible consumption/ prosumers). Flexible growth or even contraction is a matter of fact as there is awareness of the value of resources. Consumers are being responsible prosumers.

Mobility is reduced as online tools are well accepted in the whole system (education, work, etc.). Society is highly connected online.

Research and innovation is oriented towards social needs. There is only a small knowledge and tech gap between big companies and SMEs. Industry structure is contracting due to prosumers. Business models are oriented to aspects of collaboration.

People are involved in the policy system through bottom-up democracy and shared agendas.

### 3.1.5.3 Scenario C “Big brother 2084” (black)

#### Key factors futures shapes

- Education and training – market-driven
- Resistance to change – nothing happens
- Industry structure – virtual reality → production, consumption, experiences
- R&I – business-oriented R&I
- Knowledge and tech – large gap between big companies and SMEs
- New tech – technological exclusion
- Business – pay for use
- Skilled employees – polarization of job skills

- Governmental support – government with a more simplified bureaucracy regarding funding, payments in advance, indirect costs ... easier way to justify expenses (simplicity in administration process)
- Legislation – corporation control
- Shared agendas – collective intelligence

#### Headlines<sup>4</sup>

Big brother 2084

#### Story

It is 2084 and society is again under control of big corporations. All the research is done by industry, but the advantage is that waste recycling is a new business opportunity. The result is a totally controlled society with a zero-waste way of life. Education and training are market-driven. Therefore, society is not well educated as a whole, and there is a polarization of job skills. Only the needs of the large companies are fulfilled. No new models (RRI/innovation) are integrated into society due to a general high resistance to change.

Artificial intelligence and virtual reality have been introduced in the production process, in the consumption world, and in the lives of people in general. People are accustomed to this supported way of living. As in the movies “WALL-E” or “The Matrix”, human beings are no longer used to autonomous lives but are highly dependent on supporting computer systems.

The innovation system is highly oriented towards the large companies. There is a big gap between small and large companies in technology and knowledge. New technologies are not used to address general societal challenges in new and more effective ways. New technologies are owned only by a few and are used only for the benefits of a few, not for the whole society.

There is a public-private debate concerning business models which are influenced by public procurement and regulation. Thus public procurement can be a driver for innovation and new business models. In general, government has a more simplified bureaucracy regarding funding, payments in advance, and indirect costs. This is an easier way to justify expenses with a higher simplicity in administration processes. However, legislation is in the control of the large companies, which therefore have the power to control the whole system.

### 3.1.5.4 Scenario D “The new creative techno-hippie-society (sharing economy)” (dark red)

#### Key factors futures shapes

- Education and training – creativity
- Resistance to change – continuous change
- Industry structure – intelligence, young city clusters
- R&I – social needs oriented
- Knowledge and tech – small gap between big companies and SMEs
- New tech – tech democracy
- Business – sharing economy
- Skilled employees – holistic shared knowledge

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<sup>4</sup> This stakeholder group considered a longer period.

- Governmental support – government with a professional status, devoted to citizens and oriented to the economic development of the territory (citizen-oriented)
- Legislation – direct democracy
- Shared agendas – shared challenges, actions and solutions; shared agendas

### Headlines in 2040

- The new creative techno-hippie-society

### Story

In this open and creative world, society is very open-minded. Education is based on creativity and therefore society is highly differentiated and educated in many ways and aspects. Skilled employees have a holistic shared knowledge. Continuous change is a basis of life. Mobility is shared.

Many people live in city clusters where they use new technologies for a smart and interconnected intelligent way of modern life. **Sharing aspects are high values in this society, e.g. sharing offices, mobility, businesses etc.**

Technology is also a driver to reach a shared and interconnected way of life. Technologies are chosen carefully in a bottom-up approach characterized by **technology democracy**. Only those in charge of societal wellbeing are promoted. **There are intelligent and young city clusters where new technologies are implemented into civil life.** Industry is oriented to societal needs. However, there is a gap between high-tech/new-tech and low-tech companies. Business models are based on a **sharing economy**. Government is very professionally devoted to citizens and oriented to the economic development of the territory. Legislation is highly influenced by the civil society through direct democracy. Society as a whole and all important actors share challenges, actions and solutions and set shared agendas.

### 3.1.6 The engaged stakeholders

All branches of the quadruple helix were represented in all workshops, as shown in Figure 8. Most of the participants came from university and research institutions, followed by public administration, then industry and business, while only a small percentage represented civil society. Engaging civil society is always a challenge. Convincing NGOs to participate is not easy, especially when the thematic focus is a specific technology.

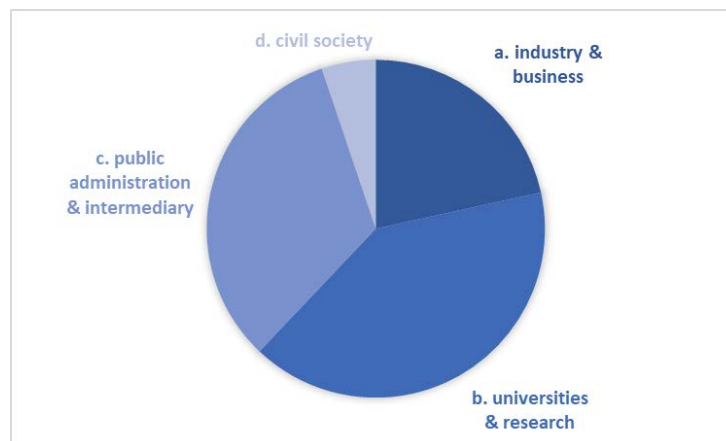


Figure 7: Quadruple helix represented in the workshops in B30.

**Table 5.** *Gender aspects – workshops in B30.*

Male and female participants were represented as follows:

WS No	Number of participants	Female	Male
WS1	26	15	11
WS2	24	13	11
WS3	23	15	8
WS4	45	25	20

## 3.2 Lower Austria

### 3.2.1 Thematic Focus: The plastics sector

The thematic focus for Lower Austria was developed with Harald Bleier and Simone Hagenauer (both from ecoplus, the Business Agency of Lower Austria), with Daniela Kitzberger (Office of the Federal Government of Lower Austria, WRST3, Wirtschaft, Tourismus & Technologie), and with Andrea Kasztler and Marianne Hörlesberger (AIT, Center for Innovation Systems & Policy).

*The plastics industry in Lower Austria will contribute significantly to a climate-compatible, environmentally friendly, resource-conserving economy through research and development of products taking into account the entire value chain.*

### 3.2.2 Key factors

The key factors are presented below according to the STEEP structure.

