Influence of global megatrends on the state of environment in Slovenia: Conclusions and key messages

Final report

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Executive Summary

Introduction

In October 2017 the Slovenian Ministry of the Environment and Spatial Planning and the Slovenian Environment Agency commissioned Collingwood Environmental Planning (CEP) to support them in undertaking a study to understand the *Influence of global megatrends on the state of environment in Slovenia*. The study focussed in particular on identifying potential implications and related risks, opportunities and responses of two global megatrends (GMTs) from EEA European Environment State and Outlook Report (SOER) 2015 considered to be of particular relevance to Slovenia and its environment: *GMT 7: Intensified global competition for resources*; and *GMT 9: Increasingly severe consequences of climate change*.

A participatory method was used, adapted from the methodological toolkit "*Mapping Europe's Future: understanding the impacts of global megatrends at the national level*" (EEA, 2017). A key feature of the method were two workshops through which a range of national experts reflected on the GMTs and identified and prioritised potential implications for Slovenia, followed by the discussion of specific risks and opportunities related to these implications and how Slovenia may respond to these. Background research was also completed for each prioritised implication, to collate existing indicators and evidence of change in Slovenia.

The workshops and research outcomes were then used to prepare a set of key messages for Slovenia. These form the main content of this final project report and are presented in full in Section 2. Finally a qualitative assessment was completed to consider what the priority GMT implications, risks and opportunities may mean for the achievement of strategic environmental goals in Slovenia including Slovenia Development Strategy goals and the UN Sustainable Development Goals.

GMT implications: Key messages for Slovenia

The two GMTs explored through this study (intensified competition for resources (GMT 7) and increasingly severe climate change (GMT 9) will have implications in several sectors (e.g. agriculture, economy, technology, industry, transport, tourism, etc.) and have potential impacts on food production and security, trade and resource dependence, environment, human health and vulnerability. These issues and implications are explored through 10 Key Messages for Slovenia:

A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production

Slovenia's agricultural management faces multiple risks, threatening crop yields and the security of food supply, in particular due to climate change and related extreme weather events that may become an increasingly frequent and significant threat.

The expected adverse consequences of a changing climate for Slovenia include changes in vegetation period, heat stress for livestock, irrigation vulnerability due to more frequent and severe droughts and declining groundwater levels, higher costs in agricultural production and in the long-term the abandonment of agricultural land.

If food production in Slovenia is threatened by climate change, food security may increasingly depend on the global food market, with potential implications for the security of supply for Slovenia and domestic food prices, which will be increasingly influenced by global price fluctuations.

Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence

Slovenia is largely dependent on the EU market for trade, as well as being a major recipient of European funds for key investments (e.g. in infrastructure) which have helped to create jobs and support the domestic economy.

The economic and energy dependence (or independence) of Slovenia are strongly interrelated due to the macroeconomic importance of energy sector, which in Slovenia is significantly higher than in many other EU member states.

Although Slovenia's energy dependence is below the EU average, it is entirely reliant on the imports of petroleum and natural gas, lacking domestic reserves of these important fuels.

The country sees the solution to this dependence in a transition to more renewable energy production and circular economy which will also contribute to increased energy efficiency. However, current trends show that realising these goals will require significant changes in infrastructure, investment and people's behaviour.

Multiple and conflicting demands are leading to pressure on Slovenia's limited area of productive land

Slovenia is a relatively small country, and due to its mountainous geography has limited areas of land that is flat and suitable for agricultural use, urban and industrial development. Much of this land is in the fertile river valleys and coastal areas.

At the same time Slovenia is developing economically and is seeking to expand and improve its urban, transport and industrial infrastructure.

As the area of land that is suitable for such development is limited, these land use demands are increasing pressure on available land, with implications such as the loss of natural areas, and some of the most productive agricultural land, as well as environmental pressures through soil, air and water pollution.

Transport is a key driver for environmental change and health related risks in Slovenia

Transport trends in Slovenia, in particular the observed increase in road transit transport (vehicles travelling through Slovenia), but also the growing levels of ownership and number and length of trips by private vehicle are leading to environmental and public health challenges, such as the risks to people from air pollution.

Dispersed settlement patterns and relatively poor levels of public transport provision are considered to be contributing factors in the trend towards higher levels of private vehicle ownership.

The continued economic development of Slovenia is likely to lead to increasing pressure on the natural environment

Efforts to develop Slovenia's national economy and to increase economic self-sufficiency are key drivers of, and rely upon, infrastructure development, manufacturing and agricultural production increases, higher transport demand and increased domestic consumption and trade.

In the absence of effective environmental taxation (recognising the environmental externalities of most economic activity) such changes are expected to lead to multiple and increasing pressures on Slovenia's natural environment.

Recognising and understanding trade-offs between economic sectors can help set common sectoral sustainability objectives

Limited collaboration is currently seen between economic sectors and their governance (e.g. agriculture, energy, industry).

This has resulted in a situation where there is poor alignment of sectoral objectives, and limited understanding of the resource trade-offs and conflicts as well as risks of external costs of sector activities. This lack of alignment can lead to over-exploitation of natural resources such as water, leading to increased pressure on natural capital and the environment.

An improved understanding of resource use and trade-offs within and between sectors, together with more harmonised governance and objectives could help manage resources more efficiently and improve environmental outcomes.

Environmental and economic changes in Slovenia may lead to more people becoming vulnerable

As Slovenia's economy changes some of the most vulnerable in society may be affected. For example economic pressures could lead to higher energy, water and food prices which are likely to impact on vulnerable (e.g. the elderly, those already in poverty) people, perhaps leading to increased levels of energy and food poverty.

At the same time environmental change, and in particular climate change impacts such as flooding and drought may impact most on vulnerable groups, exacerbating economic pressures and increasing social vulnerability.

Technological and behavioural change may help Slovenia move towards a more sustainable and secure future

New and emerging technologies may provide opportunities to improve resource use efficiency in Slovenia, for example by contributing to improved renewable energy generation and distribution or supporting the move to a circular economy.

However there are resource use implications in new technologies too, for example an increase in renewable energy production to provide low-carbon electricity could increase pressure on water resources.

For new technologies to realise their potential and help Slovenia become more resource efficient and sustainable lifestyle and behaviour changes are likely to be necessary, for example energy use behaviours and mobility choices (e.g. choosing electric vehicles). Governance and policy will need to play a role in guiding Slovenia towards a more sustainable and secure future.

Slovenia's reputation as a high-value tourism destination could be threatened by the environmental impacts of mass-tourism

Tourism is an important sector for Slovenia's economy, and tourist numbers have been increasing rapidly in recent years building on the country's reputation as an attractive destination.

However developments and infrastructure needed to accommodate higher tourist numbers, and the environmental impacts of tourists (increase waste, water demand) together with associated pollution (e.g. of coastal waters) could in the long-term threaten the attractiveness of Slovenia as a destination as well as impacting on the natural environment.

Better physical and environmental management of tourist regions may be necessary if Slovenia is to remain a high-value tourism destination and reap the economic rewards of its tourism sector in the long-term.

To improve resource management, environmental and economic governance, Slovenia needs to recognise the value of natural capital

Slovenia is relatively abundant in natural resources, including water and forests. However ongoing economic development across various sectors is increasing pressure on Slovenia's natural capital.

Improving knowledge and understanding of the value of Slovenia's natural capital and the critical trade-offs between environmental resources and economic development are needed to improve the governance and management of environmental resources (especially water and forests) and to preserve Slovenia's environment while ensuring sufficient resources across sectors (e.g. water for agriculture).

Challenges for meeting strategic environmental goals in Slovenia

A qualitative assessment, based on the evidence collated during this project and the judgement of experts involved, was undertaken to consider the extent to which the risks and opportunities associated with implications of GMTs 7 and 9 may support or inhibit the achievement of selected Slovenian Development Strategy 2030 goals (The goals considered of relevance to the scope of the study were Goal 1: Healthy and active life, Goal 5: Economic stability, Goal 8: Low-carbon circular economy, and Goal 9: Sustainable and efficient resource management).

The assessment of risks is presented in Figure 1 and opportunities in Figure 2. This assessment shows that risks associated with GMTs are likely to act as a barrier to the achievement of the Slovenian Development Strategy goals. For example changes in water quality and supply due to hydromorphological pressures (e.g. hydropower plants, irrigation, flood defences) are likely to obstruct the achievement of all four selected development goals due to challenges related to the effective (ground, costal, maritime) water management practices, which might raise health, economic, and sustainability concerns. On the other hand it was recognised that risks related to energy supply and poverty might also incentives the transition to the low carbon curricular economy (Goal 8), driven by the country's interest to be less depended on the energy imports.

The assessment of opportunities from GMT implications provides a more positive outlook as none were considered to act as a barrier to the achievement of the selected Slovenian development goals. Prioritisation of water and forest management, and local and organic food production are the two opportunities which are likely to support the achievement of all four selected development goals. Sustainably managed water and forest systems, as well as local organic food production, may provide health and economic benefits, support the transition to circular economy as well as directly reflect the aims of Goal 9 (Sustainable and efficient resource management).

Key to assessments in Figure 1 and 2:

↑	risk / opportunity is likely to facilitate achieving the development goal in Slovenia
→	risk / opportunity is unlikely to have a significant impact on the achievement of the development goal in Slovenia
↓	risk / opportunity is likely to act as a barrier to achieving the development goal in Slovenia

Figure 1: Impact of prioritised GMT risks on selected Slovenian Development Goals 2030

Prioritised risks	1st Goal: Healthy and active life	5th Goal: Economic stability	8th Goal: Low-carbon circular economy	9th Goal: Sustainable and efficient resource management
Air pollution affecting health (mainly due to transport and biomass burning for energy)	↓	→	→	→
Changes in water quality and supply due to hydromorphological pressures (hydropower, irrigation, flood defences etc.)	↓	↓	↓	↓
Risks to energy and resources supply due to import dependence (e.g. if one country has a monopoly over a resource that an industry in Slovenia depends on, the whole industry can collapse)	→	↓	↑	↓
Risk of energy poverty (related to high energy import dependence and volatility of energy prices)	↓	↓	↑	↓
Risks to energy supply from extreme weather events and infrastructure damage	↓	↓	↓	→
Climate change global risk (leading to irrigation vulnerability, use of pesticides, decrease in yields)	↓	↓	↓	→

Figure 2: Impact of prioritised GMT opportunities on selected Slovenian Development Goals 2030

Prioritised opportunities	1st Goal: Healthy and active life	5th Goal: Economic stability	8th Goal: Low-carbon circular economy	9th Goal: Sustainable and efficient resource management
Linking environmental and health risks for communication and policy responses(i.e. the risks to health of environmental issues)	↑	→	→	↑
Changes in diet and lifestyle (e.g. reduced meat and animal products consumption)	↑	→	↑	↑
Renewable Energy Sources and technologies development (prompted by the need of Slovenia to become less economically and energy dependent)	→	↑	↑	↑
Behavioural and technological change in relation to energy consumption and efficiency	→	↑	↑	↑
Prioritise water and forest management	↑	↑	↑	↑
Local & organic food production (example of a problem: Slovenia high quality beef and import low quality foods)	↑	↑	↑	↑

A similar assessment approach was used to consider current trends and outlooks related to the achievement of selected United Nations Sustainable Development Goals (UN SDGs) in Slovenia to 2030, assuming a business as usual trajectory (Figure 3). The SDGs goals considered of particular relevance were: 2: Zero hunger; 3: Good health and wellbeing; 7: Affordable and clean energy; 11: Sustainable cities and communities; 12: Responsible consumption and production; 13: Climate action; 14: Life below water, and 15: Life in land.

The assessment suggests that while existing policy in Slovenia have delivered improvements that indicate progress to the UN SDGs by 2030, substantial challenges remain. For example, current trends show that due to high dispersion and suburbanisation Slovenia's settlements are not yet resilient and sustainable in line with the SDG 11, despite the efforts of spatial policy to strengthen urban centres. However, by 2030 that might improve for example following the implementation of new spatial development policies. Due to its rich biodiversity and high water quality, Slovenia is currently well positioned to meet the SDGs 14 (Life below water) and 15 (Life on land). However, this study identified various risks (e.g. poor water and forest management, development pressures, lack of alignment sectors) which suggest a less positive picture in the near future and challenge the long-term achievement of these goals. Notably, the assessment of 2030 outlooks for Slovenia look least positive in relation to SDG 2 (Zero hunger), and SDG 12 (Responsible consumption and production).

Figure 3: Assessment of current trends and outlooks related to meeting selected SDGs in Slovenia

UN SDGs	Current trends	Outlook to 2030
SDG 2:End hunger, achieve food security and improved nutrition and promote sustainable agriculture		
SDG 3: Ensure healthy lives and promote well-being for all at all ages		
SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all		
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable		
SDG 12: Ensure sustainable consumption and production patterns		
SDG 13: Take urgent action to combat climate change and its impacts		
SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development		
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss		

	Improving trends dominate
	Trends show mixed picture
	Deteriorating trends dominate

1 Introduction

1.1 Introduction to this report

This report is the final output of the project *Influence of global megatrends on the state of environment in Slovenia* (henceforth 'the project'). It brings together all project outcomes (see Annex 1), and in particular the results of the two project workshops on impacts of global megatrends (GMTs) for the state of the environment in Slovenia and potential responses, and distils these outcomes into key messages for Slovenia.

Following this introduction this report sets out:

- A brief overview of the methodology used, how GMT implications and key messages for Slovenia were identified and an overview of the key messages (Section 1.2 and 1.3).
- Presentation of 10 key messages, capturing the available evidence and expert opinions on risks, opportunities and responses related to these implications (Section 2).
- An assessment of the significance of risks and opportunities from GMT implications for meeting strategic goals in Slovenia (Section 3).
- Proposals for potential next steps following the project for the Slovenian Environment Agency and Ministry of Environment (Section 4).

Various annexes are also included which provide additional background materials relevant to different sections of the report.

1.2 Project background and method

1.2.1 Background

In October 2017 the Slovenian Ministry of the Environment and Spatial Planning and the Slovenian Environment Agency commissioned Collingwood Environmental Planning (CEP) to support them in undertaking a study to understand the *Influence of global megatrends on the state of environment in Slovenia*.

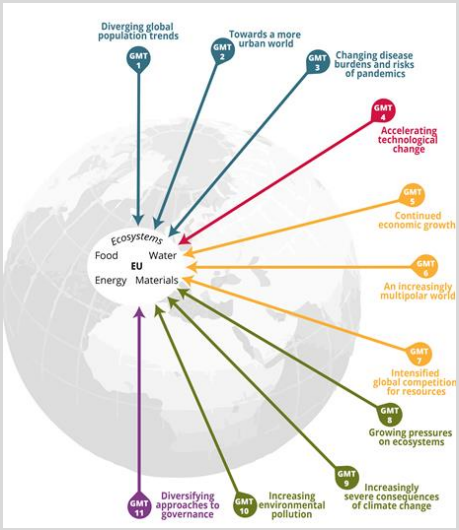
The aim of this project was to adapt and apply the methodology *'Mapping Europe's environmental future: understanding the impacts of global megatrends at the national level'* (EEA, 2017) (henceforth 'methodological toolkit') to identify potential implications of GMTs on the state of the environment in Slovenia and the ability of Slovenia to meet environmental goals set out in national strategic documents and the UN Sustainable Development Goals (SDGs).

This project considered global megatrends as analysed by the European Environment Agency (EEA) in their European Environment State and Outlook Report (SOER) 2015 (EEA, 2015).

The EEA identified 11 GMTs of relevance to Europe, and at the request of the Ministry of the Environment and Spatial Planning this project focused on identifying potential implications of two specific GMTs: *GMT 7: Intensified global competition for resources*; and *GMT 9: Increasingly severe consequences of climate change*.

What are global megatrends?

The EEA SOER 2015 defines global megatrends (GMTs) as 'large-scale, high impact and often interdependent social, economic, political, environmental or technological changes' that can have decisive and critical implications. The megatrends analysed in the EEA SOER 2015 provide a research- and expert-judgement-based perspective on how interrelated and connected global drivers and trends are likely to evolve over time. The EEA SOER 2015 assessment of GMTs analyses 11 megatrends that are considered to be of key importance to Europe's long-term environmental outlook.



EEA's Global Megatrends:

1. *Diverging global population trends*
2. *Living in an urban world*
3. *Changing disease burden and risks of pandemics*
4. *Accelerating technological change;*
5. *Continued economic growth?*
6. *An increasingly multipolar world*
7. *Intensified global competition for resources*
8. *Growing pressures on ecosystems*
9. *Increasingly severe consequences of climate change*
10. *Increasing environmental pollution load*
11. *Diversifying approaches to governance.*

1.2.2 Value-added of the project

The key value added of applying this approach for Slovenia has been:

- Providing opportunities for national experts to meet and exchange knowledge and expertise, including with experts in different technical and policy fields.
- Enabling the identification and prioritisation of ways in which Slovenia may be influenced now and in future by global drivers and trends (i.e. GMT implications).
- Bringing together existing evidence (reporting, indicators etc.) from national sources related to the prioritised implications, including some national insights and preparing factsheets to present this information which is available for use by experts in the country.
- Facilitating discussion about national responses to long-term risks and opportunities from global drivers of change affecting Slovenia's environment and strategic goals which can be used as part of national long-term strategic planning.
- Collating information and knowledge (on the meaning of the GMTs and their influence on the European environment, as well as the methodology to identify their implications at the national level) that can be followed-up with activities for example in the process of state of the environment reporting.

1.2.3 Methodological approach

The methodology adopted was centred on participation and the input of national experts, through two project workshops: scoping implications (November 2017); risks, opportunities and responses (April 2018). Requests for feedback and information were also sought through emails to national experts and bilateral discussions organised by the Slovenian Environment Agency.

The methodology followed the process described in the methodological toolkit and adapted them to the needs of this national study. A description of the main project activities as well as brief summaries of the two workshops are presented in Annex 2.

1.3 Identifying key messages for Slovenia

The identification of implications of GMTs 7 and 9 for the state of environment in Slovenia was a key outcome of the scoping workshop and formed the basis for consideration of key messages as one of the main outputs for this project. At the end of the scoping workshop six priority implications were selected by experts for further consideration.

