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Plan4Blue Scenarios for Blue Growth

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ABSTRACT

Title: Plan4Blue Scenarios for Blue Growth. Qualitative analysis based on expert opinions.

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Abstract

Plan4Blue scenario process has a strong participatory element that is implemented by Delphi study and workshops. The scenario process adds qualitative information from Delphi rounds and workshops and leads to analysis on possibilities, also via identifying existing synergies or conflicts between blue economy sectors. In the first phase of the Plan4Blue scenario building, the aim was to look at possibilities and probabilities in order to create the draft future images. The analysis contained all blue economy sectors, in order to identify the important ones in terms of future development. In the second phase, selected blue economy sectors were focused on, based to the results of first rounds of Delphi, and to the results of economic analysis in WP T1.

This deliverable present the finalized alternative scenarios for Blue Growth, including futures tables, futures images, and possible pathways leading to the alternative scenarios. They have been created based to the results of the Delphi rounds carried out in 2017 and 2018, and scenario workshops in Helsinki 2017 and Tallinn 2018. Links to deliverables on current status of blue economic business sectors and development trends of key sectors, and sector strategies will be done.

This deliverable combines the closely interlinked activity delivery reports:

D.T1.4.1	The first report on feedback and views of crossboundary and multisector expert panel
D.T1.5.1	Report of the first cross-border multilevel workshop, including first set of scenarios
D.T1.9.1	Second report of the Delphi-panel: report of the views of the experts
D.T1.10.1	Report of the second cross-border multilevel workshop; including final scenarios
D.T1.11.1	Final report of expert panel work

The maps produced as part of the process are presented in WP3 Deliverable D. T3.6.1 Maps visualizing first versions of blue growth scenarios (Roose et al. 2017).

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CONTENTS

1. INTRODUCTION

1.1. Aims and tasks of WP 1

This deliverable presents the alternative future scenarios for Blue Growth as result of the scenario building process in Plan4Blue WP 1 (Figure 1), Potential for Sustainable Blue Economies. The aim in the first phase of the scenario building was to look at possibilities and probabilities in order to create the draft futures tables and future images. The process started from identification of drivers and their alternative futures states, which is a key issue in scenario development. Drivers were identified first for Blue Economy as a whole and then for unique blue economy business sectors. In the second phase, pathways to the alternative futures were drafted. Plan4Blue scenario process included a strong participatory element that was implemented with including expert stakeholders into scenario process, in Delphi study and workshops. The scenario process adds qualitative information from Delphi rounds and workshops and leads to analysis on possibilities, also via identifying existing synergies or conflicts between blue economy sectors. This deliverable presents the results of all these components, including the Delphi rounds and scenario workshops in 2017 and 2018.

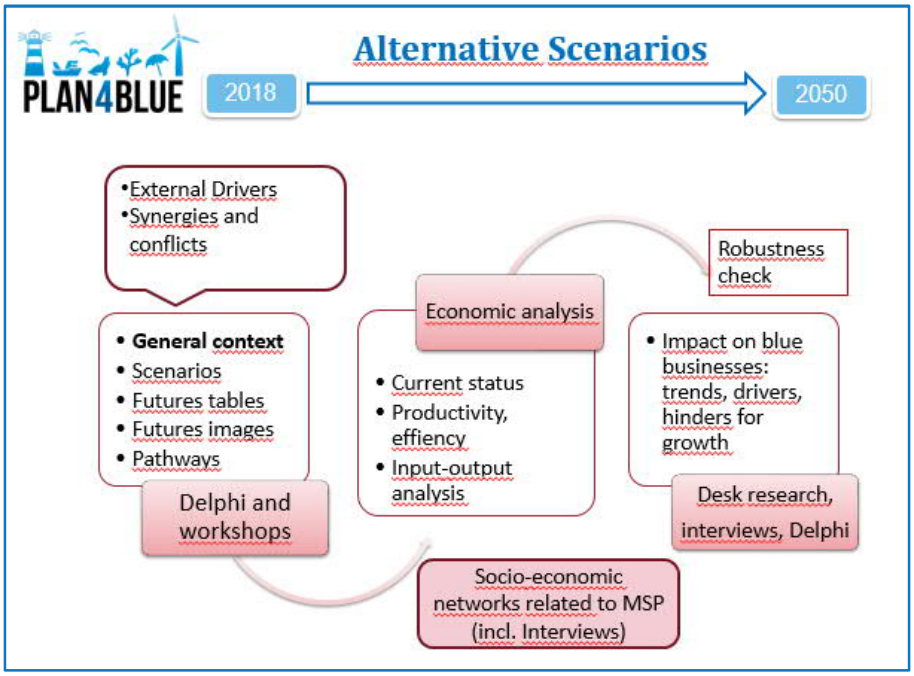


Figure 1. Plan4Blue scenario process

Other tasks of the Plan4Blue scenario process produced both qualitative and quantitative data. Their results are reported in other deliverables of WP T1. Economic analysis provides data on probable futures, potential of the blue economy sectors and on future trends. Statistical analysis and supporting interviews identified the current business activities and trends for each blue economy sector and respective subsectors within the project area.