**Table 6.** The key factors for the plastics sector in Lower Austria.

Category	Factor	Description
Socio-cultural	<b>Highly skilled employees (esp. women)</b>	A lively R&I ecosystem requires highly educated people and skills and provides a foundation for welfare in the territory. Gender equality is about promoting gender balanced teams, ensuring gender balance in decision-making bodies, and always considering the gender dimension in R&I to improve the quality and social relevance of the results (e.g. make plastic technology interesting for girls). Education and training should provide skilled experts and engineers in the polymer industry and should also equip citizens with the necessary knowledge and skills to better understand polymer industry and business. The original factors <b>Skilled employees</b> , <b>Gender equality</b> and <b>Education and training</b> were merged to create this key factor.
	<b>Awareness</b>	The general population lacks knowledge about plastics. The image of the plastics industry is currently very poor. The population lacks awareness of the use and importance of polymers and the effects of the use of polymers and their responsible use in industry. Responsible action is aimed at establishing meaningful results for as many people as possible. Will industry be able to develop awareness of its own responsibility so that we can act better in the future? The factors <b>Image in civil society</b> and <b>Responsible actions</b> were merged to create this key factor.
Technological	<b>Responsible Research and Innovation</b>	The activities of a Research and Innovation ecosystem are a collaboration between firms and universities or research organisations, in patenting and scientific activities. Research and development is seen as a promoter for the innovation and economic system. Are there enough R&D activities (e.g. integrating new technologies and digitalization)? Are these the right R&D activities? Research and Innovation ecosystems are considered as whole value chains including interactions, global aspects, and characteristics of polymers in an ecological context and specific application fields. This key factor also considers people's well-being (e.g. jobs, living standards, health). Well-being is the experience of health, happiness, and prosperity. It includes having good mental health, high life satisfaction, a sense of meaning or purpose, and ability to manage stress. The original factors <b>R&amp;D</b> , <b>Holistic thinking</b> and <b>Wellbeing</b> were merged to create this key factor.

Category	Factor	Description
	<b>Raw materials</b>	So far, the oil industry has been the most important supplier of resources for plastics. New developments now point towards renewable raw materials (organic raw materials, other raw material sources such as sugar, etc.).
	<b>Production technologies and facilities</b>	The plastics industry has to keep up with quality and price worldwide. What opportunities and challenges will machine and plant manufacturers face in the next 30 years? How should the plastics industry align? This key factor considers production plants (e.g. locations and capacities), technologies for producing materials and machines, and high-tech applications along the entire value chain.
Economic	<b>Competition</b>	The plastics industry in Lower Austria could create thousands of jobs if sufficient earnings were generated. Actors compete regionally and globally as well as with other industries. Aspects such as markets, business models, value chains, etc. must therefore be considered here. Europe is a saturated market, so export markets are crucial. The industry must take measures locally but think globally and circularly. The factors <b>Global market</b> and <b>Business models</b> were merged to create this key factor.
	<b>Application fields</b>	Plastics has many possible fields of application, including packaging, automotive, medical, and other high-tech applications.
Ecological	<b>Environmental protection</b>	The problem of ecological damage caused by plastics in the past needs to be addressed. Plastic does not disappear or degrade but breaks up into small parts (microplastics). Scientists warn that the chemicals in plastics cause serious health problems, including allergies, obesity, infertility, cancer, and heart disease. The plastics industry must consider the environmental impact of the entire product life cycle, including the carbon footprint, i.e. the amount of carbon dioxide emissions associated with all the activities of the industry. An effective recycling infrastructure (including processes and actors) is a critical condition for environmental protection. The factors <b>Damages of the past</b> , <b>Carbon footprint</b> and <b>Recycling</b> were merged to create this key factor.
Political	<b>Funding and taxes</b>	The polymer industry can be influenced by funding programs and taxes. Policymakers can support change processes in the polymer industry with special programs and strategic measures. We consider here access to funding (at the regional, national, or EU level) for R&D and product launches. Tax policy refers to all government measures in the area of taxation. These measures can be used to pursue a variety of objectives such as fiscal goals (e.g. increasing tax revenue) or economic policy goals (e.g. a tax cut can increase the disposable income of citizens and thus overall economic demand). The factors <b>Governmental support</b> and <b>Tax policy</b> were merged to create this key factor.
	<b>Regulations, standards and norms</b>	Regulations are rules made by a government or other authority in order to control the way something is done, or the way people behave. Relevant examples for the plastics industry are health regulations or bans on plastic bags. The term “standard” is generally used as a synonym for technical norms that have gained wide acceptance in practice. Norms include social and political norms that may or may not be prescribed by laws and regulations.

### 3.2.3 Future shapes of key factors

Based on the 10 key factors listed above, the workshop participants in Lower Austria created the following future shapes. For most of the key factors, three future shapes were created. For three of the key factors, four future shapes were created.

**Table 7.** *The future shapes of the key factors for the case of Lower Austria.*

Key factor	Future shape (i)	Future shape (ii)	Future shape (iii)	Future shape (iv)
<b>Highly skilled employees (esp. women)</b>	Responsibility is included in curricula in the whole education system. Training in dealing with plastics is provided not only for technicians but also for society, starting in kindergarten. This leads to a new awareness of and image for plastics.	There is no plastics education in Lower Austria. Plastics are used but not produced in Lower Austria.	High-tech plastics are produced in Lower Austria. There are plastics specialists. There is education and training for niches only.	
<b>Awareness</b>	There is a rising public awareness, and decisions related to plastics are made consciously and voluntarily. Products are responsibly designed.	Decisions are made only when forced by laws and regulations. Plastics are used sensibly based on regulation (e.g. deposit systems for plastics).	There is no awareness and no regulation. Lifespan of plastics is exhausted. Fossil raw materials are used for plastic production. Waste plastics are considered as raw material.	
<b>Responsible Research and Innovation</b>	Ethics are considered very important in R&D. The environment is highly valued (energy, resources, curbing carbon emissions, etc.). There is no contradiction between profits and ethical conduct.	Profit is the main driver of R&D. R&D is focused within tight system boundaries. There is no responsibility for the impact of R&D. This system is in some ways a continuation of the current situation.	There is no R&D in Lower Austria. Lower Austria is completely dependent on external developments for R&D.	
<b>Raw materials</b>	50% of primary plastic comes from recycled material. The region can meet the needs for raw material.	The diversity of different plastic materials is restricted by law.	Crude oil is very expensive. Therefore, Lower Austria provides itself with raw materials coming from the territory.	

<b>Production technologies and facilities</b>	Lower Austria holds sustainable technology and market leadership worldwide in the field of plastics mechanical engineering (recycling machines, injection moulding).	Lower Austria is a flagship region for collection and sorting technology and preparation of PC plastic materials (digitalization).	Competitive production is no longer possible in the region.	Only regional production is possible.
<b>Competition</b>	Lower Austria is a model of excellence for sustainable use of plastics worldwide. As the circular economy is optimally implemented, the plastics industry in Lower Austria is growing to the same extent as the recycling industry.	The plastics industry has disappeared from Lower Austria. 20,000 jobs have been lost.	Nothing changes. We “keep muddling along”, producing what others want, regardless of sustainability.	
<b>Environmental protection</b>	The carbon cycle is closed in Lower Austria (reduce, re-use, repair, recycle) on micro and macro levels. There is growth and perfect circulation.	Eco-design: design for recycling is taken into account from the early beginning of product development. Only recyclable plastic products are developed. Growth is moderate.	Quality is prioritized over quantity (fewer plastic types, long life, repair ability, consumer behaviour, textile industry). There is a reduction in consumption.	The environment is ignored. Money rules the world. Continuation as before.
<b>Application fields</b>	Lower Austria is a competence region for sustainable plastic development and production. Plastics are more widespread because the circular economy is optimally implemented. At the end of their life cycle, plastics are 100% recycled.	Lower Austria is plastic-free because plastics are completely prohibited with regard to processing and use.	There is no change from the current situation. Everybody waits for other actors to initiate changes in the direction of sustainability.	