Through the project, a range of national indicators were also identified as being of potential relevance to understanding the influence of GMT on the environment of Slovenia and support the expert discussions on identifying risks and opportunities (see Annex 3). In the workshop on risks, opportunities and responses, experts discussed these six priority implications and identified specific risks and opportunities for Slovenia arising from them. The risks and opportunities considered when identifying key messages are presented in Annex 4.

Taken together this information supported the development, in discussion with the Slovenian Ministry of the Environment and Spatial Planning and the Slovenian Environment Agency, of 10 key messages related to the implications of GMTs for the state of the environment in Slovenia. These key messages were formed by synthesising the outcomes from: expert discussions from workshops; desk-based research on the existing evidence of the prioritised implications; focused expert consultations.

The links to GMTs and their implications for each of the 10 key messages, including their policy relevance, are indicated in table 1.3.1.

Table 1.3.1. Summary of the GMT context and policy relevance of key messages

Key message title and related GMTs	Relevant national GMT implications	Selected policy links and goals
A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production		
GMT 9 *Increasingly severe consequences of climate change*	*"Extreme weather events and Infrastructure damage"* and *"Food security"*	• National Adaptation strategy for forestry and agriculture • Strategic Framework for Climate Change Adaptation • The Resolution on strategic guidelines for the development of the Slovenian agriculture and food technology until 2020 "Ensuring Food for Tomorrow" • Slovenian Development Strategy 2030: Goal 9 and Goal 11
Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence		
GMT 7 *Intensified global competition for resources*	*"Economic and energy import dependence"*	• Slovenian Industrial Policy • Smart Specialisation Strategy • Slovenian Development Strategy 2030: Goal 5, Goal 6, Goal 8 and Goal 9 • Energy Concept For Slovenia (EKS-when adopted) • National Energy Efficiency Action Plan 2017-2020
Multiple and conflicting demands are leading to pressures on Slovenia's limited land area		
GMT 7 *Intensified global competition for resources* GMT 9 *Increasingly severe consequences of*	*"Pressure on water quality and supply"* and *"Increasing environmental burden"*	• Spatial development strategy 2050 (when adopted) • Slovenian Development Strategy 2030: Goal 1, Goal 8, Goal 9, Goal 11 and Goal 12

Key message title and related GMTs	Relevant national GMT implications	Selected policy links and goals
climate change	*"Extreme weather events and infrastructure damage"*	
Transport is a key driver for environmental change and health related risks in Slovenia		
GMT 7 *Intensified global competition for resources*	"*Increased environmental burden*" and *"Economic and energy import dependence"*	• Slovenian Development Strategy 2030: Goal 1, Goal 8 • Spatial development strategy 2050 (when adopted)
The continued economic development of Slovenia is likely to lead to increasing pressure on the natural environment		
GMT 7 *Intensified global competition for resources*	"*Increased environmental burden*" and *"Economic and energy import dependence"*	• Slovenian Industrial Policy • Slovenia's Smart Specialisation Strategy • Slovenian Development Strategy 2030: Goal 1, Goal 5, Goal 6, Goal 8 and Goal 9
Recognising and understanding trade-offs between economic sectors can help set common sectoral sustainability objectives		
GMT 7 *Intensified global competition for resources*	"*Increased environmental burden*" and "*Pressure on water quality and supply*"	• Slovenian Development Strategy 2030: Goal 8, Goal 9, and Goal 12
Environmental and economic changes in Slovenia may lead to more people becoming vulnerable		
GMT 7 *Intensified global competition for resources* GMT 9 *Increasingly severe consequences of climate change*	"*Economic and Energy import dependence*" *"Extreme weather events and infrastructure damage"*	• Slovenian Development Strategy 2030: Goal 5, Goal 8, and Goal 11
Technological & behaviour change may help Slovenia move towards a more sustainable and secure future		
GMT 7 *Intensified global competition for resources* GMT 9 *Increasingly severe consequences of climate change*	*"Increasing environmental burden"* and related *"Pressure on water quality and supply"*, and *"Economic and energy import dependence"* *"Food security"*	• Slovenian Industrial Policy • Slovenia's Smart Specialisation Strategy • Slovenian Development Strategy 2030: Goal 5, Goal 6, Goal 8 and Goal 9
Slovenia's reputation as a high-value tourism destination could be threatened by the environmental impacts of mass-tourism		
GMT 7 *Intensified global competition for resources*	"*Increasing environmental burden*"	• Strategy for Sustainable Development of Slovenian Tourism for 2017–2021

Key message title and related GMTs	Relevant national GMT implications	Selected policy links and goals
GMT 9 *Increasingly severe consequences of climate change*	*"Extreme weather events and Infrastructure damage*"	
To improve resource management, environmental and economic governance, Slovenia needs to recognise the value of natural capital		
GMT 7 *Intensified global competition for resources*	*"Increasing environmental burden"* and related *"Pressure on water quality and supply"*	• Slovenian Development Strategy 2030: Goal 9

2 Key messages related to global megatrend implications for Slovenia

As noted in sub-section 1.3, the 10 key messages presented in this section are the outcome of a synthesis that captures the main elements from discussions in expert workshops supplemented by desk based research and additional expert consultations. In the key message description where specific references are not included the information has come from expert discussions in the participatory workshops.

2.1 A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production

Slovenia's agricultural management faces multiple risks, threatening crop yields and the security of food supply, in particular due to climate change and related extreme weather events that may become an increasingly frequent and significant threat.

The expected adverse consequences of a changing climate for Slovenia include changes in vegetation period, heat stress for livestock, irrigation vulnerability due to more frequent and severe droughts and declining groundwater levels, higher costs in agricultural production and in the long-term the abandonment of agricultural land.

If food production in Slovenia is threatened by climate change, food security may increasingly depend on the global food market, with potential implications for the security of supply for Slovenia and domestic food prices, which will be increasingly influenced by global price fluctuations.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 9 *Increasingly severe consequences of climate change* and in particular the implications "*Extreme weather events and Infrastructure damage*" and "*Food security*" related to this GMT as identified through the project workshops.

The following risks related to the challenges for Slovenia's agricultural sector and the security of food production were identified in the workshop discussions:

- Inadequate adaptation of agricultural management and food production to climate change and variability (disruption of food supply / yields).
- Climate change global risks leading to new plant diseases, higher costs in agricultural production, irrigation vulnerability, use of pesticides, and decrease in yields.
- Abandonment of agricultural land, decrease of agricultural land (due to climate change).
- Insufficient food production to meet domestic need, low quality of food (e.g. importing possible low quality food).

In addition the following opportunities related to the challenges for Slovenia's agricultural sector and the security of food production were identified:

- More efficient use of water sources (better practices for rainwater retention, more efficient irrigation systems, reduce abstractions, reduce groundwater use).

- Incentivise and promote local and organic food production, considering that local food systems are more resilient to climate change, to increase demand.
- Gaining new knowledge and technology (new crops; increase of organic matter in soil; development of new irrigation/frost protection technologies).
- Increase in yields from longer vegetation seasons (use of higher altitudes for food production).

What is happening in Slovenia?

The following factors were emerging from the workshop discussions as potentially influential for the agricultural sector and food security in Slovenia:

- Recognising that food production in Slovenia will be threatened by climate change, food security will largely depend on the global (food) market.
- Developments in the global market will affect the domestic food prices.
- Increase in the occurrence of extreme weather events and related damage to crops which in turn will impact the food quality and variety as well as agricultural production, and availability of feed for livestock.
- Additional investments may be needed in chemical (e.g. plant protection products) and physical (e.g. anti-frost windmills, cooling devices, change in crop varieties) measures for crop and livestock protection due to extreme weather conditions.
- Abandonment of agricultural land.
- Opportunities arising from possible extension of growing season and more sustainable production of qualitative food.
- To offset climate change impacts the use of new technology will have an effect on food quality and productivity (e.g. precision agriculture, use of drones, food processing technologies etc.).
- Possible comparative advantages (humid climate in alpine region, relatively rich water resources).

Among these factors climate change and related extreme weather events are becoming an increasingly important topic in Slovenia. According to the available evidence the production of crops in the past few years has been strongly affected by the occurrence of such events. In Slovenia's recent history there have been reports of the following extreme weather events:

- Droughts
- Heavy rainfall and Flooding (riverine, flash floods)
- Storms with strong winds and/or hail
- Heat waves

As reported by the Agricultural Institute of Slovenia (2017) the continuing trend of changing weather conditions strongly affected crop yields in 2017. Due to very warm and sunny weather in March 2017, the vegetation period started early. This was followed by an abrupt drop in temperatures and severe frost in May, which most affected fruit trees and grapevines across the country. Crop growth and subsequent yields were further affected by early drought, above average summer temperatures and five heat waves with interim cooling (Agricultural Institute of Slovenia, 2017). This weather variability was also evident in 2016 lead by a warm autumn followed by a colder than usual winter. Both of these seasons were marked by below average precipitation levels.

Due to a general dependence on rain fed irrigation, the agriculture sector in Slovenia is particularly vulnerable to short and intense summer droughts. In 2017 the Drought Monitoring Bulletin for southeast Europe[1] reported that in some aquifers of south-eastern and south-western Slovenia, groundwater levels at certain locations had reached the lowest values on record (Drought Monitoring Bulletin, 2017). The European Drought Observatory reported several heat waves in summer of 2017 which hit major agricultural areas in Slovenia with negative effects especially on grain maize and sugar beet (JRC, 2017). Agricultural drought is causing loss or heavily reducing maize crops and grassland. Severely affected by drought are also fruit and olive trees as well as vines and forage (JRC, 2017; Verbič et al., 2013).

In November 2012 more than 100 (out of 212) municipalities in Slovenia were affected by floods with total damage exceeding 200 million Euros. These floods caused damage to agricultural areas, industry, civil engineering works (e.g. transport infrastructure, distribution piping, water facilities, etc.), water courses and buildings (Government of the Republic of Slovenia, 2012). There have been a considerable number of extreme weather event occurrences in Slovenia in the last several years. More than 270 such events have been recorded from 2010-2018 including 'gustnadoes'[2], large hail, heavy rain, severe wind gusts, heavy snowfalls/snowstorms, glaze ice (European Severe Weather Database, 2018).

Even without the consequences of extreme weather events Slovenia has traditionally been, and continues to be a net importer of food, as it does not meet its own national demand for agricultural products (SORS, 2014), highlighting its vulnerability to security of food production. As reported in 2016 the level of self-sufficiency (showing the percentage of its own consumption needs that the country meets) was the lowest for vegetable (42%), fresh fruit (44%), and potato (55%) (SORS, 2017a). However, in comparison to 2013, the level of self-sufficiency in 2016 for potato has risen by nearly 10% and same for vegetables (SORS, 2014; 2016). Nevertheless, despite the relatively low rates some experts still believe that Slovenia has enough arable land and water resources that it could reverse the negative trend and significantly increase its self-sufficiency by 2030 (Plut, 2012).

With climate change being among the various drivers - the following statistics, presented by the Slovenian Statistics Office (SORS, 2016) for the period from 2006 to 2015, further underlines the challenges related to security of food production:

- The area of arable land per capita has decreased by 6%.
- The area of cereals per capita has decreased by 2 %.
- The number of agricultural holdings (majority of which are family farms) in this period has declined by 7% from 75,340 in 2007 to 70,063 (2016).
- The utilised agricultural area per capita has declined by 5%.

How might Slovenia respond?

There are various strategies and plans that address aspects of the challenges of Slovenia's agricultural sector and the security of food production.

[1] An output from the Drought Management Centre for South-eastern Europe projectin the framework of the Transnational Cooperation Programme

[2] A gustnado is a small, whirlwind which forms as an eddy in thunderstorm outflows. They do not connect with any cloud-base rotation and are not tornadoes.

In 2008 the Government of the Republic of Slovenia adopted the National Adaptation strategy for forestry and agriculture (2008) to reduce climate risk and damage to both these sectors. The other key adaptation strategy in Slovenia is the Strategic Framework for Climate Change Adaptation (2016) which provides a strategic framework, objectives and guidelines for integration of climate change impacts into policies and practice in Slovenia on national, regional and local level. The main objective of this framework is to reduce Slovenia's exposure, sensitivity and vulnerability to climate change impacts and increase the climate resilience and adaptive capacity of society. The document complements the activities taken by the EU in shape of the Common Agricultural Policy (CAP) which recognises that sustainable agriculture is key for sustainable economic development.

The Resolution on strategic guidelines for the development of the Slovenian agriculture and food technology until 2020 "Ensuring Food for Tomorrow" (2011) has recognized the need for balance between adaptation to climate change and food production on one side and mitigation of climate change on the other as one of the main challenges for the sector. Additionally, the new Slovenian Development Strategy 2030 (2017) includes two goals, which are closely linked to this implication:

- "Sustainable and efficient resource management" is the 9th goal of the Strategy and recognises the importance of high quality natural resources (water, food, timber etc.) for ensuring a higher level of self-sufficiency. Additionally, this goal acknowledges the importance of food as a high quality domestic resource for ensuring a higher level of self-sufficiency. It also notes the negative impacts of climate change on food systems emphasising the dependency of food production on weather conditions.
- "Safe and globally responsible Slovenia" is the 11th goal of the Strategy with one of the measures to achieve this target being "to promote prevention and capacity building for the comprehensive management of natural and other hazards".

On an international level to mitigate the occurrence of extreme weather events and damage to agriculture such events cause, Slovenia is a signatory to the UN SDGs, of which SDG13 (climate action) is particularly relevant (UN, 2015). A couple of key European directives relevant to challenges from extreme weather events include the Water Framework Directive, Floods Directive and the EU Adaptation Strategy.

Looking across the identified gaps and needs in responses to the GMT implications a number of key themes linked to agriculture and food production are apparent:

- Improved policy implementation requires attention even for issues where legislation is available and good.
- Need for research on appropriate crops to improve self-sufficiency in food production.
- Need for improved environmental policy integration into EU sectoral policies with more responsibilities to countries.
- Increased area of irrigated land is required to manage droughts (currently approximately 2% of agricultural land is being irrigated which is considered insufficient to ensure resilience to extreme weather events).
- Spatial planning procedures are considered lengthy (there are many levels and stakeholders included in the procedure, delaying decision-making) at all levels from local to state (MESP, 2016b). Therefore, new building and spatial legislation was adopted in November 2017, which came into force in June 2018 (new construction law and the law on spatial planning) (ZUreP-2, 2017).

- Need for promoting change in dietary habits (particularly lower meat consumption) that could lower demand for foods that are resource-intensive to produce and further enable change in food production patterns.

In relation to how these gaps and needs may be addressed:

- An analysis of the food system at a micro / local level to better understand needs and opportunities.
- Research into different technologies and practices for agriculture to improve yields and limit diseases (e.g. increase humus in soil).

2.2 Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence

Slovenia is largely dependent on the EU market for trade, as well as being a major recipient of European funds for key investments (e.g. in infrastructure) which have helped to create jobs and support the domestic economy.

The economic and energy dependence (or independence) of Slovenia are strongly interrelated due to the macroeconomic importance of energy sector, which in Slovenia is significantly higher than in many other EU member states.

Although Slovenia's energy dependence is below the EU average, it is entirely reliant on the imports of petroleum and natural gas, lacking domestic reserves of these important fuels.

The country sees the solution to this dependence in a transition to more renewable energy production and circular economy, however, current trends show that realising these goals will require significant changes in infrastructure and investment.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources* and the implication *„Economic and energy import dependence"* related to this GMT as identified through the project workshops.

In the context of Slovenia's international relationships regarding trade and resources dependence, the following risks were identified during the workshop discussions:

- Risk of energy and resources supply due to import dependence (e.g. if one country has a monopoly over a resource that an industry in Slovenia depends on, the whole industry can collapse).
- Energy poverty (Related to high energy import dependence and lack of control over volatility of energy prices. The energy prices need to be looked at in relation to individual/ household incomes).

Identified opportunities related to trade and resources dependence of Slovenia were:

- RES and technologies development (prompted by the urgent need of Slovenia to become less economically and energy dependent).
- Reduces energy consumption and increased energy efficiency (due to increased behavioural and technological change).

What is happening in Slovenia?

In relation to trade and resource dependency of Slovenia the following trends and observations were emphasised in the workshops:

- Slovenia has a small internal market and therefore it is and will remain strongly interrelated to EU and global markets, resulting in a long term economic dependence.
- Industries in Slovenia depend on imported energy, fossil fuels (mainly oil), gas, and other raw materials (minerals, metals).
- Economic dependence of Slovenia is highly affected by the energy import dependence of the country. Thus, factors that might contribute to country's energy (in)dependence, will also significantly influence its economy. The energy dependence of the country could in long term increase due to: (1) shutting down the nuclear power plant by 2050; and (2) relying on the new (imported) coal powered thermoelectric plant (TEŠ)[3]. Therefore, sustainable energy technologies, circular economy transition, and common EU energy policy could be key factors influencing country's economic end energy (in)dependence.
- In terms of energy and economic stability, transport was also identified as strongly related to the risk of critical resources supply and price volatility (predominantly fossil fuels).

The Eurostat data on economic activity, shows that after suffering a 7.8% decrease in 2009 and fluctuating for the following 5 years, Slovenia's gross domestic product (GDP) has increased by an average of 2.6% per year since 2014 (Eurostat, 2016). The export/import ratio reported for Slovenia in November 2017 was 99.9% which means that the country imports about the same amount of goods that it exports. In 2017 the exported goods amounted to €28,250 m, whilst the import was €27,526 m, of which 76.7% of total exports and 80.1 % total imports were generated by trade with EU Member States. About a fifth (20.4%) of total Slovenian exports goes to Germany, 11.5% to Italy, followed by Croatia (7.6%), Austria (7.6%) and France (5.7%) (SORS, 2017b). Goods are mostly imported in similar percentages from the same countries. This shows that Slovenian trade is heavily dependent on the EU market.