The results presented in Deliverable 1.8.1 mainly support development of probable scenarios following the backward-looking approach relying on the results of current economic performance analysis of the maritime regions' blue sectors. These outcomes once again confirm that it is impossible to make long-run predictions and elaborate scenarios relying only on statistical information. The combination of quantitative and qualitative approaches is unavoidable by the elaboration of Blue Growth Scenarios. (See Paas, T., Tverdostup, 2018).

The timeframe of scenarios is 20-30 years to 2040-2050. The first rounds of Delphi were aimed to identify probabilities and possible future images. As a result of the first phase, draft future images were formed for each of these sectors.

The main questions of the first phase of the scenario process, presented for Delphi panel and Helsinki workshop in 2017, were as follows:

Which blue economy sectors have potential to blue growth?
Which are the main conflicts and synergies between the sectors?
Which drivers and variables affect their future development?
Which kind of alternative future states in 2050 may exist in the alternative scenarios?
Which are the future uses of the sea?

In the second phase of the scenario process, in Tallinn scenario workshop and Delphi rounds, the groups discussed blue economy sector's development by 2050 in the draft alternative scenarios: Sustainability above all - Unlimited growth - Sustainability dilemma - Virtual reality. Main questions posed were:

What are the consequences of the draft alternative futures for the (selected) blue economy sectors?
Which steps would lead to the alternative futures?
Which are the most intensive and potential areas of future development?
Which kind of spatial impact the alternative scenarios would have?
What are the possibilities and potential areas for multi-use platforms and synergies?

This deliverable presents the views of the Delphi panelists and workshop participants to above questions, and the results of the complementary interviews were applicable. The mapping methods and maps are presented as part of the WP3 deliverables. Result of the scenario building are presented as futures tables and storylines for each blue economy sector. The futures table describes the possible development, what could happen in the future, based to the identified drivers and their possible future states. Brief storylines, short descriptions of the four future images and pathways about sustainable blue cross-border and cross-sector economies in the Gulf of Finland, the Archipelago Sea and their coastal areas in 2050 describe the alternative scenarios. The scenarios were finalized after Tallinn workshop in January 2018 and during the Delphi-panel rounds in 2018, both of which focused on assessment of future developments of specific blue industry sectors and subsectors.

2. BACKGROUND

2.1. Scenarios

According to Linturi & Rubin (2011), good scenarios affect to future while indicating existing options. Scenarios may be used as tools to develop views on preferred futures and how the preferred option may be promoted. A scenario may proceed from present to future (forecasting scenarios) or from future state to present (normative scenarios, backcasting).

Tuominen et al. (2014) present an example on various ways to make scenarios (see Table 1), combined from Vergragt & Quist 2011; Hirschorn 1980; Amara 1981; Börjeson et al. 2006; Tapio & Hietanen 2002), and base their approach to multiple future visions, instead of one single end point as e.g. Robinson (1990).

Table 1. Various ways to make scenarios according to Tuominen et al. (2014).

Table 1
Various ways to make scenarios (combined from Vergragt & Quist, 2011; Hirschorn, 1980; Amara, 1981; Börjeson et al., 2006; Tapio & Hietanen, 2002).

Future type	Starting from	
	Past and present: forward-looking	Future: backward-looking
Probable (what will happen)	Searching the probable course of development, e.g. trend extrapolation, deterministic scenarios. Useful in stable situations when making short term forecasts	Estimating the probability of a specific future image, e.g. traditional consensus Delphi with timing estimates. Useful in volatile situations, where a decision-maker is strongly dependent on external drivers
Possible (what could happen)	Using data driven variety of options, e.g. what...if modelling of factors external to decision-making. Useful in stable situations where the relationships between key drivers are well-known	Creating heuristic images of the future, e.g. scenario workshops, non-consensual Delphi studies. Useful in volatile situations where great changes could happen
Preferred (what should happen)	Performing incremental measure driven scenarios, e.g. what...if modelling of factors internal to decision-making. Useful in stable situations where relationships between measures and their impact are well-known	Envisioning the desirable future, e.g. backcasting, brainstorming, futures workshops. Useful in volatile situations, where strategic changes are necessary or highly desired

Plan4Blue scenarios have a strong participatory element via Delphi and workshop. In the second phase of scenario planning, in participative backcasting the involvement of stakeholders in the process is a key feature (e.g. Carlsson-Kanyama et al, 2013). Backcasting is considered suitable when "the problem being examined is complex, multilateral (affecting many sectors and levels of society), major changes are needed, dominant trends are part of the problem, externalities are involved and, finally, ''when the time horizon is long enough to allow considerable scope for deliberate choice'' (Dreborg, 1996)" (R.Milestad et al. 2014).

2.2. Delphi method

Delphi method is applicable to regional planning (e.g. Uotila et al. 2005). It is a structured communication technique, which is based on the anonymity of the participants allowing them freely express and change their opinions during the process (e.g. Maness 2012). Rikkonen (2005) has concluded that Delphi technique is capable to provide different alternative futures and argumentation of scenarios.

In regional planning processes, the Policy Delphi method is suitable as "a decision support method aiming at structuring and discussing the diverse views of the preferred future" (Maness 2012). Policy Delphi is presented in 1970's (Turoff 1970, Linstone & Turoff 2011). Policy Delphi is especially useful in generating the innovative solutions to respond to complex socio-ecological challenges, such as sustainable development (Mukherjee et al. 2015).