<p><b>Funding and taxes</b></p>	<p>Support and tax relief for the plastics industry (promoting the exploitation of regional resources; promoting specialist training; promoting public awareness).</p>	<p>There are prohibitions and directives rather than support for the plastics industry. The industry is highly taxed. Plastic has virtually disappeared in Europe.</p>	<p>Everything is left to the market forces. Plastics technology and knowledge developed in Lower Austria is exported to less developed countries.</p>	
<p><b>Regulations, standards and norms</b></p>	<p>Regulation is intelligent and consistent. EU resources are intelligently distributed and collected. It is mandatory to recycle a specific percentage in all plastic products.</p>	<p>There are many different regulations and standards (diversification, EU/AT/regional).</p>	<p>There are no standards and regulations.</p>	<p>Plastics are prohibited generally.</p>

### 3.2.4 Morphological analysis

By means of the intuitive holistic approach, the stakeholders created four distinct scenarios. Figure 9 is a snapshot taken at the stakeholder workshop showing the “morphological box”.

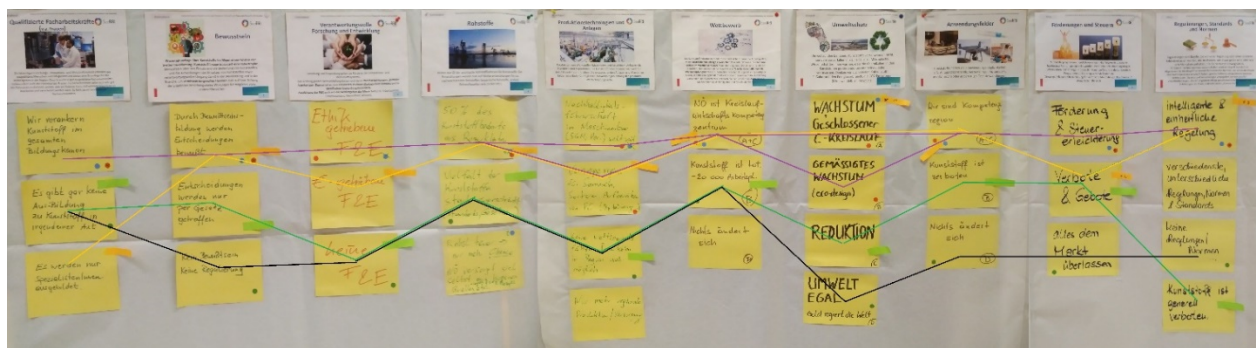


Figure 8: Morphological box from the Lower Austria workshop.

The four scenarios are described below. The colour codes of the scenarios correspond to the colours of the lines depicted on the morphological box.

Table 8. Lower Austria Scenario titles.

No.	Colour	Name of scenario
A	Violet	“Everything will be okay”
B	Dark green	“No rules just profit” (fat industry)
C	Yellow	“Happy World and Greta smiles”
D	Green	“World without plastics”

### 3.2.5 Scenarios for Lower Austria “plastic sector”

Each scenario is based on the specific future shapes of one key factor. Each key factor is represented by one future shape in a scenario. Each scenario is sketched with a summary, opportunities, risks, and relevant measures. It should be noted that the scenarios are presented from the point of view of the plastics industry. For example, the discussions of risks refer to risks for the healthy future development of this industry.

#### 3.2.5.1 Scenario A “Everything will be okay” (violet)

##### Summary

The plastics sector is currently facing a flood of attacks, which can be attributed to the plastic waste situation, e.g. in the seas. Cell phones, laptops, glasses, cars, hospitals (disposable syringes, protective clothing for COVID), etc. are inconceivable without plastic. Therefore, this scenario aims to regulate the plastics sector in such a way that sensible action is possible, and the plastics sector becomes attractive again for start-ups and young people. Therefore, the title “everything will be okay”.

In this scenario, there are closed circuits for everything (“circular economy”). A sustainability certification for companies in the plastics industry ensures that plastic is recycled. Europe and especially Austria have developed uniform smart regulations. Ethics plays an important role in research and development. Awareness of sustainability and recycling in the whole population makes it possible for ethical issues to be discussed. This scenario requires a better education. Marketing and business models have to be elaborated.

People want to recycle. Technologically, everyone can scan the material, then sort it with near-field infrared. Diversity of plastic material should be restricted because plasticizers, flame retardants, etc. are included in all kind of plastics. For each product, the packaging indicates how it can be recycled.

Lower Austria is the Silicon Valley of the plastics industry.

##### Opportunities

This scenario might indicate durable, robust products and responsible, conscious consumers.

##### Risks

Lobbying against plastic is too strong. The plastics sector is too small in Lower Austria. Petroleum is too cheap. Recycling is not anchored in law or regulation.

##### Measures

Actions for raising awareness of opportunities and risks are necessary. It is crucial to create transparency about the impact of plastic product in our life. The plastics industry needs to develop smart guidance, promotions, marketing measures.

There are many false news items about plastics in the media. This has to be penalised. The plastics industry must also use the media to present their point of view.

The importance of plastics in our everyday life and how to deal with it, from buying to recycling it, has to be organised for education from kindergarten to university. Campaigns for informing people are required. The plastic products and products with plastic parts together with their life cycle have to be assessed in a holistic way.

### 3.2.5.2 Scenario B “No rules just profit” (fat industry) (dark green)

#### Summary

In this scenario there are no regulations and taxes. Market forces are dominant. Only profit-oriented research is provided in companies, hardly any other research and development takes place in this scenario.

Capitalism rules the region. Making profit is the highest objective. Politics is subordinated. Everybody is focused on his or her own benefit and looks only after his or her advantages. The “ego” stands above all.

The probability that this happens only for Lower Austria is low because this is a global trend. There is a concentration of the population in a few conurbations. The gap between rich and poor is increasing. Basic water and food supplies are becoming more expensive for everyone because of low availability. Life becomes expensive. There is no initiative to control large corporations.

There will be no regulations in Lower Austria. There is a threat of Austria becoming a low-wage country. Production sites are available. However, the wage levels are very low. Social tensions are growing.

#### Opportunities

In this scenario there are short-term gains. There might be fewer people in the world. The environment benefits from it. There is less consumption. The next generation may do better. A counter-movement will start.

#### Risks

This scenario implies chaotic conditions. “The earth burns”, figuratively. Ecological activists one-sidedly condemn the plastics industry.

#### Measures

There are the following options for action in this scenario: Evolving (as has happened in the paper industry) towards even higher-quality plastics. Information campaigns are needed to create awareness of plastic, including its positive aspects, and to correct false information. It might be an opportunity to strengthen the next generation in this strange time.

### 3.2.5.3 Scenario C “Happy World and Greta smiles”<sup>5</sup> (yellow)

#### Summary

This scenario presents “carbon in a circle”. The circular economy is implemented by means of a new, revolutionary technology which chemically recycles plastic back to the basic elements (carbon and gases).