Slovenian Industrial Policy (2013) emphasises that internationalisation of business and use of the globalisation effects is becoming an increasing necessity for the country's economy, mainly due to uncertain domestic market growth and demand. However, foreign direct investment (FDI) flows in Slovenia, which are also important indicator of internationalisation of the economy, have been extremely low since the 2008 crisis (over -200m € in 2009). A paper by Blăjuț (2015) shows that between 2013-2014 Slovenia had the lowest percentage of foreign investors/companies among all 11 Central and Eastern EU countries. However, in 2014 the country had an unexpectedly strong tenfold FDI recovery (746m €) in comparison to the previous year (71m €) (Invest Slovenia, 2018).

In terms of economic dependence on EU, the National Reform Programme 2017-2018 reflects high reliance of the country on the European funds. These are commonly used for strengthening the competitiveness of the businesses as well as promoting key investments (i.e. roads and railways, sustainable mobility, renewable energy sources (RES) and energy efficiency) which are intended to create new jobs and boost economic growth, as well as reduce Slovenia's dependence on imported resources.

[3] TEŠ- Thermal Power Plant Šoštanj

In 2016 Slovenia imported 3.4 million tonnes more materials than it exported (by 22.6% more than in 2015). From the 20.7 million tonnes of raw and processed materials imported 24.3% were raw products, 26% semi-manufactured products and 49.7% finished products (SORS, 2017c). The growth in raw and processed materials import (by 5.7% compared to 2015) indicates the increasing dependency on global markets to sustain Slovenia's growing economy (see message: "The economic development of Slovenia is likely to lead to pressure on the natural environment").

The interrelation between economic and energy dependency in Slovenia has been highlighted by the European Commission (EC). It states that macroeconomic importance of energy sector in Slovenia is significantly higher than in other EU countries, in terms of the gross value added (3.0%) as well as the total employment (about 1.0%) generated by the sector (EC; 2015). Furthermore, looking at data from 2006 to 2014, EC also reports that in comparison to EU28 Slovenia's energy trade deficit is constantly higher, largely due to the amount of oil imports. Overall, the energy import dependency of the country in 2013 (EC, 2015) was in line with the EU average for all fuels together (about 50%). However, it was much higher for petroleum products (SI: 96%; EU28: 87%) and natural gas, which was entirely imported (EU28: 65%), mainly from Russia. In 2016, energy dependence of the country was 46%, with all petroleum and gas being imported (SORS, 2017d).

The largest energy consumer in Slovenia is the transport sector (39% in 2016), which supports the observation that the country's economy is highly dependent on the fossil fuel imports (SORS, 2017e). The transport sector in Slovenia has been growing over the last few decades, and the trend is continuing, as described in "*Transport is a key driver for environmental change and health related risks in Slovenia"* key message (section 2.4). Road transport significantly contributes to the negative picture of the high energy intensive Slovenian economy (SIP, 2013; EC, 2015).

Assumptions, predominantly based on the Slovenia's current energy policy, are that in future the country will be less energy dependent. However, due to the closure of two important power plants the energy (in)dependency of the country could largely depend on its future capacity of RES. Some projections for 2055, show increased energy dependency reflected in net energy import. Such study assumes that a new nuclear power plant is no longer an option (TEŠ 6 is terminated in 2053) and the lost capacity is being replaced by solar energy and gas, (E3. Modelling. Energy, Economy and Environment, 2017).

The overall share of RES in the gross final energy consumption has been increasing since 2006 and has reached a maximum of 22.41% in 2013, meaning Slovenia was on track to achieve the 25% target by 2020 (EC, 2015). However, the percentage of RES has since declined by 1.12% reaching 21.29% in 2016 (SI-STAT database, 2018a). As shown by the EC (2015) report Slovenia is some way behind the EU average in terms of low-carbon technology patent applications as well as share of public energy and environment R&D expenditure. A report from EC (2018) states that small and medium sized enterprises (SMEs) in Slovenia have low ambitions regarding energy savings as well as material and waste reduction. Only 14% of SMEs reported they will take actions towards energy efficiency, and only 10% plan to minimise waste, with similar percentage aiming to save material (11%), recycle (7%), and save water (10%) (EC, 2018). This suggests that significant changes will be required if Slovenia is to achieve its ambition to transit to a low-carbon economy through large-scale uptake of RES, and through this reduce the economic and energy dependence challenges the country faces.

How might Slovenia respond?

Slovenia has several policies and strategies which address challenges related to trade and resources dependence such as Slovenian Industrial Policy (2013) and Smart Specialisation Strategy (2017) both supporting technological development, RES, and green innovation.

At national level the implementation of the following 4 objectives of Slovenian Development Strategy (SDS) would decrease the economic as well as energy import dependence:

- "Economic stability", the 5th SDS goal, is a prerequisite for the high life quality and standard. Achieving the goal by supporting sustainable development, innovation and green growth to diminish the development gap between Slovenia and other countries would also strengthen economic and energy independence of the country.
- "Competitive and socially responsible corporate and research sector", the 6th goal of the strategy, is looking to address the issue of Slovenian reduced competitiveness by putting research and innovation towards green technologies in the focus of development polices. This would encourage investments in green technologies and support the uptake of RES in Slovenia which would have positive impacts on economy and decrease energy imports.
- Transition to "Low carbon-circular economy" (goal 8) is envisaged to be central to the country's economy over the next decades. It is considered to contribute to the energy and material use efficiency and support implementation of RES which would diminish energy use and currently high dependency on imported sources. The document recognises the importance of suitable (public) transport infrastructure and mobility to support the transition to a low carbon circular economy and to close the material loop and support the logistics of sources return.
- Goal 9 "Sustainable resource management" is to ensure the protection of strategic national goods such as quality water and food, to decrease country's vulnerability by implementing ecosystem management of natural resources.

The strategic policy documents that will further support the uptake of RES to decrease energy imports and economic dependence are Energy Concept for Slovenia (EKS-when adopted) and National Energy Efficiency Action Plan 2017-2020.

Slovenia, as an EU member state and signatory to international treaties, is bound to implement the EU legislation and among others follow the UN SDGs (UN, 2015). The EU energy sector Directives (e.g. Energy Efficiency Directive, Energy efficiency of Buildings Directive, RES Directive) as well as the SDGs, in particular SDG 7 (affordable and clean energy), SDG 9 (industry, innovation, and infrastructure) and SDG 13 (climate action) could encourage the country's efforts to increase energy efficiency, and become less resource and energy import dependent on other countries. This would also to some degree decrease economic dependence.

The needs and gaps in responses to risks and opportunities discussed in the project workshops in relation to resource and trade dependence of the country are:

- There are no alternative infrastructure connections for example for gas supply, which now comes to Slovenia through a pipeline from Italy.
- Although energy poverty in Slovenia is recognised as a serious issue at a policy level, at the level of society the awareness of this issue is considered to be low.
- The acceptance of RES facilities by local inhabitants is considered as a great challenge for the development of sustainable energy production in Slovenia. For example wind power plants are considered as visually disturbing, which also goes for solar power plants. However solar panels are also perceived as dangerous due to

causing fire. A strong opposition by civil initiatives against the development of RES in Slovenia is fairly frequent.

- There is a need to allocate subsidies for the development and implementation of RES more flexibly so that anyone willing to invest in RES can apply and is eligible for the funding. The eligibility is currently limited for example to certain types of houses and facilities. Criteria for allocating the funds should reflect the cost-efficiency of the measures implemented.
- There is a need to address the consumption/behavioural patterns among inhabitants in Slovenia to reduce resource (e.g. energy, raw materials etc.) consumption.
- Although there are numerous documents and initiatives addressing sustainable transport, the public transport (infrastructure) in Slovenia is underdeveloped. Slovenia is one of the least urbanised countries in Europe with 49.7% of its population living in urban areas compared to 74% seen in the continent (Worldometers, 2018a &2018b). This is one of the key reasons for a lack of quality in public transport together with the focus on developing highway infrastructure for the past 20 years. There are issues with frequency, speed, accessibility and quality of public transport (particularly in railway but also bus transport services). This has resulted in people mainly choosing to drive cars.
- External energy and other costs of transport are not taken into account. For example, due to poorly developed infrastructure the fright transport on railways is not feasible as it is too slow and therefore more expensive. Thus the majority of fright transport in Slovenia takes place on the roads.

To address the identified needs and gaps the suggestions by experts from the workshops include:

- Gas pipeline is being built from Italy through Slovenia to Hungary. This might be an opportunity for Slovenia to also get gas from Hungarian side (another connection to Russia) in addition to Italian (gas pipeline from Algeria) and Austrian (gas pipeline from Russia) side where the gas comes from now.
- Increase in RES and transition to circular economy, if successfully implemented, could lead to higher energy independence of the country.
- Higher diversification of energy resources could positively impact energy supply.
- More frequent and efficient awareness raising actions, and targeted communication regarding energy poverty.
- Promote the establishment of energy cooperatives and find other ways to attract private investors into the RES sector.
- The Government should stimulate the partially State-Owned Enterprises to invest their surplus in the EE/RES projects.
- The acceptability of RES facilities can be improved by looking at/taking on good practices from other countries. Increased awareness (e.g. by organising public events) about other (not just environmental) benefits of RES (e.g. improved health, economic and energy independence) can also contribute to better acceptability of RES facilities.
- Start investing in new economic facilities that are less energy/resources intensive to reduce pressure on demand.

2.3 Multiple and conflicting demands are leading to pressures on Slovenia's limited land area

Slovenia is a relatively small country, and due to its mountainous geography has limited areas of land that is suitable for agricultural use, urban and industrial development. Much of this land is in the fertile river valleys and coastal areas.

At the same time Slovenia is developing economically and is seeking to expand and improve its urban, transport and industrial infrastructure.

As the area of land that is suitable for such development is limited, these land use demands are increasing pressure on available land, with implications such as the loss of natural areas, and some of the most productive agricultural land, as well as environmental pressures through air and water pollution.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources* and the implications *"Pressure on water quality and supply"* and "*Increasing environmental burden*". It is also related to GMT 9: *Increasingly severe consequences of climate change* and the implication *"Extreme weather events and infrastructure damage*" as recognised in the project workshops.

In relation to the perseveration and protection of land in Slovenia the following risks were identified through workshop discussions:

- Increased exposure of land to more and more common extreme weather events (glaze-ice, flooding, draught, storms and frost).
- Land and in particular share of agricultural land is in decline which poses increasing risk to secure food production in the country.
- Large investment pressures for new land (they require a demanding and long-term coordination of development and environmental interests in the spatial planning process) and poor land management (renovation of degraded urban and other areas is not yet a priority) pose risks to the quality of natural environment (e.g. air, water, soil quality) as well as potentially deteriorates other environmental issues (e.g. climate change, protection of plants and wildlife).

There are several opportunities related to protection of land in Slovenia:

- Implementation of local and organic food production might seem more competitive as well as more attractive to young generations of farmers. This might contribute to the reversibility of the land abandonment trend, as well as mitigation of environmental pressures (e.g. use of pesticides, food transport), and increased food security.
- Prioritised resource management especially of and forest and water (including catchment basins) could improve resilience to extreme weather events (e.g. decrease soil erosion, mitigate draught and heat, reduce and slow down storm water runoff).
- Reaching higher levels of urbanisation in bigger cities with more condensed building developments would perhaps curb dispersed settlement and enable more efficient public transport connections as well as provision of other infrastructure (e.g. heating and water supply, telecommunications).

What is happening in Slovenia?

In relation to the pressures on land in Slovenia the following observations were identified at the workshops:

- Land, especially agricultural and open space, is under the pressure of urbanisation (e.g. infrastructure development and the spread of settlements), among others due to low prices of agricultural land in comparison to land designated in spatial development plans as suitable for building.
- Agricultural land and forests are being affected by increasingly stark and more and more common extreme weather events (e.g. glaze ice, draughts, storms, floods, and frost) which among other cause severe soil erosion.
- Farming and consequently agricultural land abandonment has been a trend over the last few decades.
- There are challenges related to spatial planning and decision making (e.g. technocracy and lack of data) resulting in profligacy and irrational use of land.

Although the population in Slovenian cities and towns during the past decade has been fairly steady or rising slowly (e.g. by about 20.000 inhabitants in Ljubljana) (SORS, 2017f) the land is still under pressure of (dispersed) settlement expansion (e.g. trend of building developments along the motorway) and infrastructure (including transport) development leading to change in land use. Land use change might contribute to increased environmental burden reflected in decreased water and air quality as well as soil pollution.

In relation to water quality, the land use change in catchment basins can cause degradation of surface water resources. The expanding settlements in coastal areas are problematic for Slovenia (ARSO, 2010a) (in terms of potential for pollution of coastal waters (e.g. due to increased effluent discharge).

Dispersed settlements, poor public transport connections and infrastructure push people towards unsustainable transport choices. Ownership of private vehicles in Slovenia has in the last decades surpassed many more economically advanced EU countries reaching 523 cars per 1,000 inhabitants in 2015 (Slovenian Environment Agency, 2016). In addition, the territory of Slovenia is crossed by some of Europe's major south-north transit routes which carry a high volume of international road freight. The use of motorised transport significantly affects the air quality (e.g. increased concentrations of PM_{10}/m^3) and in turn human health increasing risks for cardiovascular and respiratory diseases especially in children as reflected in key message *Transport as a key driver for environmental change and health related risks* (section 2.4). Soil is also affected by transport through road runoff. Slightly higher values of metals and nitrogen have been recorded in moss in the peripheries of bigger towns and cities as well as industrial and thermal energy plants, indicating an increased risk of soil acidification (ARSO, 2010b).

In 2012 Environmental Performance review for Slovenia OECD reported that urban sprawl and transport infrastructure has caused habitat fragmentation including the fragmentation of continuous forests (OECD, 2012). This reflects challenges in Slovenian spatial planning, which is believed to be inefficient due to lengthy and technocratic procedures and a lack of a coherent national spatial development strategy.

Pressures on land as a resource are perhaps the most obvious in relation to agricultural land which has historically been the most desirable for settlements as well as infrastructure development. Although arable land is extremely limited (Slovenia is among the countries with the lowest area of arable land per capita in EU) (SORS, 2013), it is still being used for build and infrastructure expansions while brown fields remain undeveloped. However,

agricultural land is also being abandoned due to ceasing of agricultural production. The statistics for 2006 to 2015 shows that during this time the area of arable land per capita has decreased by 6%, and the utilised agricultural area per capita has declined by 5% (SORS, 2016). Pressures on agricultural land also pose risk to the country's food security as described in key message *A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production* (section 2.1).

The land and forests are also affected by increasingly stark and more and more common extreme weather events (e.g. glaze ice, draughts, storms, floods, and frost) causing soil erosion and damage to crops. In 2017, 6,761 agricultural holdings applied for the argy-environmental-climate payments (financial aid supported by Rural Development Programme) to support practices contributing to environmental protection and climate change mitigation for 348,527 ha of land, indicating a 2% increase in the land area form the year before (Agricultural Institute of Slovenia, 2017).The estimate direct damage in "active" agricultural production due to two day frost in 2017 (21st and 22nd April) was 46.8 million euros (Ministry of Agriculture, Forestry and Food, 2018).

At the end of January and at the beginning of February 2014, severe and long-lasting ice storm affected Slovenia. It caused considerable damage to forests and forest roads, as well as energy infrastructure. Forest Service of Slovenia reported that the storm had damaged more than half a million hectares of forest. Seven million cubic meters of timber had to be felled, while 660 hectares of forest were planned to be cut down completely to plant new trees (RTV SLO, 2014).

How might Slovenia respond?

Slovenia has a spatial development strategy from 2004, which already recognisees some of the issues stated above (e.g. protection of agricultural land, encouragement of urban development in towns and cities). However, a new Spatial development strategy 2050 is being prepared and should be published in 2019. This strategy will hopefully be more powerful in integrating relevant sectors (e.g. transport and infrastructure, agriculture, environment and spatial planning) to address some of the hereby identified challenges, especially for issues related to the dispersed settlements and protection of agricultural land.

Several objectives of the Slovenian Development Strategy 2030 (2017) recognise the importance of land and spatial planning in Slovenia and if properly implemented could decrease the identified pressures:

- It is recognised that arrangement of space and living conditions is an important "societal subsystem" necessary for the adaptation to the population's age structure changes and thus supports the "Healthy and active life", the 1st goal of the strategy.
- Supporting "Low carbon circular economy", the 8th objective of the strategy, it is envisaged that spatial planning will be used to create hubs of a low carbon circular economy and development solutions at regional and local level.
- The 9th objective of the strategy, "Sustainable resource management", is to ensure sustainable resource management by providing quality living space through responsible and efficient land management, also in the light of more coherent regional development.

Other relevant strategy objectives reflect on the need to manage increased risks of natural hazards related to inadequate land developments (objective 11: "Safe and globally responsible Slovenia") and importance of integrated spatial development to achieve "Effective governance and high quality public service" (objective 12).

As an EU member state and signatory to international treaties Slovenia is bound to implement the EU legislation and among others follow the UN SDGs (2015). In the context of sustainable land use SDG 11 (Sustainable cities and communities), SDG 14 (Life below water), SDG 15 (life on land) and SDG 13 (climate action) are of particular importance.

The gaps and needs in responses to risks and opportunities discussed in the project workshop regarding the pressures on land are:

- In relation to local and organic food production current subsidy system should be adjusted and there should be higher availability of alternative production practices for framers (especially for vulnerable natural areas).
- To better manage extreme weather events prioritised water and forest management is needed that would include local and national level climate change impacts and adaptation analysis, better sectoral coordination, and clear delegation of responsibilities to appropriate institutions.

To address the identified needs and gaps the suggestions by experts from the workshop include:

- Local organic food production, which is to some extend already addressed in the strategic agricultural policy documents and supported through Rural Development Programme, cloud be further encouraged by reporting on benefits identified through research for land, economy, wellbeing and health on a national level.
- Recognition and management of territories with specific development challenges (as envisaged in the new Spatial development strategy 2050 currently in preparation) might help to address competition for space among different land uses (e.g. agriculture, settlement areas, industry).

2.4 Transport is a key driver for environmental change and health related risks in Slovenia

Transport trends in Slovenia, in particular the observed increase in road transit transport (vehicles travelling through Slovenia), but also the growing levels of ownership and number and length of trips by private vehicle are leading to environmental and public health challenges, such as the risks to people from air pollution.