The expertise matrix was used in compilation of the Delphi panel. This method has been introduced by Kuusi et al. (2006). The matrix shows the relevant categories of expertise of the participants (Varho & Tapio 2013).

2.3. Futures table

Futures table forms the basis of the scenario construction (Varho & Tapio 2013). According to Linturi & Rubin (2011), futures table is organized according to different future states of the sectors considered. The futures table method identifies the key variables for an issue and the possible future states these variables may have. Futures table helps to define and restrict the issue in the question, and then to build different future scenarios, as well as future paths leading to these sets of scenarios.

A forerunner of futures table is the field anomaly relaxation (FAR) method (according to Varho & Tapio 2013) which has been created by Rhyne (1995) as qualitative method. In FAR method, a table including all the possible states is formed, and impossible combinations of states are then excluded. The method may be used to help to form the possible future images. Seppälä (1984) developed further the method into future table.

Each row in a futures table presents different future states of a variable (Varho & Tapio 2013; Linturi & Rubin 2011). In the case of Linturi & Rubin (2011) four different states for a variable have been formed. According to Seppälä (2013) future seminars usually build at least the following future images:

- current state (business as usual)
- preferred future
- worst case scenario
- probable future

Further applications have been developed. For example in the case of Q2 technique (Varho & Tapio 2013), the number of states is not restricted and there may be several possible future states per a row in futures table.

Writing the descriptions of the future image (based to futures table) may change a certain definition of a future state. Seppälä (1984) also describes the future pathway as how it is possible to reach the preferred future image from the present. Majamaa (2010) presents three different variations to build scenarios based to results of futures table. In the first one, values are the starting point. Second option is to build three different future images, namely threatening, preferable and “business as usual” (BAU”. Third option is to use a backcasting method, in which the alternative future images are named before selecting the values from the column.

2.4. Drivers and PESTEL

Drivers can be interpreted as external forces, to which the individual actors cannot have possibility to have impact with their own means Vuorinen (2013). Another point of view is to consider them as contextual scenario elements, which focuses on framing conditions beyond the control of the relevant actors, as external factors (Milestad et al. 2014). According to Vuorinen (2013), it would be good to assess strength and probability of the drivers, and whether the drivers are positive or negative. In addition, timespan of a change can be assessed. Alternative operations to benefit of each driver (positive strength) or to protect from a driver may be considered.

PESTEL is widely used in scenario process to scan external factors, drivers, and originates from economics. It is a tool to which can be used as help forming the futures table. PESTEL analyses the impact of political, economic, social, technological, ecologic / environmental and legal changes. The concept was introduced by Aguilar (1967) as PEST analysis for Business Environment Scanning Task. Aguilar (1967) presented logic of causal relationships, instead of merely listing external factors. External industry conditions have implications and consequences for the business, and require areas of management action. Understanding cause and effect associations instead of only produce a lists of factors is better for making strategic decisions (Tovstiga and Aylward, 2008). Graphical interpretations of PEST(LE) analysis have been develop to better present causal relationships (e.g. PESTLEWeb™ , Collins 2010). Timespan for PESTEL analysis is usually considered 3-10 years, however, when combined with scenario process, it is possible to create structured descriptions of alternative futures

(Vuorinen 2013) The analysis is carried further with those drivers that are central themes for an activity (or a sector) (Vuorinen 2013).

3. METHODS

3.1. Identification of the blue economy sectors for the scenario process

In the first phase of scenario process, the analysis included all blue economy sectors applicable to the project area, in order to select those that are considered as the most important ones for in-depth analysis in the second phase. The sectors are based on EU definitions (European Commission 2012, European Commission / EUNETMAR 2013, European Commission 2014), and analysed from the point of view of project area. Each sector is divided to subsectors (Table 2). The synthesis of blue economies was assessed in the second phase and will be discussed in conclusions.

Table 2. The blue business sectors and subsectors used in the Delphi and workshop in spring-summer 2017.

Energy sector on the whole	Maritime cluster on the whole	Blue bio-economy and sub-sea resources on the whole	Tourism and culture, services for leisure activities on the whole
Wind power	Offshore construction (fixed or floating platforms)	Commercial fishery	Guest harbors and other services for leisure boating
Nuclear power	Shipbuilding	Fish-farming	Submarine tourism, diving
Submarine geothermal energy	Marine transportation (commercial shipping and ports, pilotage and towage of ships)	Aquaculture	Sport fishing
Production and distribution of biofuels	Demolition of ships	Seabed mining (sand, gravel, minerals)	Services for land-based adventure tourism (e.g. camping, hunting, visiting nature parks)
Refinement and distribution of fossil fuels	Clean tech and equipment for marine transportation	Other	Services for maritime adventure tourism (e.g. canoeing, surfing, water-skiing, “jet skiing”)
Construction and maintenance of the grids, energy lines, gas pipes	Dredging, maintenance of waterways		Coastal cruises, taxiboats
Energy transfer and conditioning (e.g. gas pipes)	Building of leisure and sporting boats		Cultural services and attractions in the coastal and archipelago areas
Storage and distribution of liquefied natural gas (LNG)	Warehousing and storage of leisure boats		Accommodation in coastal and archipelago areas, renting vacation homes
Solar power			
Wave energy			
Alternative, experimental energy modes			

In the second phase of Delphi, the analysis focused on sub-sectors according to the results of first rounds of Delphi, and to the results of economic analysis in D.T.1.1.1. (see Table 3). In Tallinn scenario workshop, the working groups selected their focus of discussion among these sub-sectors. Delphi-panelists assessed the scenarios both from the level of the blue economy sector concerned, and regarding consequences for a certain sub-sector.