Unlike today, the carbon is deposited, and everything is traced back to the elements and is recyclable, therefore mechanical recycling makes no sense. Today, it is practically impossible to recycle all plastics, because there are so many different plastic types and combinations (e.g. packaging film consists of many different polymers so that the properties are precisely given to keep the cheese fresh for days). 40% of the plastic production in Europe goes to the packaging industry. The dilemma is that the packaging could be burned well (oil is also burned). However, this produces CO<sub>2</sub>, and that is not what the strategies in Europe

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<sup>5</sup> “Greta” refers to Greta Thunberg, a Swedish environmental activist.

would like to have. Therefore, a different process is used. With a new process and advanced production technology, further growth for the plastics industry is possible.

This scenario is technologically possible. The costs are still very high for this chemical recycling. However, oil companies do not want to lose their monopoly. This implies that the oil companies themselves are eager to develop all necessary innovation for being the first in this new business.

In addition, 20,000 jobs are created in the production of plants sold globally. R&D centres are best practice examples for the whole world in this field. Appropriate business models are required. The necessary financial foundation is provided.

Intelligent regulations with motivating framework conditions to enable business models are needed.

### Opportunities

This scenario might achieve climate targets despite growth. It is possible to install these technologies in each household, which leads to decentralization. There will be wide dissemination of knowledge. Old landfills can be dismantled. Emerging economies facing the problem of environmental pollution can be made "fit" relatively quickly. Appropriate business models need to be developed in a targeted manner.

### Risks

Existing regulations protect existing business models and do not allow decommissioning of landfills. Stakeholders are unwilling to cooperate. The global competition is very high. Actors in other countries are faster.

### Measures

What can already be done today? A demonstration centre could show what is already working. There are already partnerships with existing processes and business leaders which can bring these ideas forward.

Lower Austria should establish an R&D centre with a good network all over the world. Experts and knowledge carriers must be enabled to expand their knowledge for this venture. Companies must be actively attracted to collaborate with this R&D centre. New models for incubators must be developed.

It is necessary to establish access to raw material sources. Standardization of feedstocks as starting goods is necessary. Standards have to be co-developed. A concept for creating public awareness is required, where opponents participate. Building a global network to competency providers is necessary.

A "playground" should be created where new things can be tried out and tested (exempt from regulations).

Moving forward requires 3 million euros of public and public-private partnership funding. The technology is completely new and not yet available worldwide, even in prototypes. The aim is that there are 50% female engineers.

### 3.2.5.4 Scenario D "World without plastic" (green)

#### Summary

"Together for more sustainability, out of a sea of plastic" is the slogan. Plastic is prohibited by law, but what is still available may be used. However, new production is prohibited, as is recycling of plastics. Nobody knows any more how to deal with this material. There are no jobs and no education in the plastics sector.

Thus, transport becomes more expensive because car tyres are prohibited. Medical care becomes more expensive, just as everything else. Communication is reduced, communication devices are luxury products. A technological regression is taking place. Digitalisation stops. Telegrams and letters are reintroduced.

In the big cities there are food shortages. A lot of food spoils because packaging is missing. There is an urban exodus. Viennese people migrate to Lower Austria. These people cover their own food needs by gardening.

The technological regression is high. Generally, the population is declining. There will be massive migrations and conflicts. World population is only 1 billion in total.

The black market with plastics is flourishing.

### Opportunities

Littering is solved because there are hardly any plastics. There are innovations that replace plastics. In the long term there are positive effects on the environment, because there are fewer people in the world. A slow movement is ongoing. Transport returns.

### Risks

There is a loss of wealth. Wars and waves of refugees can be anticipated. There will not be enough food and medical care. In the short term higher CO<sub>2</sub> emissions worsen the climate, because current use of the already available goods is continuing.

### Measures

This scenario requires an innovation drive towards plastic replacement. We have to consider the regional supply chains. New strategies for a life and industry without plastics is needed and has to be spread rapidly. New forms of social coexistence are created. New ethical traditions will be established (ageing undesirable). The emphasis is on regionalization to promote regional supply chains. The actions and measures are shared with less developed regions (controlling waves of refugees). Lower Austria becomes a sought-after region because of climate and raw materials.

### 3.2.6 *The engaged stakeholders*

Since the thematic focus in Lower Austria is the plastics sector, industry & business and public administration & intermediaries (incl. business clusters) were represented the most in the workshops. The next figure shows how the quadruple helix (a. industry & business, b. universities & research, c. public administration & intermediaries, d. civil society) was represented on average in all the workshops.

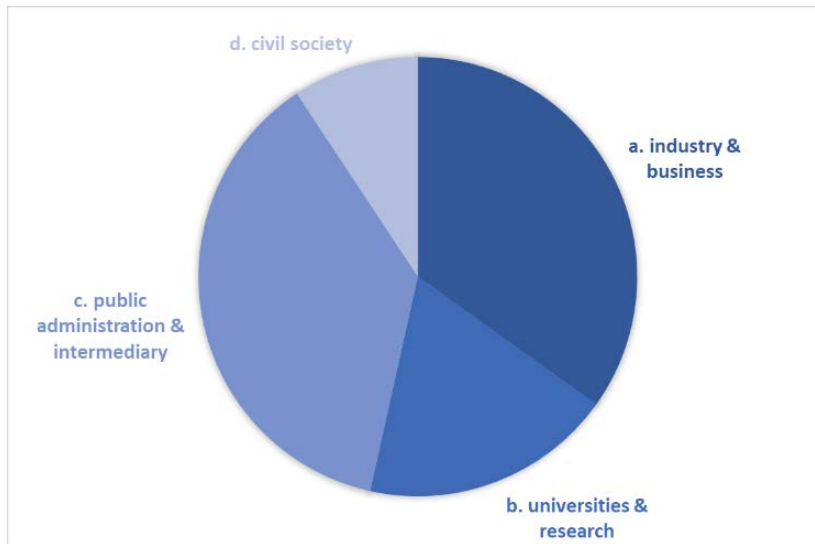


Figure 9: Quadruple helix represented in the workshops in Lower Austria.

**Table 9.** Gender aspects - workshops in Lower Austria.

Male and female participants were represented at the workshops as follows:

WS No	Sum of participants	female	Male
WS1	30	10	20
WS2	26	9	17
WS3	14	7	7

We see that in workshop WS3 there was a 50:50 share of male and female participants. In the first workshop, 1/3 of the participants were women. In the second workshop, slightly more than 1/3 of participants were women.

### 3.3 Nordland

Nordland considered a timeline until 2045.

#### 3.3.1 Thematic Focus: Responsible coastal management

Nordland contains a quarter of Norway’s coastline. Most of the region’s inhabitants live near the coast, and the sea plays an important role in key local industries such as seafood, transport, tourism, and energy. However, Nordland’s coastal communities are faced with tough long-term challenges: depopulation, an aging society, climate change, and environmental pollution. To address these complex issues, Nordland needs a knowledge-based approach to governance that strikes an appropriate balance between competing interests.

For example, the energy sector—offshore wind and oil extraction—competes for space with the traditional fishing industry. Oil spills are a looming threat for all actors involved in food production and harvesting in the sea, while industrial activities on the coast and in the sea can endanger tourism and the traditional way of life. The owners within these industries must step up and take responsibility, but the issue is complicated by the fact that traditional plurality ownership structures are being replaced by fewer, larger, and more international owners with little sense of belonging to the local community. A governance approach that strikes the right balance between creating incentives for industry and protecting the environment will result in sustainable, productive communities, to the benefit of Nordland and the world.