Dispersed settlement patterns and relatively poor levels of public transport provision are considered to be contributing factors in the trend towards higher levels of private vehicle ownership.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources* and in particular the implications "*Increased environmental burden*", and perhaps less obviously also to "*Economic and energy import dependence*" related to this GMT as identified through the project workshops.

In relation to the environmental and health challenges related to transport in Slovenia the following risk was identified in the workshop discussions:

- Air pollution from transport also affecting health.

Opportunities regarding the environmental and health challenges related to transport in Slovenia were also identified:

- Linking environmental and health risks (i.e. the risks to health of environmental issues) for better communication and policy responses.
- Connecting transport and spatial policy and the establishment of integrated transport and spatial planning.
- Transitioning to sustainable mobility and encouraging behaviour change to reduce demand for road transport.

What is happening in Slovenia?

In terms of environmental burden and health related risks in Slovenia the following observation related to transport was highlighted:

- Transport and transit transport were identified as one of the main drivers of increased environmental burden in Slovenia.

Transport sector has also seen significant growth in Slovenia with implications for air quality and ecosystem integrity. In the period from 2000-2010 freight transport (tonne/km) increased by 18.1%, private cars (passenger/km) by 23.9% and vehicle stock by 21.4% (OECD, 2012). Ownership of private vehicles has increased rapidly in the previous couple of decades exceeding the rate of many more economically advanced EU countries and reaching 531 registered cars per 1000 inhabitants in 2015 (Slovenian Environment Agency, 2016). This can be perceived as a rebound effect from Slovenia's growing economy (see key message *The continued economic development of Slovenia is likely to lead to increasing pressure on the natural environment* in section 2.5) and government focus on road infrastructure development. This suggests that in the long run, there is a need for 'decoupling' of economic growth and transport growth.

In addition, the territory of Slovenia is crossed by some of Europe's major south-north transit routes which carry a high volume of international road freight. The freight transport by road reached 81.1% of total land goods transport in 2016 (measured as tonnes/km), with the remaining share carried by railway transport (SI-STAT, 2018b).

These increases in the use of motorised transport and transit of freight by road through Slovenia lead to impacts on air quality, for example by exceeding the limit values of particles (PM_{10}) and, in the summer, of ozone. In addition to the negative impact that polluted air has on environment, there are also significant impacts on human health. As indicated by the Institute of Public Health of the Republic of Slovenia, children are being regularly exposed to concentrations of particulates in the region of 30–40 µg PM_{10}/m^3, which is above the level recommended by the World Health Organization (20 µg PM_{10}/m^3) (ARSO, 2014). Being exposed to this pollutant can progress cardiovascular diseases and respiratory diseases especially with children. There are also negative effects of these pollutants for ecosystems as they become more susceptible to eutrophication and acidification. Slightly higher values of metals and nitrogen in the peripheries of bigger towns and cities as well as industrial and thermal energy plants have been recorded in moss indicating an increased risk of soil acidification (ARSO, 2010a).

As also reflected in the key message *"Multiple and conflicting demands are leading to pressures on Slovenia's limited land area",* transport infrastructure in combination with urban sprawl poses risks of habitat fragmentation (mainly lowland forests) and transformation of agricultural land.

The transport sector is also the largest consumer of energy in Slovenia (39% in 2016), making the country's economy highly dependent on the fossil fuel imports related to this sector (SORS, 2017e). Road transport also significantly contributes to the negative picture of the high energy intensive Slovenian economy (SIP, 2013; EC, 2015). Since 2000, the final

energy consumption has increased by approximately 8% (SI-STAT database, 2018a). In addition, transport accounts for a large and growing part of Slovenia's greenhouse gas emissions (from 2,7 Mt CO_2eq in 1990 to 5,7 Mt CO_2eq in 2011) (Ecologic, 2014). As a result Slovenia is not likely to meet its Kyoto target through domestic emissions reductions.

How might Slovenia respond?

There are various strategies, plans and programmes in place in Slovenia to tackle the environmental and health risks resulting from transport.

There are two objectives in the Slovenian Development Strategy 2030 (2017), which, if realised, would have a mitigating effect on this risk:

- "Healthy and active life" is the 1st goal which aims to reduce risk to human health from environmental pollution and climate change. It also intends to change consumer behaviour as well as adjust transport structures and systems which impact the life quality of all generations towards reducing the burden on the environment.
- In particular under the 8th Goal "Low-carbon circular economy", aiming to increase the material use efficiency that could contribute to decrease in resource use and extraction therefore relieving some environmental burden, transport sector recognised as an important source of greenhouse gas pollution. Thus, the strategy indicates that Slovenia will strive to use and implement new innovative mobility concepts, develop better public transport, and optimise transit transport. The country will also work on replacing the fossil fuels with encouraging efficient energy use and the use of renewable energy sources.

The new Spatial development strategy 2050 which is being prepared and is expected to be published in 2019 has the opportunity to improve the integration of relevant sectors (e.g. transport and infrastructure, agriculture, environment and spatial planning) to address some of the hereby identified needs related to risks and opportunities.

To address environmental burden, Slovenia is as an EU member state committed to an overarching sustainable development objective, which strives for a 'high level of protection and improvement of the quality of the environment', as well as implementation of the Renewable Energy Directive (EC, 2009), which in particularly encourages the use of renewable energy sources in transport sector.

To address the issues of ensuring good environmental quality Slovenia is also bound to meet UN SDGs (UN, 2015). The once more relevant to transport sector are SDG7 (affordable and clean energy), SDG9 (industry, innovation and infrastructure), SDG11 (sustainable cities and communities), SDG12 (responsible consumption and production), and SDG13 (climate action).

The following gaps and needs related to the risks and opportunities (i.e. air pollution from transport effecting health, linking environmental and health risks) were reflected:

- There is lack of public transport, including poor infrastructure and lack of intermodal connectivity – leading to low levels of use and people preferring (or needing) to use cars.
- The dispersed settlement patterns, contribute to the difficulties achieving the critical mass for the presence/improvement of public transport services between settlements.
- Lack of appropriate stimuli (e.g. pricing, reimbursing some expenses from the use of public transport in salaries) to achieve change in citizens' behaviour on their use of transport.

- The implementation of the Spatial Development Strategy of Slovenia, which was adopted by the National Assembly of the Republic of Slovenia in 2004, shows deviations from the directions and some undesired spatial development trends, the most recognisable being the suburbanisation along the completed motorway network (MESP, 2016b). For decades, priority was given to the construction of motorways before planning and modernizing the railway lines, pushing people to unsustainable transport choices.
- Funding often goes to road projects but not for more sustainable transport initiatives (public transport etc.).
- Moving freight (especially international freight) from the road network on to the railway. This would require a significant investment, restructuring and reform in the Slovenian Rail (SŽ), but would greatly reduce both the pollution from transport and congestion on existing highways, as well as improve road safety.

To address these needs and gaps suggestions include:

- Improve inter-modality of public transport, e.g. connection between trains and buses, making it easy to take bikes on trains and buses etc.
- Bike sharing schemes, such as the one in Ljubljana could be seen more widely.
- Car sharing could be expanded. Although it does exists (ride.org / prevoz.org) it is quite limited.
- Car clubs also exist but are quite limited. One example is in Ljubljana with electric cars. Clubs like that should reach a mass take-up.
- Introduction of alternative forms of public transport and means of transport in remote areas.
- Changing work practices by enabling and even encouraging employees to work from home – thus reducing commuting from distant locations.
- Integrating transport and spatial planning.

2.5 The continued economic development of Slovenia is likely to lead to increasing pressure on the natural environment

Efforts to develop Slovenia's national economy and to increase economic self-sufficiency are key drivers of, and rely upon, infrastructure development, manufacturing and agricultural production increases, higher transport demand and increased domestic consumption and trade.

In the absence of effective environmental taxation (recognising the environmental externalities of most economic activity) such changes are expected to lead to multiple and increasing pressures on Slovenia's natural environment.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources*, and in particular the implications "*Increased environmental burden*" and "*Economic and energy import dependence*" related to this GMT as identified through the project workshops.

The workshop discussions identified the following risks related to these GMT implications:

- Environmental risks related to increased domestic production and consumption in Slovenia.

- Loss of long-term value of natural capital, and risk of green washing.

In addition the following opportunities related to these GMT implications were identified:

- Improved harmonisation between environmental objectives across sectors.
- Development of new products and services with lower environmental impact including through domestic R&D.
- RES and technologies development, prompted by the need of Slovenia to become less economically and energy dependent. If Slovenia is to reduce reliance on imports of energy (and other) resources, the development of RES may be speeded up together with investments in technological development.
- Maintaining the decoupling of economic growth from energy and other resource demand: reduced energy and resource consumption and increased efficiency due to behavioural and technological change e.g. behavioural: active mobility and use of public transport, waste reduction and recycling; technological: shifting toward advanced manufacturing, which uses technologies that tend to be less energy- and resource-intensive; use and implementation of energy efficient technologies in buildings.

What is happening in Slovenia?

Discussing economic growth and associated environmental pressures the following observations were highlighted:

- Broad middle class[4], including a declining rate in people living under the poverty threshold: 0.4% reduction in at-risk-of-poverty rate in 2016 compared to 2015 – with 13.9% of population living below the threshold. The expansion of the middle class is associated with increasing rates of consumption and a national trend for internal migration to coastal areas. Such trends are combining to increase environmental pressures in Slovenia.
- Increased pressure on water management (including water supply) in coastal areas, especially during the tourist season, and the rising use of chemicals for water quality treatment are also likely having an effect on local ecosystems and biodiversity.

Additionally, the apparent dominance of political and economic interests that outweigh environmental protection add to the increasing environmental burden in Slovenia, implying the need for improved decision making that would recognise the value of natural capital, for example by recognising and seeking to measure and account for through taxation or pricing the environmental externalities associated with economic development.

The growth of gross domestic product is commonly associated with shifts in consumption patterns, resource use and the production of waste. According to OECD real GDP growth in Slovenia has annually surpassed 2% since 2014 with the latest evidence projecting that in 2017 the growth was 4.86% (OECD, 2018). Meanwhile the municipal waste generated in Slovenia has grown by 22.9% in the period 2002-2016 (SI-STAT database, 2018c).

To increase economic resilience and take advantage of an increasingly global economy Slovenia is continuously seeking increased foreign direct investment (FDI). FDI flows into

[4]According to Pew Research Center analysis of data from the World Bank PovcalNet database – in 2011, 85% of Slovenia's population had middle (**$10.01-20 daily**) or upper-middle($20.01-50 daily)income.

Slovenia have seen a significant rise in recent years. The Ministry of Economic Development and Technology (2018) reports that after a slight decline in 2016 FDI flows are expected to surpass €1,450 m in 2018. Such a large influx in foreign investment in the national economy could lead to growth in manufacturing, industry and service sectors that could cause increasingly negative consequences to Slovenia's natural capital.

Historically economic growth, energy and resource consumption are coupled as an economy rapidly grows, increased employment increases incomes, resulting in higher domestic demand for goods and services – including higher demand for energy and the resources required for manufacturing, transporting and disposing of products. Reflecting the growth seen in Slovenia's GPD, since 2000 the final energy consumption has increased by 7.95% with 4,931,000 tonnes of oil equivalent been consumed in 2016 (an approximately 4% increase in comparison with the previous year, with the transport sector being the largest consumer with 39% of the total) (SI-STAT database, 2018a; SORS, 2017e). The growing energy demand leads to increasing risks for the stability of power system operation to meet the growing needs.

One of the options to address this issue, is development of new energy infrastructure. According to a 2015 study on hydropower projects on Balkan rivers there were 181 hydropower projects planned in Slovenia and five being under construction (Schwarz, 2015). The large number of planned projects is assumed to include small hydropower projects. This poses potentially significantly increased risks for aquatic ecosystems including biodiversity, water stagnation etc. as well as water availability as a result of increased exploitation.

How might Slovenia respond?

Concern for the natural environment has historically always been of high importance for Slovenians, and Slovenia's government is now also bound to exercise this concern for natural environment through its membership of the EU (i.e. by being bound to EU environmental directives such as the water framework directive). Sustainable development is an overarching objective for the EU, which is committed to a 'high level of protection and improvement of the quality of the environment'.

As discussed in key messages *Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence* (section 2.2) and *Technological and behavioural change may help Slovenia move towards a more sustainable and secure future*(section 2.8), Slovenian Industrial Policy (2013) as well as Slovenia's Smart Specialisation Strategy (2017) encompass the principles of sustainable development by encouraging investments in green innovation and technologies, as well as development of RES.

There are five goals in the Slovenian Development Strategy 2030 (Government of the Republic of Slovenia, 2017), which, if realised, would have a positive effect on preserving Slovenia's pristine environment:

- "Healthy and active life" is the 1st goal which aims to reduce risk to human health from environmental pollution and climate change. It also intends to change consumer behaviour which has a negative impact on ensuring quality of life for all generations and reducing the burden on the environment.
- Objectives of the 5th goal "Economic stability" intend for Slovenia's economic growth to be inclusive and green based on high competitiveness and innovation. This is foreseen to enable sustainable development, and reduce burden on the environment.
- "Competitive and socially responsible corporate and research sector" is the 6th Goal of Slovenian Development Strategy 2030. Among the objectives to achieve this goal is to place innovations and research in the centre of Slovenia's development policies

which should be directed towards environmentally acceptable technologies and eco-innovations. Environmental responsibilities of enterprises and research organisations will be promoted. Such policies would have positive impact on competitiveness as well as contribute to decrease in environmental burdens.

- The 8th Goal "Low-carbon circular economy" is looking to increase the material use efficiency that could contribute to decrease in resource use and extraction therefore relieving some environmental burden. Transport sector is also recognised as an important source of environmental burden under this goal – especially by greenhouse gas pollution. The strategy indicates that Slovenia will strive to implement new mobility concepts and other measures to promote sustainable mobility (e.g. e-mobility, public transport).
- "Sustainable and efficient resource management" is the 9th goal of the Strategy and is striving to increase the quality of natural resources by implementing ecosystem-based management of these resources. Other objectives include efficient and sustainable water, soil, and forest management, biodiversity preservation, and sustainable agriculture.

2.6 Recognising and understanding trade-offs between economic sectors can help set common sectoral sustainability objectives

Limited collaboration is currently seen between economic sectors and their governance (e.g. agriculture, energy, industry).

This has resulted in a situation where there is poor alignment of sectoral objectives, and limited understanding of the resource trade-offs and conflicts as well as risks of external costs of sector activities. This lack of alignment can lead to over-exploitation of natural resources such as water, leading to increased pressure on natural capital and the environment.

An improved understanding of resource use and trade-offs within and between sectors, together with more harmonised governance and objectives could help manage resources more efficiently and improve environmental outcomes.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources*, and in particular the implications "*Increased environmental burden*" and "*Pressure on water quality and supply*" related to this GMT as identified through the project workshops.

The workshop discussions and expert consultations identified the following risks in relation to trade-offs between economic sectors:

- Poor harmonisation between the objectives of various sectors (including insufficient consideration of external costs in pricing) is considered a risk in Slovenia that requires consideration which could be addressed by joined-up resource management.
- Lack of long term view in natural capital management.
- Decreasing level of geothermal water in some areas (due to over-extraction).

In addition the following opportunity related to trade-offs between economic sectors was also identified:

- Improved harmonisation between the objectives across sectors.

What is happening in Slovenia?

There is a lack of integrated working between stakeholders and sectors at different governance levels (local, regional, and national) which is considered as a major challenge for resource management policy. Often this leads to sectors competing against each other instead of working in synergy. In some cases this leads to over-bureaucratisation (e.g. spatial planning) whereas in others it results in lack of implementation of existing policies. Additionally, common lobbying practices within natural resource sectors may be influencing public decisions and undermining social and environmental interests and objectives, which could increase pressures for privatisation of natural resources.

How can Slovenia respond?

The Slovenian Development Strategy 2030 (Government of the Republic of Slovenia, 2017) includes three goals, which are closely linked to the recognition of trade-offs and common sectoral objectives:

- The 8th goal "Low-carbon circular economy" recognises the de-coupling of economic growth and the growth in the use of resources and greenhouse gas emissions (through education, raising awareness, and innovation) as key aspects to achieve this.
- "Sustainable and efficient resource management" is the 9th goal of the Strategy that aims to implement the ecosystem management of natural resources, ensure efficient management of surface and ground water, and soil, maintain high biodiversity levels and provide sustainable forest management.
- The 12th goal "Effective governance and high-quality public service" recognises the need to create a highly developed culture of cooperation among stakeholders, which among other things will contribute to harmonised development and spatial planning at the regional level.

The following gaps and needs related to the risks and opportunities were reflected:

- The decision making process should start developing the ability to include a long term perspective in decision making processes.
- There is a need for a broader understanding that undermining natural capital could pose the threat for the implementation of long term sectoral development strategies (e.g. tourism, agriculture etc.).

To address these needs and gaps on trade-offs between economic sectors the following suggestion was raised:

- Using established planning methods such as cost benefit analysis including external costs and benefits, strategic environmental assessment, public participation in decision making, objective based budgeting.

2.7 Environmental and economic changes in Slovenia may lead to more people becoming vulnerable

As Slovenia's economy changes some of the most vulnerable in society may be affected. For example economic pressures could lead to higher energy, water and food prices which are likely to impact on vulnerable (e.g. the elderly, those already in poverty) people, perhaps leading to increased levels of energy and food poverty.

At the same time environmental change, and in particular climate change impacts such as flooding and drought may impact most on vulnerable groups, exacerbating economic pressures and increasing social vulnerability.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources* and in particular the implication "*Economic and Energy import dependence*" related to this GMT. It is also linked to GMT 9: *Increasingly severe consequences of climate change* and the implication *"Extreme weather events and infrastructure damage"* of this GMT as identified through the project workshops.