Table 3. Subsectors focused on in phase two of scenario process (2018)

Energy	Marine cluster	Maritime / coastal tourism	Blue bioeconomy
Wind energy	Maritime cargo transportation	"Nature tourism" – recreation, camping, outdoor activities etc. ; cottages and camping	Aquaculture, fish farming
Solar energy	Maritime - transport of passengers	Off-shore water sports: diving, fishing, canoeing etc.	Algae & mussel farming
Wave energy	Building of ships & cleantech	Cultural heritage, history	Fishing
		Boating, sailing (guest harbors)	

3.2. The selection of expert panel

The expertise matrix was applied in compilation of the Delphi panel (Varho 2015, Kuusi et al. 2006). The aim was to guarantee the representation of each blue economy sector, and well-balanced participation from Estonia and Finland, from public and private sectors, as well as NGOs. Prospective panelists were identified by internet searches and by utilizing the knowledge of the project partners. The aim of the selection of the prospective panelists was to form a group of experts representing the fields of spatial planning, business activities and environmental issues of the study area. Focus was on those stakeholders that have concrete interests or activities in the coastal and sea areas either regarding businesses or sea-use planning. Thus, the academics were not largely invited in the panel or the workshop despite their considerable expertise. In addition, representatives of business sectors were mostly affiliated to business-support organizations, associations or groups, thus representing the general views of certain industry rather than a single company. In the last phase of scenario process, the interviews provided a possibility to gather more opinions from business sectors.

At first, the extensive lists of possible stakeholders were prepared, and then the matrix including selected stakeholder organizations and representatives was composed. This matrix was commented and completed by the project partners. As the topic of the study included regions from Finland and Estonia as well as several business sectors and other stakeholders, the eligible size of the panel was planned to be circa 40-60 persons (cf. Loë et al. 2016). The prospective panelists were asked to be engaged to the entire scenario process of the project. Thus, knowing the challenges to have long-term engagements, 132 invitations were sent by email both in Finnish and in Estonian. Some of these invitees were also contacted with telephone. Total of 55 invitees accepted the invitation to the Delphi panel. In 2018, two new members were recruited to the panel. The anonymity of the panelists was preserved throughout the Delphi-rounds of the questionnaire and Helsinki and Tallinn scenario workshops.

3.3. First on-line questionnaire of the Delphi study

The aim of the first Delphi study was to define such blue business sectors and drivers that are considered relevant to the future regional development of the Gulf of Finland and the Archipelago Sea, both in Estonia and Finland. The questionnaire included survey questions regarding the blue economy sectors shown in Table 2.

In order to explore the expert opinion about the spatial characteristics of wide range of blue business sectors, the first on-line questionnaire of the Delphi study included both traditional survey questions and Delphi type questions. Thus, the two rounds of Delphi questionnaires performed in 2017 were not a pure Delphi study. However, as in traditional Delphi study, the respondents could change their view and answer again to the questions, based on the results of the first round of Delphi.

The study was carried out using on-line questionnaire because of the rather high number of the panelists. HARAVA, a map-based survey tool that integrates responses with spatial data, was selected as the query tool. HARAVA is produced by Dimenteq Oy and it is has been listed among the Good Practices by the UN Human Rights Council in March 2015 (https://www.eharava.fi/en/).

The HARAVA-questionnaire was formulated so that it included Likert scale, slide switch and open questions as well as map questions (English version in Annex 1). In the planning phase of the project, the questionnaires were planned to carry out in English. However, during the selection process of the panelist and formulation of the on-line questionnaire, the need to use their native languages became apparent in order to increase the response rates to the rather comprehensive on-line questionnaire as well as the open questions in it. The formulation of several language versions of the HARAVA questionnaire and the translation of the questions and answers caused extra work. There were two similar versions of questionnaires in Finnish and in Estonian, and an identical English version. The questions were formulated and tested by the Plan4Blue-project partners. The open links to the HARAVA questionnaire were sent to the panelists by e-mail.

The questionnaire had three parts: the definition of the changes, synergies and conflicts of the blue businesses, selecting the PESTEL drivers that influence the development of the blue businesses and considering the weak signals and black swans. The questionnaire included the following main questions of which the first three were for each business sector, respectively, and 4th and 5th considered the entire project area:

- The definition of the changes i.e. how the production and other activities of a certain blue economy sector will change in the project area, both on land and on sea (onshore and offshore), by the year 2050.

- Identification of synergies and conflicts of the blue business sectors.

- Map questions considered the locations where activities of a certain sector should be located in future and whether they should be increased or decreased, to claim new areas or to be totally banned (with illustrations on maps).