From a governance perspective, how can Nordland balance competing interests in coastal development? What is the best approach to striking a balance between creating incentives for industry and protecting the environment?

#### 3.3.2 Key factors

The Nordland case requires a different structure and considers the categories “societal aspects”, “biology & technology”, economy & planning”, and “regulations” for meeting the demand of the local government.

**Table 10.** The key factors for “responsible coastal management” in Nordland.

Category	Factor	Description
Societal aspects	<b>Active citizens</b>	The inhabitants of the coastal communities are actively engaged in fostering sustainable development and creating an attractive living environment, e.g. through entrepreneurship.
	<b>Population development</b>	Many coastal communities see a decline in the number of younger residents, especially highly educated ones, as urbanization continues. There is a need for new industries offering interesting, well-paid jobs.
	<b>World heritage and protection</b>	World heritage status and other area protection mechanisms help to preserve nature for our descendants and humanity. Such mechanisms also facilitate tourism. However, they may impede other forms of economic development.
	<b>Highly educated population</b>	The coastal communities need highly educated people (both professionals and people with other forms of higher education) in order to be able to develop new value chains and adopt new technologies. Need for education and research.
Biology & Technology	<b>New species</b>	We develop new organisms and plants in the sea and domesticate them. Breeding and genetic development of new species and plants generate innovation in coastal industries and enable new value chains. This creates a need for new production technologies and new methods of ensuring food safety. Research can develop sea-based production of food for humans, animals, and fish by utilizing

Category	Factor	Description
		the photosynthesis of algae. Algae can be used for energy production, antioxidants, proteins, carbohydrates, fibre, vitamins, and minerals.
	<b>Established and new production concepts</b>	Nordland has value chains within seafood, energy, minerals, and metals. Closed systems create security against diseases and parasites and make it possible to utilize new locations. Integrated Multi Trophic Aquaculture (IMTA) means that different species are farmed together in a way that creates synergies, for example through nutrient recycling. Aquaponics are integrated systems of fish and plant farming in which waste from the fish serves as fertilizer for the plants (circular economy).
	<b>Technology</b>	Digitalization, robotization, artificial intelligence, and the internet of things increase efficiency and productivity and improve logistics, market contact, and climbing in value chains. This includes autonomous boats and production facilities and new fishing technologies.
Economy and planning	<b>Business models and fishery policies</b>	Fishing boats catch wild fish and deliver them for further processing, laying the foundation for value chains. New business models must also look at fisheries regulations, quotas, etc.
	<b>Market access, global value chains, and logistics</b>	We produce seafood for the local market, the rest of Norway, and the world. Norway has an EEA agreement that ensures access to the European market. Wild card: Pandemics put pressure on food security and security in value chains.
	<b>Tourism</b>	The tourism industry is looking for attractive properties and locations along the coast. Travel costs are low, and the markets are growing. Tourism is an important source of jobs. Wild card: Pandemics.
	<b>Diversity in nature and society</b>	Biodiversity is a measure of genetic variation in species and variation in ecosystems. We can build on many forms of knowledge, including traditional knowledge, local knowledge, and cultural diversity.
	<b>Pollution and destruction of nature</b>	Coastal areas are exposed to environmental pressure, pollution, and the exploitation of many new and established industries and value chains.
	<b>Wind power</b>	Wind farms are built on land and in offshore areas close to or far from the coast.
Regulations	<b>Other regulations</b>	This factor covers regulation of fishing and aquaculture and their value chains (licenses, etc.). Increased production and new species of fish create conditions for disease, epidemics, and parasites among fish. Research on these complex problems is sectorized and focused on a few indicators and methods. Ocean acidification and other factors alter living conditions in the sea, threatening biodiversity and species survival. Regulations also apply to the interaction between land and sea, including competition among different users, natural conditions, and how research can solve challenges in planning, access to production rights/quotas, and challenges in maintaining access to the coastal industries for interesting investment opportunities for local owners/entrepreneurs.

### 3.3.3 Future shapes of key factors

For each key factor, 3 or 4 future shapes were developed. The future shapes are shown in Table 11.



**Table 11.** *The future shapes of the key factors for the Nordland case.*

Key factor	Future shape (i)	Future shape (ii)	Future shape (iii)	Future shape (iv)
<b>Active citizens</b>	People show great interest in society (but this can also result in decisions not getting made)	Active consumers and users of resources and nature; risk of over-exploitation of resources	Passive citizens; little interest in business and society	
<b>Population development</b>	Depopulation of rural Norway; Nordland will have only 50,000 inhabitants, concentrated in one city	1 million inhabitants in Nordland	Growth in all coastal communities; blue-green tourism and blue-green industry are more dominant than today	
<b>World heritage and protection</b>	No protection of heritage areas	Use and protection vs. protection and use	Total protection - no activity or development	
<b>Highly educated population</b>	Interesting jobs are a driver of migration to Nordland by highly educated people	The city is a driver of migration to Nordland by highly educated people	Highly educated people do not base themselves in Nordland	
<b>New species</b>	Atlantic salmon specialization	Diversification - polycultures	Climate crisis (too warm, too cold, too rough)	
<b>Established and new production concepts</b>	More growth, more fish farming	No growth	Green growth / IMTA (Integrated Multi-Trophic Aquaculture)	
<b>Technology</b>	The coast of Nordland is a treasure trove - in the sea, on the sea, under the sea	Nordland loses the competition: falls behind in technological development, remains a raw material producer	Ecological diversity: technology provides safety, new knowledge, more jobs, improved efficiency	
<b>Business models and fishery policies</b>	Broken cooperation between coastal societies and fisheries	End of traditional harvesting - new possibilities for energy, mining, and fish farming	New species - crabs, mackerel, jellyfish	Fish become a common good
<b>Market access, global value chains, and logistics</b>	Geopolitically "as is", stable market access	Global instability, protectionism, trade wars	More open markets	Stronger regional and local markets
<b>Tourism</b>	Tourism increases at the same rate as today: wear and tear on nature, more jobs in tourism	Collapse in tourism; people are not allowed to travel because of pandemics	Quota tourism: a fixed number of tourists allowed	Zero-emission tourism; virtual tourism; domestic tourism
<b>Diversity in nature and society</b>	Traditional industries gradually become extinct	Sustainable, balanced, knowledge-based governance	Circular economy; less consumption	Segregated communities; loss of diversity, knowledge, ecosystems

Key factor	Future shape (i)	Future shape (ii)	Future shape (iii)	Future shape (iv)
<b>Pollution and destruction of nature</b>	"Back to nature": restoration of nature, recycling, waste management, circular economy	"Tough priorities": climate prioritized over biodiversity; wind power, clean energy dominant	"Downward spiral": we continue as before; ecosystems break down; shortage of clean food and water	"Point of no return": we must learn to live with the consequences of past sins - too late to turn around
<b>Wind power</b>	Exploiting possibilities for renewable energy production in coexistence with other industries	No development because of area conflict and lack of knowledge; today's energy mix is continued	Innovation and new production methods provides us with energy production that does not create area conflicts	
<b>Other regulations</b>	As today – predictable regulations; safe food vs. cheap food	Self-regulating industries - risk of ecological collapse	Stricter regulation - less coordination	No activities leave an environmental footprint, hence no need for regulation
<b>Regulations to protect ecosystems</b>	Status quo	Liberalization - no obstacles for businesses	No production, zero emissions - only harvesting	More regulation

### 3.3.4 Morphological analysis

The next figure (Figure 11) is a snapshot from the workshop with the stakeholders. The scenarios based on this stakeholder work are described below.