The following risks related to vulnerability of different social groups in Slovenia were identified through the workshop discussions:

- Some communities (e.g. those in flood prone areas) in Slovenia may be disproportionately affected by climate change having less capacity to prepare for, respond to, and recover from climate-related hazards.
- Risk of energy poverty (Communities being affected by volatile energy prices - would require to be looked at in relation to individual/ household incomes).
- Energy supply (the system is not resilient to such shocks as heat waves and resulting low water levels affecting hydropower plants – thus communities could be affected by shortages of supply).
- As highlighted in the key message *Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence* (see section 2.2) there is a risk of resource supply due to import dependence (e.g. if one country has a monopoly over a resource that an industry in Slovenia depends on, the whole industry can collapse leading to mass unemployment).
- Risks related to transition to low carbon economy (e.g., slow restructuring processes possibly resulting in job losses etc.).
- Agricultural management and food production (disruption of food supply / yields could affect food accessibility and affordability in particular for the most socially vulnerable groups in Slovenia).
- Risk of insufficient water supply during periods of droughts and increased demand for water supply during tourist season (coastline and karst) (RRC Koper, 2015).

The opportunities that could address vulnerability of different social groups in Slovenia are:

- RES and technologies development (Slovenia to become less economically and energy dependent continuing to ensure energy supply and affordability to all social groups in Slovenia).
- Reduced energy consumption and increased energy efficiency due to behavioural and technological change could relieve pressures on existing energy production capacities and ensure continuous energy supply for all social groups in Slovenia.

- Include local and organic food production in agricultural policy to support alternative food supply and reduce dependency on imports.
- Research of different technologies and practices for agriculture (increase humus in soil) to increase local food production and minimise dependence on food imports.

What is happening in Slovenia?

Social vulnerability to climate change is likely to become an increasingly important issue in Slovenia as the number of extreme weather events has exceeded 270 occurrences since 2010 (European Severe Weather Database, 2018). Such circumstances are causing significant damage to transportation, energy infrastructure, agricultural land and forests further leading to increased social vulnerability in many communities across the country.

Globally, the prices of natural resources are rising due to the changing consumption patterns, depletion of natural resources and influences from global markets. It was discussed that changing consumption patterns could lead to an increase in resource (i.e. water) prices in global and consequently national market, which would affect the accessibility or affordability of resources for Slovenians. The academic and grey literature identified in this study does not confirm the increase in global or European water prices, whilst data on water prices in Slovenia is currently not available.

Although energy poverty in Slovenia is recognised as a serious problem at a policy level, in society there is low awareness of this issue.

It has also been recognised that the extreme weather events driven by climate change and infrastructure damage will have an impact on the water-energy-food nexus with the magnitude of such effects on local communities is considered high:

- Supply of drinking water is uncertain in certain regions in Slovenia (Primorska, Prekmurje).
- Supply and price volatility of critical resources (mainly fossil fuels, but not excluding other resources).
- Developments in the global markets and changing consumption patterns will affect domestic prices of natural resources and food.

How might Slovenia respond?

Available evidence in Slovenia indicates a notable variability in the occurrence and impacts of extreme weather events (ARSO, 2010c; Drought Monitoring Bulletin, 2017). It is important to recognise those communities being most vulnerable to such events and introduce measures that would increase their resilience. There are three goals in the Slovenian Development Strategy 2030 (Government of the Republic of Slovenia, 2017), which, if realised, would have a positive effect on addressing social vulnerability:

- "Economic stability" which is the 5th SDS goal, is a prerequisite for the high life quality and standard. Achieving that by supporting sustainable development, innovation and green growth to diminish the development gap between Slovenia and other countries would strengthen economic and energy independence of the country and ensure communities are insusceptible to the risks associated with energy poverty, increasing energy, water and food and restricted supply.
- "Low carbon-circular economy" is the 8th Goal of Slovenian Development Strategy 2030. Among the priorities for this goal is to increase the energy and material use efficiency and uptake of RES, which would lead to decreased energy use and diminished sources import on which the country is currently heavily dependent.

Lowering the risk of energy supply would address possible vulnerabilities of household consumers that rely on continued energy supply to meet their needs.

- One of the measures within the "Safe and globally responsible Slovenia" goal (11th goal) which could address social vulnerability to extreme weather events is to promote prevention and capacity building for the comprehensive management of natural and other hazards.

The following recommendations were identified that could have a positive impact on reducing vulnerability of communities in Slovenia, in particular related to energy poverty:

- Humanitarian aid could actively help in dealing with problems related to energy poverty.
- More frequent and efficient awareness raising actions on energy poverty, and ensure targeted communication.
- Increased awareness about positive aspects of RES such as health and economic benefits improve the acceptability of RES facilities among people.
- Improved water management.

2.8 Technological and behavioural change may help Slovenia move towards a more sustainable and secure future

New and emerging technologies may provide opportunities to improve resource use efficiency in Slovenia, for example by contributing to improved renewable energy generation and distribution or supporting the move to a circular economy.

However there are resource use implications in new technologies too, for example an increase in renewable energy production to provide low-carbon electricity could increase pressure on water resources.

For new technologies to realise their potential and help Slovenia become more resource efficient and sustainable lifestyle and behaviour changes are likely to be necessary, for example energy use behaviours and mobility choices (e.g. choosing electric vehicles). Governance and policy will need to play a role in guiding Slovenia towards a more sustainable and secure future.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources* and in particular the implications "*Increasing environmental burden*" and related "*Pressure on water quality and supply*", as well as "*Economic and energy import dependence*" implications related to this GMT. It also relates to GMT 9: *Increasingly severe consequences of climate change* and the implication "*Food security*" of this GMT as identified through the project workshops.

In relation to technological and behavioural change the following risks were identified in workshop discussions:

- Changes in water quality and supply due to hydromorphological pressures including hydropower as RES and due to periods of droughts and increased demand for water supply during tourist season (coastline and karst).

The following opportunities regarding societal change and technological development were also identified:

- Changes in diet and food production (e.g. reduction of meat and animal products consumption (e.g. uptake of more sustainable agriculture practices) as well as lifestyle (e.g. ways of travelling, commuting) to tackle consequences of climate change.
- Development of RES and technologies, and increased energy and resource efficiency prompted by the need of Slovenia to become less economically and energy dependent.

What is happening in Slovenia?

In relation to technological and behavioural change to reach sustainability the following observations were noted:

- It is likely that the air pollution will increase due to growing motorisation and transit transport, as well as large numbers of small domestic biomass firing installations which would also affect human health. However, when discussing long term timescales (2030-2050) it was suggested that environmental burdens could decrease, as also reflected in the Energy Concept of Slovenia. This will be supported by the introduction of new/sustainable technologies, increased energy production from RES and greater use of electric cars.
- Economic and energy dependence are strongly interrelated (see key message *Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence*, section 2.2). Future energy supply might be at risk due to shutting down the nuclear power plant by 2050, and relying on the new (imported) coal powered thermoelectric plant (TEŠ)[5] in the future. Thus, the development of sustainable energy technologies, production, storage and share of renewable energy sources (RES), and the envisaged transition to circular economy could play the crucial roles in the extent to which Slovenia will be economic end energy (in)dependent.
- Technological innovations could further raise pressures on water in Slovenia, as it is potentially an abundant renewable energy source, as well as due to increased use of water in agriculture (irrigation due to more frequent draughts) and tourism. However, new technologies can also result in less resource-intensive lifestyles that could relieve the pressure on water demand.
- Moving towards more sustainable food production, partly driven by increasingly severe consequences of climate change, might show as an opportunity in terms of the food quality. On the other hand, there might be trade-offs among food quality and sufficient amount of food as well as biodiversity. For example, the options to transit to extensive, organic or ecological farming to improve food quality and at the same time contribute to biodiversity, could be limited as food productivity in these forms of agriculture is generally lower.

Slovenian Industrial Policy (2013) suggests, the country should invest in green innovation and develop eco products in order to tackle the issue of low material productivity (GDP/resources used) and create a less energy intensive economy. This is further supported by the Slovenia's Smart Specialisation Strategy (2017) aiming for production of sustainable bio-balanced materials, and supporting development of technologies for (re)use of (secondary) materials and waste, and production of energy from RES. Slovenia has already been grouped among the "eco-innovation leading" countries in Europe. Although the country is scoring high in eco-innovation inputs, activities and outputs, however for resource

[5] TEŠ- Thermal Power Plant Šoštanj

efficiency outcomes the score is below EU average (EIO, 2017). As reflected by EC (2018) report the ambitions of small and medium sized enterprises (SMEs) in Slovenia towards energy savings, material and waste reduction are at the tail end of EU countries. This implies that if technological and behavioural change is to drive Slovenia towards better future, significant societal and governance shifts will be required.

As also discussed in the key message *Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence*(section 2.2) the share of RES in the gross final energy consumption has in recent years declined jeopardizing the achievement of the 25% target by 2020. Slovenia lags behind the EU average in terms of low-carbon technology patent applications and R&D expenditure related to public energy and environment (EC, 2015).

How might Slovenia respond?

Slovenia has a variety of policies and strategies aiming to encourage positive behavioural change towards sustainable development, food and energy production, and use of resources, driven by technological innovation and transition to circular economy. All these ideas are also strongly reflected in the objectives of Slovenian Development Strategy 2030:

- "Economic stability" which is the 5th SDS goal, is to be achieved by supporting sustainable development, innovation and green growth to diminish the development gap between Slovenia and other countries.
- The 6th goal "Competitive and socially responsible corporate and research sector" is looking to put research and innovation towards green technologies in the focus of socially and environmentally responsible development polices, enable the environment for creating digital trends, and encourage creativity and thereby strengthening the participation of science and art.
- According to the Strategy goal 8 "Low carbon-circular economy" is a priority development objective of the entire national economy aiming to achieve decoupling of economic growth and resources use, driven by research, technology, innovations and education leading to change in consumption patterns.
- The goal 9 "Sustainable resource management" is striving towards ecosystem management of natural resources of strategic national importance (e.g. high quality food and water) in order to increase countries resilience and independency.

The move to technological development and behavioural change in Slovenia is also strongly supported by EU as well as international SDGs, in particular SDG 7 (affordable and clean energy), SDG 9 (industry, innovation, and infrastructure), SDG 11 (sustainable cities and communities), SDG 12 (responsible production and consumption) and SDG 13 (climate action).

The gaps and needs that have been noted in relation to the identified risks and opportunities for technological and behavioural change in the workshop discussions and expert consultations are:

- Need to address the poor acceptance of RES facilities by local inhabitants.
- Need to change the restrictive regulation for RES investment and counter the anti-RES lobbying.
- Positive behavioural change in transport is hindered by underdeveloped public transport infrastructure.
- There is a lack of research, evidence and communication on the environmental impacts of Slovenian agriculture, especially animal farming and meet production, and benefits of low meet or meet free diets.

These gaps could be addressed by:

- Looking at good RES facility placement practices from other countries and increasing awareness about health, economic and other benefits of RES, not just environmental.
- Attract private investors into the RES sector and establish energy cooperatives.
- Investing in and developing modern transport infrastructure supporting elements like intermodal public transport, bike and care sharing schemes, and making a better use eco funds (e.g. EBRD and national taxation).
- Striving for better coordination across department e.g. education (school meals, curriculum), agriculture (farming practices), health (benefits of reduced meat), and environment, and taping into youth movements around less meat heavy or meet free diets and lifestyle.
- Improved water management.

2.9 Slovenia's reputation as a high-value tourism destination could be threatened by the environmental impacts of mass-tourism

Tourism is an important sector for Slovenia's economy, and tourist numbers have been increasing rapidly in recent years building on the country's reputation as an attractive destination.

However developments and infrastructure needed to accommodate higher tourist numbers, and the environmental impacts of tourists (increase waste, water demand) together with associated pollution (e.g. of coastal waters) could in the long-term threaten the attractiveness of Slovenia as a destination as well as impacting on the natural environment.

Better physical and environmental management of tourist regions may be necessary if Slovenia is to remain a high-value tourism destination and reap the economic rewards of its tourism sector in the long-term.

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to *GMT 7: Intensified global competition for resources* and the implication "*Increasing environmental burden*" related to this GMT. It is also linked to GMT 9: *Increasingly severe consequences of climate change* and the related implication "*Extreme weather events and Infrastructure damage*" of this GMT as identified through the project workshops.

As tourism sector grows the environmental pressures are expected to intensify as highlighted in workshop discussions:

- Increased demand for water, in particular for drinking and sanitation could put additional pressure on existing groundwater management strategies. Tourism and leisure activities can be a significant factor in water consumption at the national level. According to Gössling et al. (2012) water consumption rates are in the range of 84-2,000 litres per tourist per day, and up to 3,423 litres per bedroom per day.
- Changing global consumption patterns and the related demand for goods and services.
- Urbanisation, especially hospitality infrastructure (e.g. hotels) to meet the growing demand. This further leads to land use change due to construction of infrastructure (including transport). The urbanisation of coastal land is considered to be a particular

issue for Slovenia and the potential for pollution of coastal waters (e.g. due to increased effluent discharge) (ARSO, 2010c).
- The continuous development of transport infrastructure and transport use to serve tourism sector are important elements of environmental burden (e.g. air pollution, lad use change, habitat fragmentation etc.).
- Large number of tourists can, in the long term, undermine the natural environment that is currently perceived as Slovenia's comparative advantage.

The opportunities for Slovenia's tourism industry include:

- Competitive advantage for tourism sector as in global terms Slovenia is less impacted by heatwaves and droughts compared to current typical summer destinations (e.g. Greece, Spain etc.) leading to tourists choosing more pleasant conditions in the Alpine region, especially over summer period.
- Opportunities for development of SMEs arising from spa (thermal water) tourism that could benefit local communities in eastern and central Slovenia.
- Opportunities for development of tourism (new tourist products and infrastructure) in remote areas.

What is happening in Slovenia?

Since 2006 Slovenia's tourism sector has experienced a steady growth as 2016 recorded record numbers of tourist arrivals to date. The industry had a 12.0% (3,032,256) increase in international tourist arrivals compared to 2015, placing it above the European average. The total number tourist arrivals (including domestic) and their share corresponds to 4,317,504 arrivals and 11,179,879 overnight stays, which is 9.9% and 8.1% more than in 2015 respectively (Slovenian Tourism Board, 2018). The foreign inflow from tourism in 2016 reached 2.35 billion euros (The Slovenia Times, 2017).

Located in Central Europe and bordering the Mediterranean climate change pose serious and diverse threats to tourism industry in Slovenia considering the variety of experiences it can offer in a small geographical area. The recently approved Sustainable Development Strategy for Slovenian Tourism has identified four distinct macro destinations: Mediterranean Slovenia, Alpine Slovenia, Thermal Pannonian Slovenia and Central Slovenia & Ljubljana illustrate the diversity of destinations where extreme weather events could have potentially significant costs. However the latest assessment report (AR5) from the International Panel on Climate Change (Kovats et al., 2014) highlights the Mediterranean as one of the most vulnerable regions in the world to the impacts of global warming with central Europe being less affected by climate induced heatwaves and droughts. Slovenia, lying on the crossroad of Alpine and Mediterranean climate, is recognized as a highly vulnerable country to climate change impacts, the most relevant being: increased number and magnitude of heat waves in the summer, summer droughts, summer flash floods, winter floods and reduced snow cover (ARSO, 2017a; ARSO, 2017b).

How might Slovenia respond?

The Strategy for Sustainable Development of Slovenian Tourism for 2017–2021 (2017) defines key policies for reorganisation of macro regions and tourism products, institutional and legal framework, accommodation, development of tourism infrastructure, human resources, spatial planning, natural and cultural assets, and small and medium-sized companies. The main ambition for the strategy is for Slovenia to become a green, active and healthy destination offering five-star experiences. Simultaneously it foresees to achieve the following tourism development objectives that could further add to the environmental pressures from increasing consumption of resources, urbanisation and pollution:

- Increase in currency inflow from €2.35 billion in 2016 (The Slovenia Times, 2017) to €3.7 - €4 billion by 2021.
- Increase in tourist arrivals from 4.3 million in 2016 to 5-5.5 million by 2021.
- Increase in tourist overnight stays from 11.1 million overnights in 2016 to 16-18 million overnights by 2021.
- Average length of stay 3.1-3.4 days by 2021.
- Increase in new tourist rooms by 18,000 to 22,000, of which 8,500 renovated and 6,500 new rooms in the hotel sector.

For Slovenia's tourism sector to remain attractive and competitive both on a regional and global level it has to be based on pristine environment ensuring that short term economic gains from growing tourist arrivals do not compromise the natural resources that attract visitors in the first place.

In order to ensure sustainable tourism in Slovenia the new tourism strategy does recognise the need to introduce measures to define specific areas (destinations) for the development of tourism, establish a sustainable model for visitor management and draft a national plan for green (sustainable) tourism. However for Slovenia to maintain its reputation as a green tourism destination it might be necessary to shift public investment in tourism from promotion to improved visitor management. This could be achieved by discouraging the visitation of areas where tourist pressure is undesirable and investing in infrastructure improvement of desirable destinations. The focus should be on high value tourism to ensure actual quality of tourist experience with the 'green' promise the sector promotes.

2.10 To improve resource management, environmental and economic governance, Slovenia needs to recognise the value of natural capital

Slovenia is relatively abundant in natural resources, including water and forests. However ongoing economic development across various sectors is increasing pressure on Slovenia's natural capital.

Improving knowledge and understanding of the value of Slovenia's natural capital and the critical trade-offs between environmental resources and economic development are needed to improve the governance and management of environmental resources (especially water and forests) and to preserve Slovenia's environment while ensuring sufficient resources across sectors (e.g. water for agriculture).

Global drivers and implications, risks and opportunities for Slovenia

This key message is linked to GMT 7: *Intensified global competition for resources* and in particular the implications "*Increasing environmental burden*" and "*Pressure on water quality*" of this GMT as identified through the project workshops.

Ensuring sustainable management of natural resources in Slovenia in a more joined-up process would have a lasting economic, social and environmental benefits. This approach could ensure that those that manage natural resources, those that benefit from good quality, reliable natural resources and those that have the potential to have an impact on natural resources, are part of the agenda setting and decision making process. One of the

opportunities related to the challenges to ensure joined up resource management is to ensure harmonisation between the objectives across sectors.

What is happening in Slovenia?