- According to a PESTEL classification, the estimation of the major political, economic, social, technological, environmental and legal drivers affecting the development of blue economy by the year 2050.

- Consideration of the weak signals and black swans.

Background data were provided as follows: maps about the current uses and restrictions of the project area (Annex I and WP3 Deliverable D.T3.5.1 Collection of contemporary Gulf of Finland maps for scenario building), preliminary results of the economic analysis of the selected business sectors and information on the environmental vulnerability analysis. The economic analyses and environmental vulnerability analysis are presented in the other deliverables of Plan4Blue WP1 and in WP2.

PESTEL was used as a method to survey different drivers, which then were processed as variables into the futures table per blue economy sectors. The aim was to identify the impact of each driver into the target of the analysis. Open questions surveyed the opinions on how different drivers affect specific blue economy sectors.

Because of the detailed questions, the questionnaire was quite long, which was reflected in couple of the general comments by the respondents. This issue was considered when testing the questionnaire, and weighted against the aim to explore the expert opinions of all the blue business sectors. Because of this, it was decided not to restrict or select them in advance by the project partners. However, there were no obligatory questions except identification of the panelist, and the panelists were instructed to answer at least those questions they had clear opinion.

In the map questions, the point symbols were used to make it easy to fill the map and the dialogue boxes for each point (see guidance from Annex I). The symbols were asked to be placed at the approximate center of the area respondent meant. Additionally, the desired direction of the future change of the certain business activity in that location was asked. When a respondent placed a symbol on a map, a separate dialogue box appeared and the respondent should select some of the following choices: increase, decrease, claim new areas, total ban. Multiple areas could be marked in the same category. As a background data for each map page, the business locations of the sector in question were placed as a layer on the base map and the respondent could open the legend of the map layers in each map view in order to hide or change the transparency of the layers. ESRI's ArcGIS software were used for the creation and analyzing of all the maps of this study.

3.4. Two rounds of Delphi in 2017

The first round of the on-line questionnaire was open from 26th April to May 25th, 2017. All the Finnish and Estonian answers were combined together in one excel table. The links to the HARAVA questionnaire were sent to the panelists by e-mail. As the links were open for all and the questionnaire was not possible to save and continue later, the identification of a panelist was set as compulsory answer. Otherwise, the panelists were asked to select those items or answer at least those questions they think were relevant considering the future development.

HARAVA-system creates separate id-number, timestamp and empty row for the answers always when the questionnaire is opened from the link. Thus there were plenty of empty rows as well as zero values, which meant that some respondents had opened the link and possibly flicked through the questionnaire. These empty or zero value rows were excluded. Most of the panelists gave their names for the identification as requested. Few respondents opened the questionnaire link several times and e.g. gave some different answers to some Likert scale selections. In these cases, the answers with later timestamp were chosen for further analysis. Rows with no identification, background information and only some answers to selections were excluded. There were two cases included in further analysis with no proper name, but with full panelist's background information and responses for most questions. On the other hand, four rows with name of the panelist but with no answers were excluded from further analysis.

The answers of 42 panelists were included in further analysis in the first round of the Delphi. Some of the respondents did not answer to all questions and thus the number of responses changed in different questions. Seven respondents answered to map questions. The panelists filled either Finnish or Estonian versions of the questionnaire and answered in Finnish and Estonian also to the open-ended questions. These answers were translated in English for further analysis.

The main results of the round I were composed for the Delphi round II as power point presentations. The questionnaire was otherwise similar than in the first round, but for each business sector, the results of the business in question were attached in the beginning of the question page and the panelists were asked to add their comments regarding the results as open-ended question. They could also answer again to the other questions, and the answers of the first round were replaced by these new selections for the final analysis of the two Delphi rounds.

The second round of the Delphi was performed in summer 2017 in order to give all the 55 panelists an opportunity to reflect the results of the first round as well as to add new answers or change their previous opinions. The HARAVA questionnaire was open from 14th June to 12th July 2017. The results of the first round were attached to the HARAVA questionnaires. The results were in English, but they consisted mostly of charts and maps, with few texts. Respondents were asked to comment the results or fill in parts of the questionnaire. These new answers replaced their previous answers from the round I.

Seven Finnish and seven Estonian panelists viewed the second round of the Delphi questionnaire. Some had clicked through the questionnaire and had produced only 0-answers. These were excluded from the further analysis. One of the panelists answered the questionnaire only in the second round. Three of the panelists answered again to some of the Likert scale questions, others did not change or add any answers. The excel table containing the results of the first round were modified according to the changes of the second round and answers of the new panelist were added as a new row. There were only few answers from one panelist to map questions of the round II. These were joined with the results of the first round map questions using ArcGIS software. Thus the total number of responded panelists were 43 in 2017 Delphi rounds.

3.5. Second on-line questionnaire of Delphi in 2018

The questionnaire was sent as Webropol-questionnaire on February 16th, to 33 Delphi members in Finland and for 24 in Estonia. A personalized e-mail link was used. Most of the reminders were sent using the same personalized e-mail link, however, as reminders were sent by other members of the research team, an open internet link was used, too. Using a personalized e-mail link in answering allows easier possibility to assess one's own reply, to reflect that with the replies given by the respondents in the first round. The 3rd round was closed on 8th of April, and the 4th round was opened on 18th of April, with report of the responses . It was closed on 30th of April. Altogether 16 replies were received, 15 of which on the 3rd and one on the 4th round. None of the panelists changed their answer given during the 3rd round.