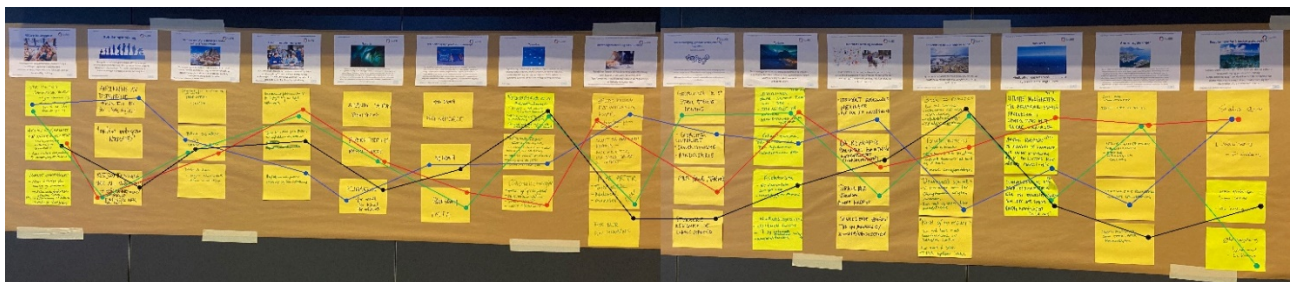


Figure 10: Morphological box from the Nordland workshop.

The colours of the lines correspond to the four scenarios.

On the basis of the morphologic box and the consistent bundles of future shapes of key factors the following four scenarios were sketched.

**Table 12.** *The titles of the scenarios for Nordland.*

No.	Colour	Name of scenario
A	Red	Thriving, open economy
B	Green	Diversity and sustainability
C	Blue	Loss of control
D	Black	Closed, self-sufficient ecosystem

### 3.3.5 Scenarios for Nordland

Each scenario is based on the specific future shapes of one key factor. Each scenario is sketched with a title, short summary, headlines, opportunities, risks, and unexpected events.

#### 3.3.5.1 Scenario A “Loss of control” (red)

##### Summary

Scenario A is based on the assumption that Nordland will face an international environment in 2045 characterized by political instability and trade wars. These challenging conditions will cause Nordland’s exports – and thereby Nordland’s economy – to decline. This in turn will set off a chain of other negative events: the population size will decrease as inhabitants migrate to other regions, brain drain will lead to a drop in the overall education level, and the capacity for innovation will suffer.

Foreign investors will take advantage of cheap land and other assets to gain control of large swathes of the regional economy, but the foreign investors will not stimulate much local innovation. The long-term consequences for the local community are uncertain.

The key features that distinguish Scenario 1 from the other scenarios are the sharply negative economic indicators and the loss of local control over the resources of the region. However, amid the gloom there are opportunities. Declining real estate prices and asset values make Nordland a relatively inexpensive place to establish a business or settle down, potentially attracting companies and highly educated people (e.g. “digital nomads”) to the region. While tourism has declined overall, there is a potential for growth in experience-based tourism as the natural environment of Nordland remains attractive and is less crowded than before. Nordland can market itself as a safe haven for foreign investors in a time of geopolitical uncertainty.

##### National headlines in 2045

- *“Shanghai Construction Group buys out Lofoten to develop it as a tourist destination”*
- *“Due to animal ethics salmon farming is banned”*
- *“The North East passage sees more traffic than the Suez Canal”*

##### Local headlines in 2045

- *“Leinesfjord primary school and junior high school shuts down in the autumn of 2045—students must commute to Bodø”*
- *“Powerful nations show increased interest in Nordland’s coastal islands”*
- *“Members of the Hunstad community clean up unused land areas in order to grow vegetables”*
- *“8000 climate refugees arrive from Italy—Venezia is under water”*

##### General news trends

- Nordland has become a region well-known for its culture
- Computer hacking, and attacks are becoming more widespread
- Population decline

##### Story and drivers

- Renminbi is the most important currency

## Opportunities and their usage

**Marine sector:** Develop technology, become more innovative, increase competency, focus on the whole value chain, bioprospecting, market flexibility, product exclusivity—ensured by origin tracking.

**Self-sufficiency:** High and versatile competency, reduced waste, diversified production.

**Attractive place to live and visit:** Not too expensive, well planned, nature is preserved, exclusive tourism.

**The County of Culture:** Exotic, intimate, and exclusive experiences, polar nights, weather experiences, relaxation, untouched nature.

**Active citizens:** Great speed of development, innovation, creativity.

**Recreate traditional industries in new contexts:** Culture landscapes, grazing, sharing economy.

## Risks and their transformation

Geopolitical instability is the main risk.

- High and relevant competency—both formal and experience-based
- Develop incentives for spreading out into the region—and moving into it
- Harvest marine resources on more trophic levels → new competencies on ecology
- Grow “plants” in the ocean
- Greater focus on regional attractiveness and sustainability in tourism; increased domestic tourism
- Regional immigration and recruitment—international migration → competency, culture, health care workers
- Establish businesses with high competency on ecological changes
- Streamline hydropower: production, electrical grid, consumption
- Sharing economy in two parts. First: shared car, house, cabin, transport. Second: common facilities—not private
- Regulations and tax regions that are transparent and fit well together—regional differentiation: one size does not fit all
- More defence; safe harbour for investors
- Digital nomads

## Unexpected events

**Table 13.** *unexpected events in scenario A “loss of control”.*

No.	Unexpected event	Impact on the scenario	Preventive measures / activities	Reactive measures / activities
1	War	Amplifies the negative factors	Dialogue, contact, respect, diplomacy, defence strategy	Military mobilization, peace negotiations, self-sufficiency
2	Political stability	Helps when developing relations with powerful nations—the relations induce stability		Resume “ordinary” activities, develop co-creation with other countries
3	Large-scale immigration	Too great of a population influx		Integration efforts, stimulate job growth

### Which concrete actions can be started?

- Coastal zone plans that give consideration to many different development paths, opportunities, and risks
- Diversification of production—products in more value chains and on more levels (quality, exclusivity) → good financing options and innovation in small, medium, and large businesses
- Regulations intended to create economic, social, and environmental sustainability
- Increased research to ensure the sustainability above; strengthen R&D communities
- Strengthen culture → strengthen quality of life → creativity → mental health → active citizenry

Bodø 2024 (cultural capital in the EU) should be spread to all of Nordland.