Generally there is a trade-off between sustained growth of national economy and growing demand for natural resources as the buying of products and services that fuel economic growth requires more resources to meet the growing demand. International companies in natural resource industries can also add to the pressure on natural capital by seeking better access to resources in the form of substantially increased FDI in resource-rich countries. According to Invest Slovenia, forming part of the Slovenian Public Agency for Entrepreneurship, Internationalisation Foreign Investment and Technology, Slovenia is prioritising on building a strong business-friendly environment as a precondition to capturing growth-fuelling FDI investments (Invest Slovenia, 2018). The institution recognises the importance of FDI to Slovenia's economic growth and notably, the FDI flows in the country have continued to grow last 12 months since early 2017 (The Slovenia Times, 2018).

In the light of the international trade agreements like CETA[6] and increased FDI in resource extraction might increase privatisation of abundant high quality natural resources in Slovenia. As discussed extraction of abundant high quality water resources in Slovenia might be an interesting long term investment for foreign corporations, which could possibly be supported by the country's political interest for economic prosperity. This could lead to increased pressures on the country for privatisation of natural resources even if access to resources such as water is protected by Slovenia's Constitution.

Water is a primary resource across industry, energy and agriculture sectors. The intensification of water use has been observed since 2002 and peaking in 2014 with 125,577,489 thousand/m^3 used. In the period from 2002 – 2016 the use of water in industry has grown by 35.3%. Although water resources in Slovenia are considered abundant and of high quality, these trends indicate a necessity for improved water management to ensure long term water availability in key sectors like agriculture.

Forests in Slovenia form an important role in the landscape being rich in diversity and alleviating the impact of natural disasters and human pollution. According to Ministry of Agriculture, Forestry and Food, 74% of forests in Slovenia are private property, while 26% are public (owned by the state or communes). The Ministry has recognised that the large fragmentation of forest property and the number of private forest owners and co-owners (314,000 individual forest owners), is presenting a serious obstacle to ensure professional maintenance of private forests (MKGP, 2007).

Although the area covered by forests in Slovenia has been constantly increasing since the beginning of 20^{th} century the trend is not equally distributed across Slovenia. The forest cover is mostly increasing in areas where there is much forest, while areas with intensive agriculture and suburban areas are facing strong pressures which gradually lead to clearance of already scarce remains of forests (MKGP, 2007).

[6] CETA- new trade agreement between EU and Canada

How might Slovenia respond?

"Sustainable and efficient resource management" (9th goal) is the main goal in the Slovenian Development Strategy 2030 (2017), which, if realised, would have a positive effect on natural capital. The main aim of this goal is to increase the quality of natural resources by implementing ecosystem-based management of these resources. Other objectives include efficient management of surface and ground water, and soil, sustainable forest management, maintaining high levels of biodiversity, and sustainable agriculture.

The following recommendations were identified for resource management and the recognition of value of natural capital through expert consultations:

- To improve resource management in Slovenia there are favourable circumstances for collaborative and community based management practices as long as the existing resource ownership structure in respected.
- Land owners should be rewarded for the ecosystem services they provide to the wider community, such as carbon sequestration, water regime, biodiversity or visitor experience.
- Slovenia can use water and forest as competitive advantage by keeping and improving the existing good management practices based on the existing legal and constitutional basis. This would ensure that Slovenia benefits from the expected global rise in price of water, timber and other renewable resources. In order to achieve this requires the Government to not under-price these natural resources to attract investment or to cash in on short term windfalls.

3 Challenges for meeting environmental goals in Slovenia

3.1 Risks and opportunities for the achievement of selected Slovenian Development Strategy 2030 goals

This sub-section provides an overview assessment of the extent to which risks and opportunities associated with GMT implications may support or inhibit the achievement of Slovenian Development Strategy 2030 goals considered relevant to the scope of this study.

The four selected goals assessed are:

- 1st Goal: Healthy and active life
- 5th Goal: Economic stability
- 8th Goal: Low-carbon circular economy
- 9th Goal: Sustainable and efficient resource management

Drawing on the knowledge of a range of national experts in environmental, agriculture and resource related research, planning and policy, together with the collection and review of available evidence (literature, indicators) enabled the project to identify and prioritise risks and opportunities associated with the implications of GMTs considered in this study.

Considering the risks and opportunities presented in Tables 3.1.1 and 3.1.2 a qualitative assessment of the likely impact of the risks and opportunities on the four selected Slovenian Development Goals was carried out.

This assessment was performed by looking at each risk and opportunity in the context of the targets of each particular goal, and considering the evidence collected and presented in the key messages (Section 2) a judgement based assessment was made of the impact it will have on the ability of Slovenia to achieve each goal using the following criteria:

↑	risk / opportunity is judged as being likely to facilitate achieving the development goal in Slovenia
→	risk / opportunity is judged as being unlikely to have a significant impact on the achievement of the development goal in Slovenia
↓	risk / opportunity is judged as likely to act as a barrier to achieving the development goal in Slovenia

Table 3.1.1: Impact of prioritised GMT risks on selected Slovenian Development Goals 2030

Prioritised risks	**1st Goal: Healthy and active life**	**5th Goal: Economic stability**	**8th Goal: Low-carbon circular economy**	**9th Goal: Sustainable and efficient resource management**
Air pollution affecting health (mainly due to transport and biomass burning for energy)	↓	→	→	→

Prioritised risks	1st Goal: Healthy and active life	5th Goal: Economic stability	8th Goal: Low-carbon circular economy	9th Goal: Sustainable and efficient resource management
Changes in water quality and supply due to hydromorphological pressures (hydropower, irrigation, flood defences etc.)	↓	↓	↓	↓
Risks to energy and resources supply due to import dependence (e.g. if one country has a monopoly over a resource that an industry in Slovenia depends on, the whole industry can collapse)	→	↓	↑	↓
Risk of energy poverty (related to high energy import dependence and volatility of energy prices)	↓	↓	↑	↓
Risks to energy supply from extreme weather events and infrastructure damage	↓	↓	↓	→
Climate change global risks (leading to irrigation vulnerability, use of pesticides, decrease in yields)	↓	↓	↓	→

The outcomes of this assessment are quite diverse, but illustrate some of the key ways in which Slovenia's natural environment and policy is being and will be affected by global megatrends. As might be expected, the risks associated with GMTs are assessed as predominantly likely to act as a barrier to the achievement of meeting the Slovenia Development Strategy goals. Some reflection on the ways in which GMT risks may influence the achievement of the development goals include:

- Changes in water quality and supply due to hydromorphological pressures are likely to obstruct the achievement of all four selected development goals. For example an increased number of hydropower plants and other physical alterations of Slovenia's water bodies modifying their shores, water level and flow could hinder the achievement of the target of 9th Goal (Sustainable and efficient resource management) on *effectively managing surface and groundwater, coastal and maritime resources, and achieving their good status*. There is also risk of insufficient water supply due to periods of droughts and increased demand for water supply during tourist season (coastline and karst).
- Multiple risks related to the energy domain were discussed during the workshops and are present among those prioritised. Assessing their impact on the selected development goals, two of the "energy" risks in particular are likely to interfere with Slovenia's ability to achieve the development goals: Risks to energy supply from extreme weather events and infrastructure damage and risk of energy poverty**.** Both of these risks are likely to put increased pressure on one the targets of the 5th Goal

(Economic stability) *designing sustainable solutions in order to maintain balanced public finances and sustainably reduce public debt.* High energy import dependence and increasing damages to existing energy infrastructure from extreme weather events would put growing pressure on public spending to disproportionately invest in energy sector possibly leaving other sectors underinvested.

- The success of both "Healthy and active life" (1st Goal) and "Economic stability" (5th Goal) is likely to be hindered by most of the prioritised risks. Air pollution from the increasing use of transport combined with potentially growing pressures on sustainable, affordable and secure energy and water supply as well as climate change risks are issues that would all need to be considered when looking at policies, strategies and plans to achieve "Healthy and active life" in Slovenia. Most of these issues would also hinder the achievement of the "Economic stability" goal, in particular in the form of externalities from climate change that are endured by the society. Additionally, energy and resource import dependence could destabilise key economic sectors and prevent this to goal to be achieved.

Notably not all GMT risks were judged to be in conflict with the development goals. It was considered that the risk of energy and resource supply due to import dependence coupled with energy poverty might motivate policy and decision makers to apply new technologies, ideas and practices to address these existing issues. Assuming that these solutions could include sustainable and environmentally responsible actions this would help to provide conditions for the transition to low-carbon circular economy (8th Goal).

The assessment of opportunities from GMT implications presented in Table 3.1.2 provides a more positive outlook as none were judged to act as a barrier to the achievement of the selected development goals.

Table 3.1.2. Impact of GMT opportunities on selected Slovenian Development Goals 2030

Prioritised opportunities	**1st Goal: Healthy and active life**	**5th Goal: Economic stability**	**8th Goal: Low-carbon circular economy**	**9th Goal: Sustainable and efficient resource management**
Linking environmental and health risks for communication and policy responses(i.e. the risks to health of environmental issues)	↑	→	→	↑
Changes in diet and lifestyle (e.g. reduced meat and animal products consumption)	↑	→	↑	↑
Renewable Energy Sources and technologies development (prompted by the need of Slovenia to become less economically and energy dependent)	→	↑	↑	↑
Behavioural and technological change in relation to energy consumption and efficiency	→	↑	↑	↑

Prioritised opportunities	1st Goal: Healthy and active life	5th Goal: Economic stability	8th Goal: Low-carbon circular economy	9th Goal: Sustainable and efficient resource management
Prioritise water and forest management	↑	↑	↑	↑
Local & organic food production (example of a problem: Slovenia high quality beef and import low quality foods)	↑	↑	↑	↑

Some key reflections on impacts on these goals and which of those are likely to be most straightforward to achieve include:

- The two opportunities: prioritising sustainable water and forest management and expanding local & organic food production would likely facilitate achieving all of the selected development goals. For example, the benefits from healthy natural environment (e.g. prioritising clean and accessible water, sustainably managed forests) could help provide health benefits and wellbeing of local populations (1st Goal). Sustainably managed water and forest systems could also align with the aim of inclusive and green economic growth for Slovenia that will ensure economic stability (5th Goal). Additionally, forest management practices that ensure trees are sustainably harvested and replaced could provide a renewable source for circular economy (8th Goal) as timber uses low energy processes, is durable and generates little waste that cannot be recycled or used as a source of renewable fuel. Finally, sustainable water and forest management would directly reflect the targets of the 9th development goal.
- Assuming the identified opportunities are realised, they would all help Slovenia to successfully meet the various targets outlined in the 9th development goal. In particular the target on sustainable soil management and preservation of soil ecosystem services, preventing further soil degradation and rehabilitating degraded soil could be achieved through local & organic food production. Organic agriculture practices encourage soil fauna and flora, improve soil formation and structure in turn increasing the nutrient and energy cycling. Soil management techniques applied in organic agriculture also play an important role in soil erosion control.

3.2 Trends and outlooks for selected UN SDGs in Slovenia based on Key Messages from this GMT study

This sub-section provides an overview of current trends and outlooks related to the achievement of UN SDGs in Slovenia. The assessment is based on the evidence presented in the key messages (Chapter 2) and collected through the two expert workshops and associated research. The scope of the study means that the evidence base only supports an assessment of selected SDGs, and those considered relevant to the study are:

- SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
- SDG 3: Ensure healthy lives and promote well-being for all at all ages.

- SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all.
- SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable.
- SDG 12: Ensure sustainable consumption and production patterns.
- SDG 13: Take urgent action to combat climate change and its impacts.
- SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
- SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

The assessment of current trends and outlook to 2030 (see Table 3.2.1) was completed by initially identifying the relevant key messages for each of the selected UN SDGs. Following the listing of relevant key messages, each was analysed in the context of the targets presented for the selected UN SDGs. Considering the relevant GMT implication, identified evidence and risks and opportunities embedded in each of the key messages the assessment was completed using qualitative criteria to present an indicative assessment of trends.

The assessment assumed a business as usual trajectory. It is noted that if existing national strategies (such as the Slovenia Development Strategy) were to be implemented in full and all goals and targets achieved, then the outlook would be generally positive (improving). However the evidence collected and the perspectives reflected through this study suggest that many challenges remain for Slovenia to achieve such strategic goals.

It is also recognised that the evidence base used in this assessment is limited to that collated through the study on GMT implications in Slovenia. The assessment should therefore be seen as indicative and selective rather than comprehensive, and is intended to give an overview of the potential 'direction of travel' in relation to selected SDGs in Slovenia.

The outcome of analysis presented in Table 3.2.1 indicates the type of trends (improving/ mixed/ deteriorating) that are considered to be dominant in Slovenia in the context of a particular SDG. This could allow policy and decision makers to recognise the likely degree of difficulty in achieving the selected UN SDGs in Slovenia.

While Slovenia's policies have delivered many improvements that indicate progress to the UN SDGs by 2030, substantial challenges remain, for example:

- Slovenia's settlements are not yet resilient and sustainable in line with the SDG 11. Slovenia is characterized by diverse settlement structures. The country has large number of dispersed settlements with half of the population living on the countryside. In 2014 there were 6,034 settlements in Slovenia (SORS, 2014), of which 57 were unpopulated settlements, 90% of all settlements have a population of under 500 and one third of the total population, approximately one quarter of the settlements have a population of under 50. Seven cities have a population of more than 20,000 and they are home to slightly more than one quarter of the total population. In terms of the degree of urbanisation, Slovenia is among the least urbanised European countries. The degree of urbanisation stands at approximately 50% and has not increased in the last decade despite the focus of spatial policy on strengthening urban centres (MESP, 2016b).
- The development of settlements and the consequent changes in land use are affected by demographic trends (e.g. population, age structure, migration etc.). Recently, the focus of inter-municipal migrations shifted from rural areas to functional urban areas of larger centres. The process of suburbanization has been occurring with higher

intensity, additionally supported by the construction of new infrastructure like residential housing, production and service facilities, public service facilities (e.g. healthcare, education etc.) and the construction of public infrastructure (e.g. transport infrastructure).

- The available national evidence indicates that the high quality of water resources and rich biodiversity means that Slovenia is well positioned to meet the targets of SDGs 14 (Life below water) and 15 (Life on land) by 2030. However if the various risks identified in this study (e.g. hydromorphological pressures, poor harmonisation of objectives on resource use between sectors etc.) remain disregarded, this would deteriorate Slovenia's pristine environment and potentially jeopardise the achievement of both SDGs.

Table 3.2.1. Assessment of current trends and outlooks related to meeting SDGs in Slovenia

UN SDGs	Current trend	Outlook to 2030	Relevant to Key message
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture			• A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production • Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence • Multiple and conflicting demands are leading to pressures on Slovenia's limited land area • The continued economic development of Slovenia is likely to lead to increasing pressure on the natural environment • Environmental and economic changes in Slovenia may lead to more people becoming vulnerable
SDG 3: Ensure healthy lives and promote well-being for all at all ages			• Transport is a key driver for environmental change and health related risks in Slovenia • Environmental and economic changes in Slovenia may lead to more people becoming vulnerable
SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all			• Slovenia's relationship with Europe and the world may lead to increasing trade and resource dependence • Technological and behavioural change may drive Slovenia towards more sustainable and secure future • Transport is a key driver for environmental change and health related risks in Slovenia
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable			• Multiple and conflicting demands are leading to pressures on Slovenia's limited land area • Transport is a key driver for environmental change and health related risks in Slovenia
SDG 12: Ensure sustainable consumption and production patterns			• Multiple and conflicting demands are leading to pressures on Slovenia's limited land area • A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production • The continued economic development of Slovenia is likely to

UN SDGs	Current trend	Outlook to 2030	Relevant to Key message
			lead to increasing pressure on the natural environment • Recognising and understanding trade-offs between economic sectors can help set common sectoral sustainability objectives • Technological and behavioural change may drive Slovenia towards more sustainable and secure future • To improve resource management, environmental and economic governance, Slovenia needs to recognise the value or natural capital • Slovenia's reputation as a high-value tourism destination could be threatened by the environmental impacts of mass-tourism
SDG 13: Take urgent action to combat climate change and its impacts			• A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production • Reliability of water supply • Slovenia's reputation as a high-value tourism destination could be threatened by the environmental impacts of mass-tourism
SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development			• The continued economic development of Slovenia is likely to lead to increasing pressure on the natural environment • Technological and behavioural change may drive Slovenia towards more sustainable and secure future • Slovenia's reputation as a high-value tourism destination could be threatened by the environmental impacts of mass-tourism • To improve resource management, environmental and economic governance, Slovenia needs to recognise the value or natural capital
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss			• A changing and more variable climate presents emerging challenges for Slovenia's agricultural sector and the security of food production • Multiple and conflicting demands are leading to pressures on Slovenia's limited land area • Transport is a key driver for environmental change and health related risks in Slovenia • The continued economic development of Slovenia is likely to lead to increasing pressure on the natural environment • Recognising and understanding trade-offs between economic sectors can help set common sectoral sustainability objectives • Technological and behavioural change may drive Slovenia towards more sustainable and secure future • Slovenia's reputation as a high-value tourism destination could be threatened by the environmental impacts of mass-tourism • To improve resource management, environmental and economic governance, Slovenia needs to recognise the value or natural capital

Key to shading:

	Improving trends dominate
	Trends show mixed picture
	Deteriorating trends dominate

4 Next steps

Taking into consideration the wide spectrum of relevant policy areas and issues identified as being influenced by the two prioritised GMTs and their implications, this research study does not seek to provide a comprehensive overview and analysis of all of them. Additionally, in their review of project outputs the policy sector experts noted some shortcomings which may be addressed in future work in this area by national experts.

In particular the following suggestions were made:

- National experts could use this report as a platform to further develop the presented narrative to elaborate on all topics in the report and ensure that the key messages include a more detailed context for Slovenia. For example more indicators and concrete real life examples that represent the current state in Slovenia could be included in different sections to better illustrate the narrative and connect with current policy concerns.
- National experts could elaborate in more detail on the role of spatial planning in addressing the risks and opportunities identified in the project workshops.
- Ideally, the workshops should involve a wider range of participants from various institutions, fields and sectors in order to avoid the repetition of firm beliefs and get fresh views, ideas and recommendations.
- Some ideas and recommendations proposed by the participants at the workshops duplicate the elements (e.g. measures, actions) of certain existing strategic policy documents, which could reflect a general implementation deficit of policy objectives in some areas. However, the stated recommendations could be used to support the preparation of the priority list on the corresponding topics.
- The Slovenian Ministry of Environment and Spatial Planning as well as The Slovenian Environment Agency suggest that the updated Ecological footprint indicator[7] should be considered in the future work on GMTs, as the data could support further analysis. For example, the recent report reveals, that roughly 24% of the Ecological footprint of Slovenia comes from the carbon footprint on housing alone (Global footprint network, 2018), showing that energy efficiency of residential buildings is a hotspot and improvements is this area are essential for Slovenia in the context of both GMTs considered in this study (*GMT 7: Intensified global competition for resources*; and *GMT 9: Increasingly severe consequences of climate change*).