The questionnaire included:

- background questions

- questions related to future scenarios of blue economy sectors and/or their sub-sectors: energy, marine cluster, tourism, culture, and services for leisure activities, blue bio-economy and sub-sea resources.

Futures tables and futures images were created separately for blue economy sectors. In the futures table, each row represents different future state of a variable. These variables were formed based to the drivers identified in the process. The members of Delphi received also summary of strategies on blue economy sector as a background file. Answering in English, Finnish or Estonian in the open questions was possible. Some of the replies were received in Finnish and translated into English.

3.6. Two rounds of Delphi in 2018

The aim of the Delphi-rounds 3-4 in 2018 was to evaluate the draft futures tables and images of future, which were created based on the results of the first Delphi-rounds in 2017, and complemented with the results of the scenario workshop arranged in Helsinki in June 2017. Based on the responses, draft futures tables and brief descriptions of the alternative scenarios, future images were compiled for blue economy sectors, describing possible alternative developments in 2050. Webropol was choosed as tool to compile the questionnaire, as no further map-based questions were planned to be presented in on-line questionnaire. Instead, map-based questions were worked with in Tallinn scenario workshop.

3.7. The first scenario workshop in 2017

The workshop was held in Helsinki 15th-16th June 2017 (Annex II). The Delphi panelists, project partners and other stakeholders and experts had been invited. Total of 30 experts attended the workshop of which nine were from Estonia and 21 from Finland. Six of them were Delphi panelists, four were academics from project organizations and 20 were from other organizations. With moderators and organizers, the number of the participants was 40.

The aim of the Helsinki workshop was to complement and assess the results of Delphi study. In the beginning of the workshop, the background information and the main results of the Delphi round I were presented for the participants. A slightly modified Learning café method was applied (cf. Aldred 2011). The participants were divided into three working groups prior to the workshop in order to ensure the representation of all four economy sectors in each working group.

There were two moderators in each group on both days, one led the groups through the exercises and the other made notes. In addition, the discussions were recorded, but the recordings had partly varying quality. This was because at times the participants discussed lively with each other or moved around the room and tables. The moderators wrote memorandums of each session based on the notes, photographs and recordings. The drawings of the map exercise were later digitized to ArcGIS shapefiles based on the photos taken right after the group working.

On the first day of the workshop, working groups, moderators and methods used were the following:

- Group 1. Potential Blue Economy sector developments by 2050 (Tuomas Pohjola, Anu Lähteenmäki-Uutela). The theme explored the potential of the blue economy by applying Lego serious play method (e.g. James 2013). The participants of the working group were asked to put such activities on the map that they believe will be there in 2050. This session was video recorded.

- Group 2. Synergies and conflicts of blue economy sectors (Riku Varjopuro, Hanna Nieminen). The other theme was about the synergies and conflicts of the blue economy sectors in the project area, with making post-it notes and counting the number of mentions of each synergy or conflict.

- Group 3. Main drivers for sustainable Blue Economy sectors: political, legal, social, economic, environmental, technological (Riitta Pöntynen, Anne Erkkilä-Välimäki). Lists of drivers were provided to the participants and they selected, added, removed or ignored them.

Three working groups circulated and discussed of all the three themes during the first day. However, the first session was longer than the others, 45 minutes because they started from scratch. The second and third groups worked each theme further based on the results of the first group for half an hour. Each three session rooms had a large canvas map placed on the table and printed background maps of the on-line questionnaire placed on the walls (see e.g. Roose et al. 2017: background maps).

On the second day, all three groups continued with the same moderators. All the groups carried out a map exercise "Sea-use plan for the year 2050". The aim of the exercise was presented first for all participants and after that the group work continued. Large canvas maps with the borders of restricted areas of the project area were applied to each group (See e.g. Figure 2). The canvas was covered with transparent plastic sheet on which the groups could make their markings. The idea of the exercise was to get ideas and have a discussion on the future developments of the blue business sectors. By drawing, the groups were asked to indicate the most important areas of different activities in 30–40 years' time. All the groups worked for circa one hour and afterwards they had a 15 minutes time to examine and comment the maps created by the other two groups.

After the exercise, all the drawings were photographed and later turned into a digitized form by WP 3. WP 3 worked with all collected map materials to form combination maps per each four blue economy sectors. The combination maps presents the results from both the Delphi panel and HARAVA-questionnaire and the workshop. As a final product, WP 3 produced intensity maps to see trends of the growth in blue economy sector related activities. These heatmaps present the future intensity centers of sector-related activities in the year 2050 for each sector separately. All digitized map results and visualizations of the first versions of blue growth scenarios are available in WP T3 deliverable D.T3.6.1 "Maps visualizing first versions of blue growth scenarios" (Roose et al. 2017).