### 3.3.5.2 Scenario B “Thriving, open economy” (green)

#### Summary

The key assumption of Scenario 2 is that Nordland will face an international environment characterized by open and stable markets. This is the opposite of the assumption underlying Scenario 1, and the outcomes are equally dissimilar: whereas Scenario 1 has the weakest economic indicators of all the scenarios, Scenario 2 has the strongest. In Scenario 2, Nordland takes full advantage of its connectedness to the global economy. Local businesses drive a boom in exports based on technology and innovation within the blue and green sectors, and as a result the region attracts a population of active and well-educated citizens.

As it embraces globalization, Nordland is open to foreign investment but uses regulation to make sure the activities of foreign actors are aligned with local interests. There is a risk that this strategy will not succeed, and foreign investment will lead to a loss of control over local resources. Moreover, the dependence on exports makes Nordland vulnerable to future international trade disputes and shocks to the global economy.

#### General news trends in 2045 (headlines)

- *“Coastal societies with active and well-educated citizens”*
- *“Diverse blue-green industries based on ecology, technology, and market access”*
- *“Regulations that ensure diversity and are knowledge-based”*

#### Story and drivers

Pride of the Northern Norwegian identity. We shall make a living from the whole value chain. We use fish, energy, and nature to create proud Nordland communities. This development is based on 1) regulations based on ecosystem, research, and traditional knowledge; 2) new industries leading to increased population; and 3) digitalization.

Inclusion and an active everyday life ensure good public health!

#### Opportunities

- Increased education, locally based research, fewer high-school drop-outs
- Fish, energy, nature
- Increased cultural understanding
- New agreements with the EU

**How can these opportunities be used? Which actions will be possible?**

- More innovation; locally **owned** businesses
- Attractive for external investments if they preserve **local** interests
- Regulations ensure local dividends and sustainable governance of resources
- We must use the increased pride of being from Northern Norway to pull the weight together

**Risks**

- Lose control of resources
- Lose access to markets (incl. global markets)
- Depopulation
- Centralization towards the south
- Global collapse

**Develop ideas for transforming the risks into opportunities**

- Take actions to keep natural resources, land, power, areas on the land and sea local
- Be active in international trade
- Build regional and local knowledge
- Provide correct information to the population along the coast. Dissemination of research and facts
- The will to change will increase as global challenges, or collapse, become more real

**Unexpected events**

**Table 14.** *Unexpected events in scenario B “thriving, open economy”.*

No.	Unexpected event	Impact on the scenario	Preventive measures / activities	Reactive measures / activities
1	Global food production collapses	We have a good foundation for food production → we can produce food for ourselves and for others	Land protection, knowledge about cultivation and harvesting, pure oceans, aquaponics	Transfer labour to primary industries
2	Lack of electrical power throughout the world	Challenges with transport, production, storage, cooling	We must build local energy production/water/sun/heat exchangers/small-scale nuclear power plants	Energy saving, reduced production, change to other energy sources (wind, sun, etc.)

**Which concrete actions can be started?**

- Build knowledge communities
- Engaged and inclusive citizenry
- Research that can be used to regulate and protect ecosystem
- Challenge the Research Council of Norway to build up regional research communities
- Build and secure robust infrastructure

- Support new and adaptable industries
- Regional control of regulations

### 3.3.5.3 Scenario C “Closed, self-sufficient ecosystem” (blue)

#### Summary

In Scenario 3, Nordland’s economy focuses on the local and regional markets while minimizing carbon emissions and damage to the environment. Whereas in Scenario 1 Nordland suffers involuntarily from a decline in exports caused by global events, Scenario 3 is inward-looking by choice: the region forms its own ecosystem, in ecological balance and shielded from international turbulence, with local ownership of natural resources. There is little need for environmental regulation since no activities leave a footprint.

While the regional economy and natural environment are protected to some extent from global shocks, this comes at the expense of economic growth, which is close to zero. In addition, despite the closed nature of the regional ecosystem, it is impossible for Nordland to shield itself completely from the effects of external ecological disasters.

#### Headlines in 2045

- *“Nordland’s coast in ecological balance with local ownership of natural resources”*

#### Story and drivers

- Municipalities in Nordland create GREAT value based on nature-given conditions, fishing, tourism, fish farming, etc.
- Development is governed bottom-up (by citizenry)
- Loss of natural resources is reversed or stopped (ecological balance)
- Nordland has knowledge-based governance and a sustainable use of natural resources
- Active citizens contribute to local value creation
- Good conditions for living in Nordland and we keep value in the county
- “There’s light in the windows” (Norwegian expression meaning that there is no depopulation). The local society is attractive to live in: jobs, schools, leisure activities, and eldercare is readily available and accessible
- Nordland is climate neutral, but we are affected by the global environmental and climate crisis

#### Opportunities

- Intact nature
- More power to the citizenry
- Ownership and real influence
- Value remains in the local society

#### How can these opportunities be used? Which actions will be *possible*?

- Create attractive local societies

## Risks

- Political will
- Market forces
- Ecological changes, e.g. climate
- Local and global conflicts

## Develop ideas for transforming the risks into opportunities

- Collapse in the global market → local production and value creation
- Intact nature becomes a rare commodity
- Conflicts can become a unifying force
- Think of value creation in a different way → not only economic value
- Climate refugees

## Unexpected events

**Table 15.** *Unexpected events in scenario C “closed self-sufficient economy”.*

No.	Unexpected event	Impact on the scenario	Preventive measures / activities	Reactive measures / activities
1	Collapse in fish stocks	<ul style="list-style-type: none"> <li>- Foundation for living goes away</li> <li>- Foundation for conflict</li> <li>- Emigration</li> </ul>	<ul style="list-style-type: none"> <li>- Stricter regulation</li> <li>- Harvesting new species</li> <li>- Stop global warming (reduce emissions)</li> </ul>	New industries, increased food production
2	Pandemic	<ul style="list-style-type: none"> <li>- Decreased employment</li> </ul>	<ul style="list-style-type: none"> <li>- Social distance</li> <li>- Preparedness</li> </ul>	<ul style="list-style-type: none"> <li>- More effective vaccines</li> <li>- Good and reliable information</li> </ul>
3	Armed conflict (economical, digital, conventional)	<ul style="list-style-type: none"> <li>- Complete decimation</li> <li>- Emigration</li> </ul>	<ul style="list-style-type: none"> <li>- Dialogue</li> <li>- Political efforts</li> </ul>	-
4	Migration waves	<ul style="list-style-type: none"> <li>- <b>Positive:</b> population growth</li> <li>- <b>Negative:</b> strain on the welfare state</li> </ul>	<ul style="list-style-type: none"> <li>- Limit global warming and its effects</li> </ul>	-
5	Digital collapse	<ul style="list-style-type: none"> <li>- Information and communication are made difficult</li> </ul>	<ul style="list-style-type: none"> <li>- Alternative information systems / communication systems</li> </ul>	-
6	Sun storms, natural disaster, external enemy	<ul style="list-style-type: none"> <li>- Economic losses</li> <li>- Human losses</li> <li>- Active citizenry</li> <li>- Strong local communities</li> </ul>	<ul style="list-style-type: none"> <li>- Preparedness</li> <li>- Good planning</li> <li>- Change where we live</li> </ul>	-

### *Which concrete actions can be started?*

- Stricter regulations towards MORE local value creation



- Assume a circular economy
  - o Recycle all waste and emissions
- Only sustainable production through the value chain
- “What is a good life?” – change the notions of what a good life entails

### 3.3.5.4 Scenario D “Diversity and sustainability” (black)

#### Summary

In Scenario 4, Nordland is willing to sacrifice optimal economic growth for the sake of sustainability, biodiversity, and quality of life, becoming a beacon for the world in this regard. Even more so than in Scenario 3, the approach to environmental protection is “back to nature”: recycling, the circular economy, waste management, and restoration of nature are emphasized.