These actions would add to the credibility of this report and ensure its potential for broader future use.

[7]Technical Report: The Ecological Footprint of Slovenia (Global footprint network, 2018); available at: http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/medijsko_sredisce/2018/09_September/11_Ekoloski_odtis_SJ/Technical_Report_on_the_Ecological_Footprint_of_Slovenia_20180830.pdf (accessed 9 November 2018)

In addition the process and outputs of this project have sparked valuable discussion with cross-sector experts and this could be followed up by:

- Extending the analysis to include additional GMTs as well as to social aspect (especially for agriculture and food production and energy).
- Creating a "Summary for Policy Makers", that in particular would present interlinkages among GMT implications supported by graphic presentations, diagrams and other visual materials.
- Drawing on the outcomes of the project to supplement and support national state of environment reporting, for example by including outlooks and forward looking perspectives for selected key topics.
- Developing new analyses to design measures and instruments related to the risks and opportunities identified in each key message.
- Using the outcomes of the project and building on the findings presented in the key messages to:
    - engage different sectors in discussion about harmonising sector goals;
    - act as the starting point for additional research into understanding trade-offs in resource use such as water / energy between key sectors in Slovenia;
    - engage relevant experts in discussion and additional research into the value of natural capital in Slovenia and understanding the impacts of key economic sectors on this value (in terms of environmental externalities);
    - engage with citizens to facilitate behavioural change and ensure more sustainable use of transport/food and natural resources;
    - set up discussions with key sector representatives to help understand and communicate the complex relations and trade-offs in many environmental policy areas; and,
    - address the question on how the gaps identified on risks and opportunities should be addressed.

Finally, the national experts are invited to use the presented evidence (e.g. implication factsheets; risk and opportunity assessment outcomes) in their own work, and build on these to achieve strategic objectives.

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Abbreviations

CEP – Collingwood Environmental Planning

EBRD – European Bank for Reconstruction and Development

EC – European Commission

EEA – European Environment Agency
EU – European Union

FDI – Foreign direct investment

GDP – Gross Domestic Product

GMT – Global Megatrend

R&D – Research and development

RES – Renewable energy sources

SDG – Sustainable Development Goal

SDS – Sustainable Development Strategy

SMEs – Small and medium sized enterprises

SOER – European Environment State and Outlook Report

UN – United Nations

OECD – Organisation for Economic Co-operation and Development

Annexes

Annex 1 Materials delivered through the project

The technical specifications of this project "*Influence of global megatrends on the state of environment in Slovenia*" required that the final report includes a logical summary of previous tasks. The table below summarises the specified project requirements and related project outputs delivered to the Slovenian Environment agency over the course of the project.

Project requirements	Related project outputs
Summary of the material which served as a basis for implementing the project	• Project overview note 03-11-17.docx • GMT 7 and 9 drivers and trends unpicked 03-11-17.docx • GMT 7 & 9 overviews landscape 03-11-17.docx
Analysis of the state of the environment in Slovenia and its relation to global megatrends	• Slovenia GMT FINAL Interim report 23-11-17.docx
Impacts of megatrends on the state of the environment in Slovenia–piano table	• Slovenia GMT implications workshop 2 background note FINAL 280318.pdf • Piano table in this report Section 3 (i.e. Final report)
Impacts of megatrends on the set environmental objectives in Slovenia and objectives of sustainable development (GMT)	• This report Section 3 (i.e. Final report)
A summary of risks/opportunities from the identified implications of selected GMTs	• This report Section 2 and 3 and Annex 4(i.e. Final report) • Slovenia GMT FINAL Interim report 23-11-17.docx
A summary of gaps/needs to address the risks/opportunities	• This report Section 3 (i.e. Final report) • SLO GMT Workshop 2 FINAL record 080618.docx
Identified trade-offs	• This report Section 3 (i.e. Final report) • SLO GMT Workshop 2 FINAL record 080618.docx
Concise messages which will serve as a support in the preparation processes of PSO, SRS or NPVO–it must be defined who was included in the preparation and possible strengths	• This report Section 2, 3 and 4 (i.e. Final report)
List of indicators and outlooks used during the project (in particular for the piano table)	• This report (i.e. Final report Annex 3)
Description of the course of the project	• Project overview note 03-11-17.docx • Slovenia GMT FINAL Interim report 23-11-17.docx • SLO GMT Workshop 2 FINAL record 080618.docx

Annex 2 Mapping Europe's environmental future - process flow chart

The process of adapting the method tool kit was carried out by following the steps presented in table below in a sequential manner.

	In Task 1 (Step 1), the project focussed on two GMTs at the request of the Slovenian Ministry of Environmental and Spatial Planning, GMT 7: Intensified global competition for resources and GMT 9: Increasingly severe consequences of climate change, as they were felt to be most relevant to and likely to have strongest effects on the state of environment in Slovenia. The collation and review of national indicators related to GMT 7 and GMT 9, was completed focusing on two thematic clusters: ecosystem vulnerability and energy stability which were agreed based on discussions between the project team, the Slovenian National Environment Agency and the Ministry of Environment and Spatial Planning, with the aim of enabling a focused discourse at the scoping workshop.
	In Task 2 (Step 2) the consultant team collected and reviewed the background materials followed by a scoping workshop in Ljubljana - prepared and facilitated by the project team. Following the workshop a report on potential implications of GMTs 7 and 9 on the state of the environment in Slovenia was prepared.
	For 6 priority GMT implications selected at the scoping workshop in Task 3 (Step 3) desk based research was completed and evidence requested from experts. This evidence was compiled into factsheets on each implication.
	The key activity in Task 4 (Step 4) was a workshop on risks, opportunities and responses related to each priority GMT implication using the evidence collected in Step 3 as a basis for assessment of risks and opportunities.
	In Task 5 (Step 5) all outcomes of the study were brought together in a final report outlining the method used, summarising the outputs and including key messages and challenges for meeting Slovenia's environmental goals.

A central aspect of the methodology was the participation of national experts in two national workshops in Step 2 and Step 4. More than 20 experts participated in each workshop. Experts were invited by the Slovenian Ministry of the Environment and Spatial Planning and

the Slovenian Environment Agency, and included national experts in following areas: Land use and spatial planning; Water quality and ecological status; Soil and agriculture, Energy efficiency and public health. Experts included those from national ministries, universities, research institutes, the private sector (insurance) and NGOs.

Firstly, a scoping workshop (Step 2) was held in November 2017 in Ljubljana to discuss the potential implications of global megatrends for the state of environment in Slovenia. The main objectives of the workshop were to:

- Discuss in an open manner **how the selected megatrends**, as described by the EEA, **might impact Slovenia's environment**, with a particular focus on ecosystem vulnerability and energy stability.
- Provide a space for **experts to share their knowledge and expertise**.
- **Generate workshop outcomes** which will serve as the first step in a process of analysing the impacts of GMTs on the environment of Slovenia and national environmental goals.

In total 29 specific potential GMT implications for ecosystem vulnerability and energy stability thematic clusters were identified, including: increasing demand on natural resources consequently increasing environmental burden; direct and indirect pressures on biodiversity and ecosystems for example due to land-use changes, water quality and supply; import and economic dependency with risks to energy and food supply and, climate change impacts, in particular floods and droughts, which already afflict Slovenia's agriculture and soil quality and are expected to become more frequent and severe.

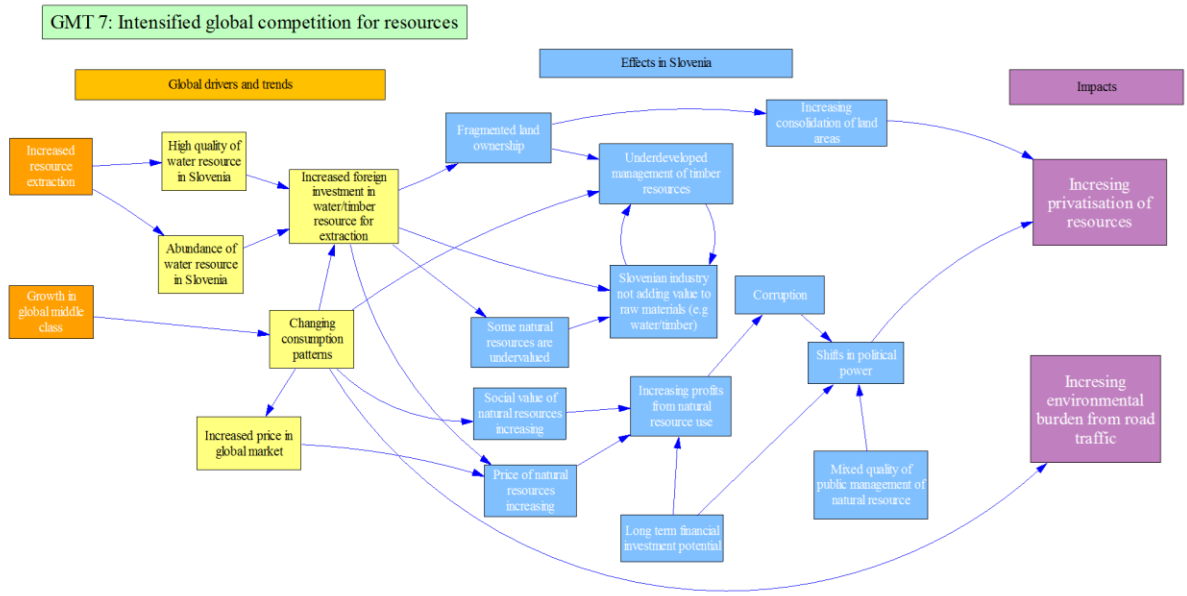
The complete list of identified potential implications for the state of environment in Slovenia, were further explored in an exercise where participants were given the opportunity to select from this list those implications they consider most important, using a sticky-dot 'voting' process. Following this exercise the facilitators selected the top six highest voted implications from each GMT - 12 implications in total.

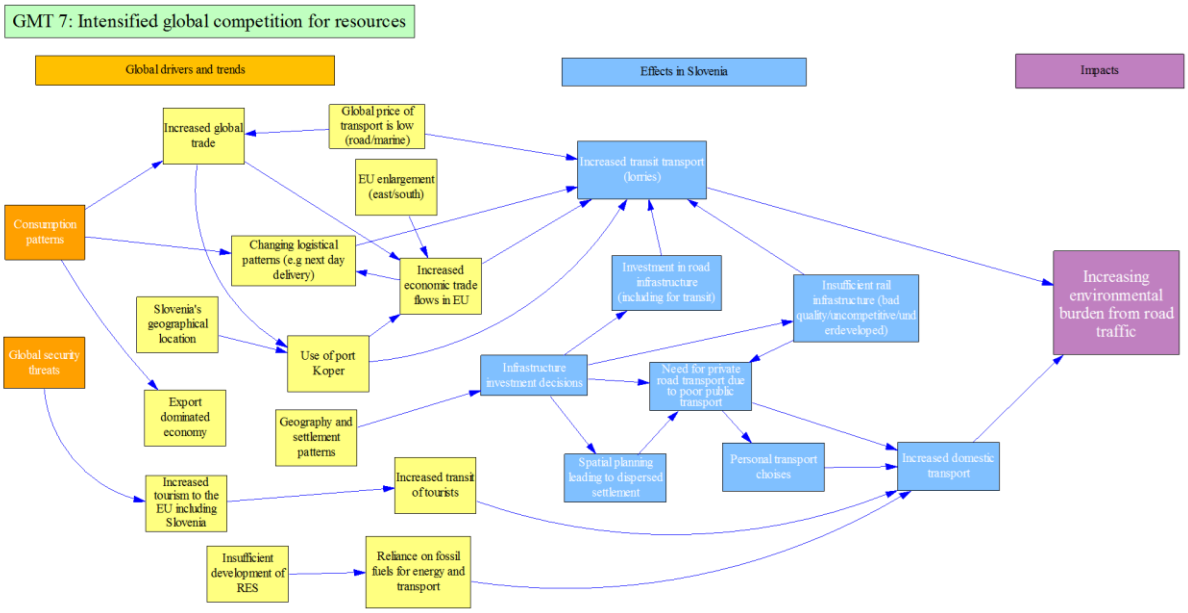
Additionally a live mapping of the global drivers / trends and identified implications for Slovenia were performed which included active participation of all participants. Four implications (two for each of the GMTs), which received the highest number of sticky dots were used for mapping.

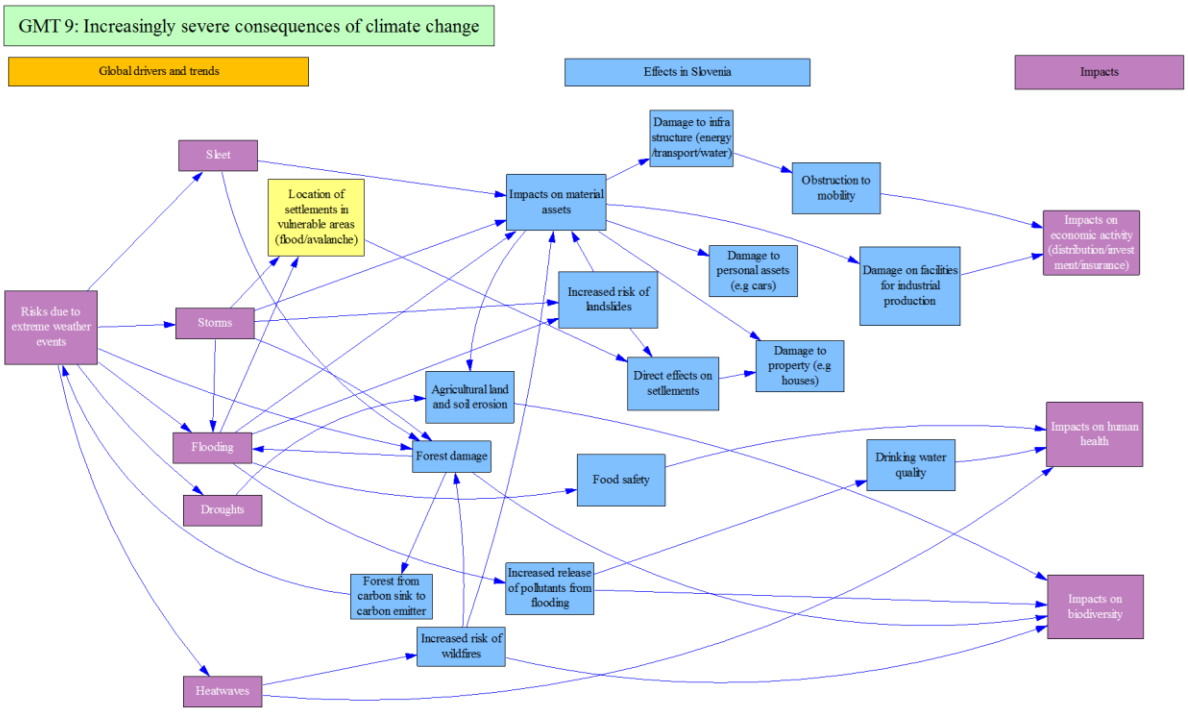
The objectives of the mapping exercise were:

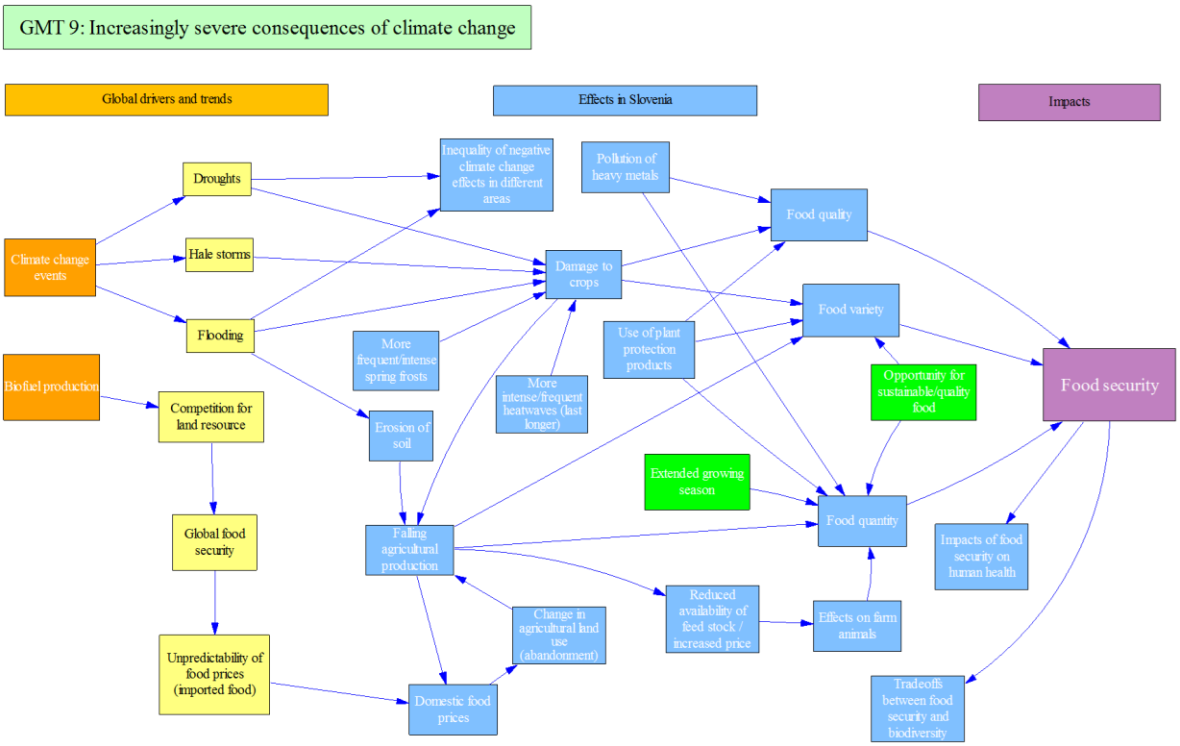
- To enable participants to discuss and reflect on the connections between global drivers / trends and identified potential implications in Slovenia from GMT 7 and GMT9
- To map the implications discussed in earlier using simple causal chains / mind-maps to be created using Vensim software
- Through this mapping, to explore and understand the logic / tell the story of how GMTs may be influencing the environment in Slovenia.