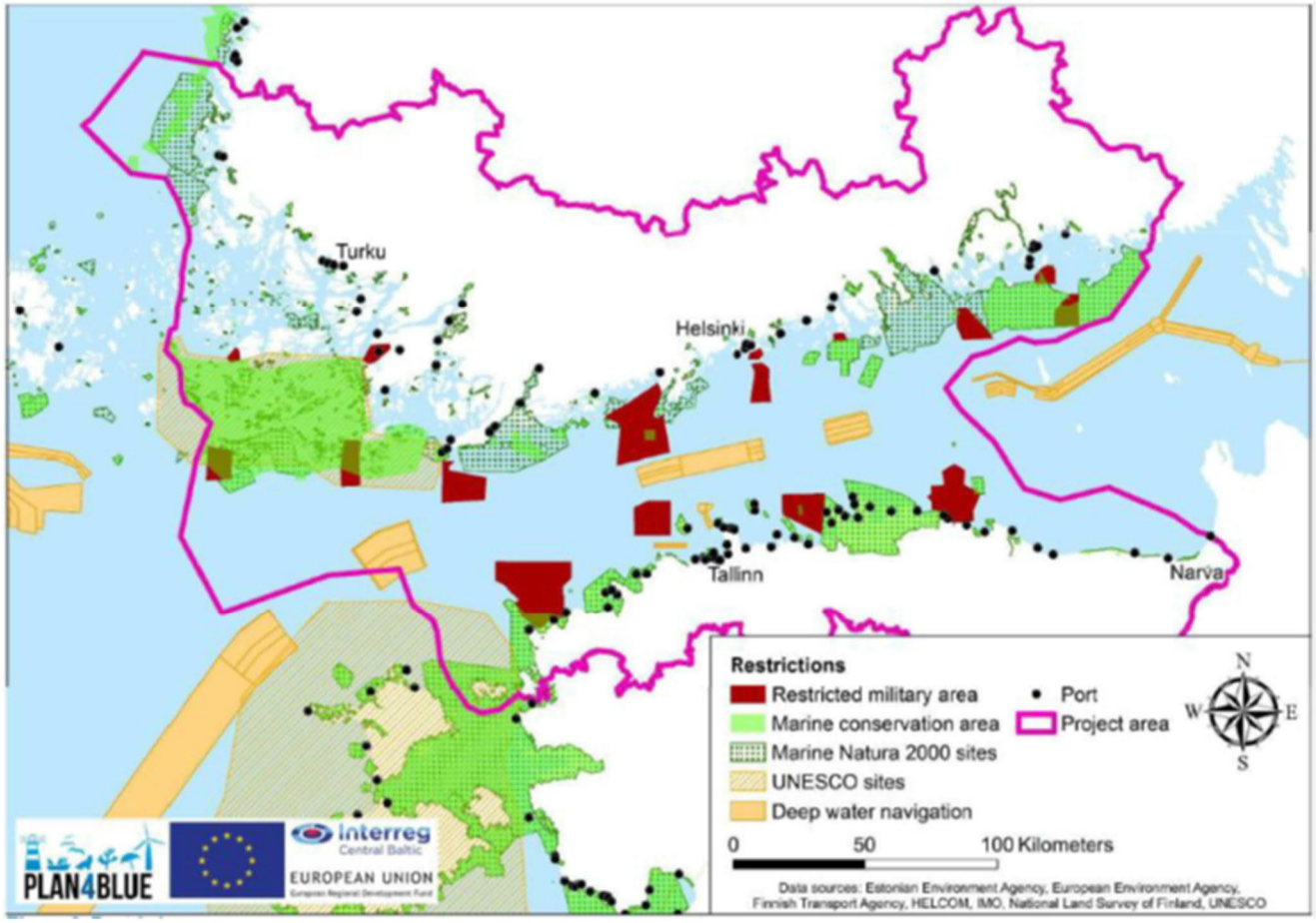


Figure 2. Basemap of the project area (Roose et al. 2017). The restrictions of the sea use are marked on the map.

3.8. Second scenario workshop in Tallinn: Blue Economy Scenarios for Maritime Spatial Planning

The second workshop of Plan4Blue was arranged in Tallinn, on January 23 and 24th, 2018. The aim of the workshop was to assess first drafts of scenarios for Blue Growth, including sector-specific futures tables, images of future and their impact on selected blue economy sectors (see Table 3). Furthermore, in the backcasting exercise, the participants identified pathways to the draft alternative scenarios. In mapping exercise, the participants assessed what kind of spatial impacts different scenarios would have.

The working was based to the expert survey and the scenario workshop organized in Helsinki, 2017. Their results were combined in creating draft future images for blue economy sectors in Gulf of Finland and Archipelago Sea areas: energy, maritime cluster, tourism, culture and services for leisure activities as well as blue bioeconomy and subsea resources. Mapping exercise was based the combination maps on sea-use for year 2050 with indication of initial hot spot areas for blue economy. (Final programme of the workshop in Annex IIII).

In Tallinn workshop, there were altogether 41 participants, including moderators and organizers. Of the 28 experts, 19 were from Estonia and 9 from Finland. Number of Delphi panelists in Tallinn workshop was 6, 2 from Finland and 4 from Estonia.

Get together – event was organized on the previous evening. At this event, Plan4Blue scenario work and sustainability of blue futures was introduced by Riku Varjopuro, SYKE. Liisi Lees of the University of Tartu introduced UN Sustainable Development Goals of the 2030 and Agenda for Sustainable Development. Environmental cumulative risk analysis and assessment background for the Gulf of Finland Blue growth scenario development was presented by Robert Aps of the University of Tartu.