Scenario 4 distinguishes itself from the other scenarios in that coastal communities – even smaller ones – remain vibrant and avoid population decline and brain drain. This is achieved not only by virtue of the environmental attractiveness of the communities but also through the successful harnessing of digital technologies and marine resources to create interesting jobs and connect the coastal communities to the world. In terms of economic linkages to the global economy, Scenario 4 occupies a middle position between Scenario 2 and Scenario 3: not as outward-looking as the former, nor as insular as the latter. Innovation within the blue and green sectors are important drivers of the regional economy. Ownership of the economy is largely local.

Risks to the Scenario 4 way of life exist in the form of external threats to the environment and the possibility that international actors may disrupt the local anchoring of the economy, with unpredictable consequences for long-term sustainability.

#### Headlines in 2045

- *“Another district school is reopened”.*
- *“Nordland has become an international centre for blue, sustainable development”.*
- *“Tide-power turbines replace wind power”.*

#### Story and drivers

- Digitalization has led to strengthening of the districts → local anchoring and exciting jobs
- More children; digital solutions; more active coastline
- We have living coastal societies, found balance between use and protection of nature, many attractive jobs based on innovation, new species and fishing of new species; circular economy & IMTAS → Nordland has become a centre for this kind of technology
- Changes in laws lay guidelines for:
  - o Focus on local needs in all businesses incl. tourism, fish farming, fisheries
  - o Local ownership
    - Nature-based industries such as fish farming, power production, etc.

## Opportunities

- Experience-based tourism
- Infrastructure
- Opening of the Northeast Passage
- Support for early stage entrepreneurship
  - o Innovation
  - o Specialization
- Preparedness
- New markets

## How can these opportunities be used? Which actions will be possible?

- New industries
- Interdisciplinarity
- Urbanization / outdoor recreation
- Transportation

## Risks

- International relations under siege
- New conflicts
- More pollution
- Threats to the ecosystem
- International actors pushing out local actors and those who live in the local community

## Develop ideas for transforming the risks into opportunities

- Preparedness for the ecosystem
- Regulation of Airbnb
- Strengthen Norway's influence
- Environment, health and safety

## Unexpected events

**Table 16.** *Unexpected events in scenario D “diversity and sustainability”.*

No.	Unexpected event	Impact on the scenario	Preventive measures / activities	Reactive measures / activities
1	Russia invades	- Becomes Russian - Corruption	- Strengthen the military - Use diplomacy - Relation building	
2	Natural disaster	- Changed preconditions → growth conditions for fish farming and similar	- Improve scalability	
3	Pandemics	- Export markets collapse	- Self-sustained → food; medications	- Infection control - Bioprospecting
4	Radioactive pollution	- Resources destroyed		
5	Giant tsunami	- Destruction	- Warning systems	

### Which concrete actions can be started?

- Establish preparedness centre for 1) emissions; 2) defence; and 3) catastrophe management
- Self-sufficiency in terms of 1) food; 2) medicines; 3) energy; and 4) technology
- International dialogue and diplomacy
- Strengthen education and research in the region → establish knowledge centre for sustainable blue development
- Tourism governance: 1) tourism tax / regulation; 2) infrastructure (waste, toilets, parking, transport); and 3) development and sustainable experiences

### 3.3.6 The engaged stakeholders

**Table 17.** *Gender aspects - workshops in Nordland.*

Male and female participants were represented as follows:

WS No	Sum of participants	female	Male
WS1	36	16	20
WS2	29	15	14
WS3	24	13	11

There is a balance between female and male participants, approximately 50:50 on average.

## 4 CONCLUSION

The stakeholders developed four scenarios in each of the three SeeRRI territories. The developed scenarios describe desirable and undesirable futures. The intention was to span a wide space of possible developments and actions and an awareness of this space inside the stakeholder group. Since, the engaged stakeholders come from the quadruple helix organisations a broader awareness for the future is created.

Why do we also consider undesirable futures? These futures increase awareness of the actions needed by to avoid them and foster innovation to prevent their occurrence or mitigate the negative effects.

This co-creation stakeholder process focuses on the specific challenges of a territory. This challenge is formulated within the thematic focus and builds on it as a starting point. This approach promotes the engagement of stakeholders affected by the thematic focus in the foresight work. The methods ensure that the results impact each territory, since the futures for each territory are co-created by the people concerned.

We worked with the innovation ecosystem in the three territories in SeeRRI. The actors in each innovation ecosystem belong to the four arms of the quadruple helix. The foresight process with the eight steps in Figure 4 was diverse & Inclusive, anticipative & reflective, open & transparent, and responsive & adaptive to change.

The starting point is crucial to the scenario development technique. The definition of the thematic focus, has to be clearly described and delimited, so that the next steps in the process can proceed in a logical way and made clear to all stakeholders. If the starting point is unclear, the context analysis and the identification of the influencing factors is very difficult. Because of the COVID-19 pandemic, more virtual meetings were organized to assist in the definition of an adequate thematic focus for each of the three territories.

We applied “uncertainty / impact analysis”, “social network analysis”, and “cross-impact analysis” to analyse the context and the environment of the thematic focus. The results were discussed with leaders and experts in the territories. This analysis may have unexpected results. The importance and the meaning of one influencing factor is sometimes different when considered in context. Therefore, some feedback loops are needed for getting an adequate result.

During the formulation of the scenarios the stakeholders shared ideas and interacted in a very productive way.

Each of the three territories developed four scenarios. There are some differences in the analysis of the scenarios, which has consequences for the next steps of the process. In Lower Austria and in Nordland, opportunities, risks, and measures were derived. It was even possible to analyse the unexpected events in the scenarios in Nordland. The differences are due to (a) the availability of stakeholders for a longer time and (b) the COVID-19 situation last year. Thus, having further workshops in Barcelona was not possible after February 2020.

However, all twelve scenarios created in SeeRRI build a good foundation for the last step in this work, the transfer of results and created knowledge to strategies. How these findings can be understood and how they will be transferred to strategies are the next steps.

The territories are working on this. For instance, B30 takes the scenarios for developing shared agendas in the territory. Generalitat de Catalunya, the regional Government, is strongly engaged in this work ensuring that the scenarios have impact on the transfer to strategies. This emphasizes the importance of the participation of influential stakeholders. Lower Austria is working out a plan for transferring the learning to the plastic sector throughout Austria and is developing an implementation action involving the foundation of an association for coordinating the fragmented plastic sector in Austria with linkage to Plastics Europe.

The scenarios developed for Nordland are an important input for regional planning in Nordland with the involvement of the Nordland County Council. The engagement of stakeholders in this co-creation process ensures that the outcome has a high level of acceptance in the territory.

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### Links

- <https://sdgs.un.org/goals>
- <https://pestleanalysis.com/what-is-steep-analysis/>