The process constituted of one member of the project team providing the facilitation on the discourse with the participants, who were providing inputs on drivers, trends and their connections to the identified implications of GMTs. The live mapping of the causal chain using Vensim software, which was projected on the white screen, was simultaneously conducted by the other project team member. The examples of the results of this mapping exercise are presented in the Figure below.


GMT 7: Intensified global competition for resources
Global drivers and trends
Effects in Slovenia
Impacts
Increased resource extraction
High quality of water resource in Slovenia
Abundance of water resource in Slovenia
Growth in global middle class
Changing consumption patterns
Increased foreign investment in water/timber resource for extraction
Increased price in global market
Fragmented land ownership
Underdeveloped management of timber resources
Slovenian industry not adding value to raw materials (e.g water/timber)
Some natural resources are undervalued
Social value of natural resources increasing
Price of natural resources increasing
Increasing profits from natural resource use
Long term financial investment potential
Increasing consolidation of land areas
Corruption
Shifts in political power
Mixed quality of public management of natural resource
Incresing privatisation of resources
Incresing environmental burden from road traffic


GMT 7: Intensified global competition for resources
Global drivers and trends
Effects in Slovenia
Impacts
Consumption patterns
Increased global trade
Global price of transport is low (road/marine)
EU enlargement (east/south)
Changing logistical patterns (e.g next day delivery)
Increased economic trade flows in EU
Slovenia's geographical location
Use of port Koper
Global security threats
Export dominated economy
Geography and settlement patterns
Increased tourism to the EU including Slovenia
Insufficient development of RES
Reliance on fossil fuels for energy and transport
Increased transit of tourists
Increased transit transport (lorries)
Investment in road infrastructure (including for transit)
Infrastructure investment decisions
Spatial planning leading to dispersed settlement
Need for private road transport due to poor public transport
Insufficient rail infrastructure (bad quality/uncompetitive/underdeveloped)
Personal transport choises
Increased domestic transport
Increasing environmental burden from road traffic


GMT 9: Increasingly severe consequences of climate change
Global drivers and trends
Effects in Slovenia
Impacts
Sleet
Location of settlements in vulnerable areas (flood/avalanche)
Risks due to extreme weather events
Storms
Flooding
Droughts
Heatwaves
Impacts on material assets
Damage to infra structure (energy /transport/water)
Obstruction to mobility
Damage to personal assets (e.g cars)
Damage on facilities for industrial production
Impacts on economic activity (distribution/investment/insurance)
Increased risk of lindslides
Direct effects on settlements
Damage to property (e.g houses)
Agricultural land and soil erosion
Forest damage
Food safety
Drinking water quality
Impacts on human health
Forest from carbon sink to carbon emitter
Increased release of pollutants from flooding
Increased risk of wildfires
Impacts on biodiversity


GMT 9: Increasingly severe consequences of climate change
Global drivers and trends
Effects in Slovenia
Impacts
Droughts
Climate change events
Hale storms
Flooding
Biofuel production
Competition for land resource
Global food security
Unpredictability of food prices (imported food)
Inequality of negative climate change effects in different areas
Damage to crops
More frequent/intense spring frosts
Erosion of soil
More intense/frequent heatwaves (last longer)
Falling agricultural production
Change in agricultural land use (abandonment)
Domestic food prices
Pollution of heavy metals
Use of plant protection products
Extended growing season
Reduced availability of feed stock / increased price
Food quality
Food variety
Opportunity for sustainable/quality food
Food quantity
Effects on farm animals
Food security
Impacts of food security on human health
Tradeoffs between food security and biodiversity

Following a qualitative scoping assessment of each of the 12 implications' likelihood, significance and expected timeframe, 6 implications were selected by participants as being of most importance for further consideration.

The key first workshop outcomes were:

- A long-list of potential implications of global megatrends for the state of environment in Slovenia, based on expert judgement.
- Causal chain diagrams exploring the logic of how selected GMTs drive changes in Slovenia leading to the implications identified by experts.
- An initial assessment of the potential key implications, considering likelihood, extent and time-frames.

After the scoping workshop, national evidence was collated and reviewed for all priority implications and implication factsheets developed (Step 3) for each setting out: the title of the implication; short implication description; summary of identified evidence / information about how the implication may be having effects / have effects in the region; overview of existing policies and strategies that are relevant to the implication; overview of any response needs and gaps / vulnerabilities.

In preparing the implication factsheets the implications were 'clustered' in three groups: environmental pressures related; resource and economy related; and, climate related.

A second expert workshop was held (Step 4) on April 2018 in Ljubljana to discuss risks and opportunities from Global Megatrend (GMT) implications for the state of environment in Slovenia, as well as response needs and gaps. The main objectives of the workshop were to:

- To provide an opportunity to **reflect on the evidence** on whether or not GMTs will have implications for the state of environment in Slovenia, and when these implications may occur;
- To identify the **risks and opportunities posed by the GMTs** for the state of environment in Slovenia in the short, medium and long terms;
- To assess the **likelihood and magnitude of these risks and opportunities** in Slovenia: building on the initial scoping assessment completed in the scoping workshop and using the evidence collected through desk based research and discussion with experts (Linking implications to national evidence). This evidence is presented in the workshop background note;
- To consider the extent to which **current responses and strategic planning in Slovenia is "fit for the long-term", and what gaps** there may be with regard to managing risks and maximising opportunities.

During the workshop the identified national evidence related to each of the six selected implications, was discussed by experts, and through these discussions potential risks and opportunities for Slovenia's environment and environmental policy were identified. In total the experts noted 21 specific risks and 18 opportunities, which were then assessed using criteria related to the likelihood (of the risk or opportunity occurring) and magnitude (of the risk or opportunity should it occur).

Due to limited time available during the workshop, experts were invited to agree on one risk and one opportunity from each implication to discuss in terms of gaps and needs in terms of policy and other responses (e.g. practice, research/data etc.). Experts considered what

existing responses are present in Slovenia when looking at a particular risk or opportunity and what shortcomings are apparent in the existing responses.

The key second workshop outcomes were:

- A long list of risks and opportunities related to each implication prioritised in the first expert workshop.
- An assessment of risks and opportunities of implications prioritised in the first expert workshop, together with a proposal for one ‘key’ risk and one ‘key’ opportunity from each implication.
- Expert reflections on response needs and gaps associated with the assessed risks and opportunities.

Annex 3 Summary of relevant indicators to understand the influence of GMTs on the environment of Slovenia

During the course of the project the following indicators were identified as being of potential relevance to understanding the influence of GMT on the environment of Slovenia. The indicators highlighted in bold are those that overlap with the issues discussed in the project workshops.

Thematic area	Indicator title
Energy	[EN01] Energy-related greenhouse gas emissions
	[EN09] Emissions of air pollutants from energy sources
	[EN10] Final energy consumption by sector
	[EN11] Total energy intensity
	[EN16] Total energy consumption by fuel type
	[EN18] Renewable energy sources
	[EN19] Electricity production from renewable energy sources
	[EN20] Energy prices
	[EN21] Energy taxes
	[EN22] Subsidies in the energy sector
	[EN24] The share of renewables in final energy consumption
	[EN25] Energy import dependency
	[EN30] Production and consumption of electricity
	[EN31] Efficiency of systems of production, transport and distribution of electricity and heat
	[EN32] Energy efficiency and energy use in sectors of final energy consumption
Forestry	[GZ01] Forest decline and tree defoliation
	[GZ02] Naturalness of forests
	[GZ03] Growing stock, increment and fellings
	[GZ04] Forest area
	[GZ05] Deforestation
	[GZ06] Deadwood
Industrial production	**[IP01] Environmental management systems**
Agriculture	**[KM01] Consumption of pesticides**
	[KM02] Consumption of mineral fertilisers
	[KM03] Areas of land with agri–environmental measures
	[KM04] Intensification of agriculture
	[KM05] High nature value farmland areas

Thematic area	Indicator title
	[KM06] Nature areas under protection and agriculture
	[KM08] Areas of land with organic farming
	[KM09] Energy use in agriculture
	[KM10] Land use change and agriculture
	[KM11] Farm management practices
	[KM12] Specialisation and diversification in agriculture
	[KM13] Emissions of ammonia from agriculture
	[KM14] Emissions of methane and nitrous oxide from agriculture
	[KM21] Irrigation of agricultural land
	[KM22] Gross nitrogen surplus in agriculture
Marine	[MR02] Sea level
	[MR03] Bottom oxygen concentrations
	[MR04] Chlorophyll a in coastal waters
	[MR05] Bathing water quality in costal zones
	[MR06] Chemical and trophic state of the sea - this indicator is no longer being updated - data is available in VD12
	[MR07] Suitability of marine water to support marine bivalves and gastropods
Nature and biodiversity	[NB01] Population size of selected bird species
	[NB02] Threatened species
	[NB03] Game preservation
	[NB04] Subterranean biodiversity
	[NB05] Plants – species richness and endangered species
	[NB06] Brown bear
	[NB07] Compensation for damage caused by protected animal species
	[NB09] Plants – invasive species
	[NB10] Dolphins
	[NB11] Species of European interest
	[NB12] Habitats of European interest
	[NB14] Birds in agricultural landscape
Nature protection designated areas	**[NV01] Nature areas under protection**
	[NV02] Protected areas
	[NV03] Natura 2000
	[NV04] Valuable natural features
Waste and material flow	**[OD01] Municipal waste**
	[OD02] Landfilling of waste (followed until 2010)

Thematic area	Indicator title
	[OD03] Hazardous waste
	[OD04] Transboundary shipments of waste
	[OD06] Direct Material Input and Domestic Material Consumption
	[OD13] Packaging waste
	[OD16] End-of-life vehicles
	[OD17] Waste generated by manufacturing and service activities
	[OD18] Resource productivity
Instruments of environmental policy	[OP03] Eco-schools
Transport	**[PR01] Volume and structure of passenger transport**
	[PR02] Volume and structure of freight transport
	[PR03] Investments in transport Infrastructure
	[PR04] Final energy consumption in transport
	[PR06] Public awareness about the effects of transport on the environment
	[PR07] Impacts of transport on air quality in urban areas
	[PR08] Transport emissions of air pollutants
	[PR09] Transport emissions of greenhouse gases
	[PR10] Transport accident fatalities
	[PR11] Passenger car ownership
	[PR12] Age of vehicle fleet
	[PR13] Introduction of alternative fuels in transport
	[PR14] Expenditure on personal mobility
	[PR17] Quality of transport fuels
	[PR19] Municipal and regional sustainable urban mobility plans in Slovenia
	[PR21] Introducing new technologies in transport
Climate change	**[PS01] Estimated damage caused by natural disasters**
	[PS03] Greenhouse gas emissions
	[PS04] Precipitation and temperatures
	[PS05] Changes in glacier extent
	[PS06] Annual growing season length
	[PS07] Extreme weather events
Socioeconomic development	SE03] Human Development Index
	[SE08] Ecological footprint
Soil and land use	**[TP01] Land cover and land use**

Thematic area	Indicator title
	[TP02] Brownfield sites
	[TP03] Land take
	[TP06] Land cover and land use in water protection areas
Tourism	[TU02] Outstanding natural features visited
Water	**[VD01] Water exploitation index**
	[VD02] Wastewater treatment
	[VD03] River balance
	[VD04] Quality of watercourses
	[VD05] Nitrates in groundwater
	[VD06] Pesticides in groundwater
	[VD07] Phosphorus in lakes
	[VD08] Drinking water quality
	[VD10] Nutrients in rivers
	[VD11] Groundwater quality
	[VD12] Chemical state of rivers
	[VD13] Meeting water quality criteria for freshwater fish (monitored until 2014
	[VD14] Water permits
	[VD15] Groundwater recharge
	[VD16] Water protection areas
Human health and ecosystem resilience	[ZD02] Asthma and allergic diseases in children
	[ZD03] Exposure of residents and children to PM10
	[ZD04] Outbreaks of waterborne diseases attributable to drinking water and bathing water
	[ZD05] Access to safe drinking water
	[ZD08] Exposure of roe deer to heavy metals (lead and cadmium) and fluorides
	[ZD14] Exposure of children to road traffic noise in the Municipality of Ljubljana
	[ZD17] Levels of lead in children's blood in the Upper Meža Valley
	[ZD18] Mortality due to respiratory diseases
	[ZD19] Food borne disease outbreaks
	[ZD20] Heat waves and daily number of deaths
	[ZD21] Incidence of foodborne diseases
	[ZD22] Population exposure to airborne pollen/allergens

Thematic area	Indicator title
	[ZD25] Reported Lyme borreliosis cases in Slovenia
Air quality	[ZR05] Air pollution by sulphur dioxide
	[ZR06] Air pollution by nitrogen dioxide
	[ZR07] Air pollution by ozone
	[ZR08] Air pollution by particulate matter
	[ZR09] Emissions of substances that cause acidification and eutrophication
	[ZR10] Emissions of ozone precursors
	[ZR15] Emissions of particulate matter
	[ZR16] Sulphur content of fuels
	[ZR18] Effects of ozone on vegetation

Annex 4 Risks and opportunities considered for identifying key messages

Risks (and timeframe[8])	Opportunities (and timeframe)
Environmental pressures thematic cluster of implications	
Implication: Increasing environmental burden	
Increase waste and waste-water production and its impact on the natural environment	Linking environmental and health risks (i.e. the risks to health of environmental issues) for communication and policy responses
Air pollution affecting health (mainly due to transport and biomass burning for energy)	Development of new products and services with lower environmental impact / related to R&D
Poor harmonisation between the objectives of various sectors (including insufficient consideration of external costs in pricing)	Taking green tourism seriously, e.g. focussing on low-impact high value tourism
Loss of long-term value of natural capital, and risk of green washing	Improved harmonisation between the objectives across sectors
Implication: Pressure on water quality and supply	
Areas with high fertiliser run-off	Better management of rainwater (harvesting etc)
Decreasing level of geothermal water in some areas (due to over-extraction)	Improved management of water in agricultural sector (links also to changes in the systems of agricultural subsidies)
Changes due to hydromorphological pressures	Changes in diet and lifestyle (e.g. reduced meat consumption) Technological solutions
Resource and economy cluster of implications	
Implication: Economic and energy import dependence	
Risk of energy and resources supply due to import dependence (e.g. if one country has a monopoly over a resource that an industry in Slovenia depends on ,the whole industry can collapse)	**RES and technologies development** (Prompted by the need of Slovenia to become less economically and energy dependent. Perhaps we will have no other resources thus the development of RES will be faster and investments in technological development will increase)
Risk of energy and resources supply due to political tensions (e.g. 100% gas import, mainly from Russia)	**Reduced energy consumption and increased energy efficiency due to increased behavioural and technological change** (e.g. behavioural: active mobility and use of public transport, waste reduction and recycling; technological: use and implementation of energy efficient technologies in buildings)

[8]Short term (to 2020); medium term (2020–2030); long term (2030–2050)

Risks (and timeframe[8])	Opportunities (and timeframe)
Environmental risk related to increased local production in Slovenia (increased production is related for example to economic growth)	
Risks related to transition to low carbon economy (e.g., slow restructuring processes possibly resulting in job losses, collapse of "undesired" industries, energy deficits etc.)	
Risk of energy poverty (Related to high energy import dependence and no control over volatility of energy prices. The energy prices need to be looked at in relation to individual/ household incomes)	**Local supply with renewable energy sources**
Implication: Increased privatisation of natural resources ***As explained by the experts, water in Slovenia at the moment can't be privatised, as it is protected by the Constitution. Therefore, the experts stated they cannot consider the implication *Increased privatisation of natural resources* in a comprehensive manner. Thus, the potential risks and opportunities where considered hypothetically, reflecting on potential privatisation of natural resources in Slovenia in the future. An opinion was raised that that although water resources are currently protected by Constitution, this could potentially change however the experts feel this scenario is highly unlikely.	
Higher water prices	**Increased profit from foreign investments** (from selling natural resources e.g. water to private ownership)
Loss of the countries serenity over the water resources (subsequently catering a weaker position of the country in international policy)	**Opportunities for development of SMEs** (arising from awarded concessions: for example establishment of businesses which the water for drinking, opportunities for development of SMEs arising from (thermal water) spa tourism)
Risk of water supply due to private ownership of the resources	
Climate cluster of implications	
Implication: Extreme events and infrastructure damage	
Droughts (e.g. for insurance policy as droughts are not factored in)	**Prioritised resource management** (water and forest – well managed forests improve resilience to extreme weather events)
Agricultural management and food production (disruption of food supply / yields)	**Urbanisation development** **Short supply chains with locally produced food**
Water management / quality	**Competitive advantage for sectors such as tourism as in global terms Slovenia is less impacted by these events than other regions** (e.g. Greece, Spain etc.)
Vulnerability of different social groups (disrupted social systems)	
Lack of spatial planning	**The new spatial planning legislation from 2017, in force since June 2018** **The new Spatial Development Strategy of Slovenia 2050 (adoption in 2019)**
Energy supply (system is not resilient to such shocks as heat waves)	

Risks (and timeframe[8])	Opportunities (and timeframe)
Implication: Food security	
Climate change global risks leading to new plant diseases, higher costs in agricultural production, irrigation vulnerability, use of pesticides, decrease in yields	**Better use of water sources**
Abandonment of agricultural land → decrease of agricultural land (due to urbanisation, climate change, land abandonment)	**Local and organic food production** (local food more resilient to climate change + less risks)
Decreased self-sufficiency in food production / quality of food (food preferences for consumers, eco-food, local food)	**New knowledge / technology** (new crops; increase of organic matter in soil)
	Increase in yields from longer vegetation seasons (use of higher altitudes for food production)