In the workshop, keynote speaker Andrew Merrie, from Stockholm Resilience Center presented the future scenarios in a presentation "Three decades ahead – How to come to grips with uncertain ocean futures?" These science-based futures scenarios are presented with the means of scientific narration and illustrative elements. The aim of Merrie's presentation was to encourage the participants to think about unexpected future developments in their group work.

Further elaboration of the future scenarios took place in four working groups:

- Group 1. Energy. Moderator Merle Kuris, Hanna Nieminen.
- Group 2. Maritime cluster. Moderator Riitta Pöntynen, Harri Tolvanen.
- Group 3. Tourism, culture and services for leisure activities. Moderator Anu Lähteenmäki-Uutela, Anneliis Peterson.
- Group 4. Blue bioeconomy and subsea resources. Moderator Riku Varjopuro, Leena Laamanen.

Background material for the participants of the workshop consisted of the following.

- Draft futures tables and future images, as well as summary table of main strategies and their visions, targets and timespan were e-mailed for participants before the event
- In addition, participants of the previous workshop and members of Delphi expertise panel had received the resume of alternative scenarios.
- Basemaps consisted of the results of the previous Delphi round and workshop in Helsinki.

The groups discussed blue economy sector's development by 2050 in the draft alternative scenarios: Sustainability above all - Unlimited growth - Sustainability dilemma - Virtual reality.

Main questions discussed in the working groups were the following:

- Are the variables (on the rows of the futures tables; formed based to the drivers identified in Delphi and Helsinki workshop) relevant for the future development of the specific blue economy sectors in 2050?

- Which kind of alternative future states in 2050 may exist in the alternative scenarios? (described in the columns for each variable in different alternative futures)
- What are the consequences for the selected blue economy sectors?
- Which steps would lead to the alternative futures?

Each working group selected a blue-economy sub-sector focus for discussions in the working group, regarding impacts and consequences for the sector. The aim was to bring the discussion on a more practical and tangible level. The sector was selected among the subsectors focused in phase two of the scenario process (Table 3).

Backcasting exercise was realized using a timeline on a wallpaper, with timelines for each sector and scenario to work with. Post-it notes were used to mark and date which events, actions, decisions, or things would lead to alternative scenarios and when? Which actors are involved in that development?

The aim was to create paths towards 1-3 scenarios. The participants were encouraged to discuss the following points:

- How a "sustainable future" may be reached? Name 3-5 different events to reach the sustainable scenario, and their timing (post-its)
- In which circumstances a "worst case" scenario would realize? What leads to worst case scenario? Name 3-5 different (chains of) events.
- "Virtual reality" - full digitalized future – how we would proceed to that and what is the impact for the sector? Name 3-5 different reasons for that, and indicate their timing.
- Why "business as usual" = no clear decisions towards sustainability or new developments? Name 3-5 different reasons for that, indicate their timing)

In addition, task for all participants during backcasting was to add unexpected events (black swans) on the timeline. Black swans may change the development completely. In the end, the participants would also discuss which of the alternative futures would be the most preferable from the point of view of the sector under discussion, in other words the "best business environment". In addition, they were asked to assess, which would be the most likely or probable future in 2050?

In map working groups, the aim was to discuss on alternative scenarios on the map. Main question for the working groups was what kind of spatial impacts would different scenarios have? First, the working groups named the map according to which scenario it represented most. It was possible to do some changes on the map, if the map did not represent any of the scenarios or it would need finalizing, for example, if there were regional differences. After that, the working groups proceeded to draw other scenario maps.

The participants assessed changes of intensity of the blue economy sectors in different scenarios, for example:
- intensity of different energy sources in different scenarios: renewables, wind energy, fossil
- intensity of cargo, passengers, cleantech and routes
- changes in intensity of different kind of tourism
- changes in intensity of different subsectors of blue bioeconomy

In addition, the participants assessed and identified locations – which are expected to be the hot spots and main conflict areas with other sectors, and where there would be possibility for multi-use with other sectors.

3.9. Business interviews

In the final phase of scenario process, the business interviews provided a possibility to gather opinions from companies, and moreover, to make a robustness check related to the results of preliminary results of Delphi and scenario workshops. The interview plans and interviews themselves were coordinated with business interviews for D.T1.6.1 Final report on blue economic potential, sector strategies and development trends and economic and social networks in D.T1.7.1 Final report on economic and social networks.

Selection of the interviewees was done based on the four main blue economy sectors in Plan4Blue project (Table 2), and the subsectors focused in phase two of scenario process (Table 3). Altogether 22 persons were interviewed. One of them represented two sectors of expertise, tourism and blue bioeconomy and subsea. The sectors of expertise are presented in Table 4.

Table 4. Sectors of expertise of the interviewees

Expertise in sector	Finland	Estonia	Total
Energy	3	1	4
Maritime	5	3	8
Tourism	5	1	6
Blue bioeconomy & subsea	2	1	3
Other	1	1	2
	16	7	23

On energy sector, the interviewees were selected representing renewable energy modes, and one of them represented the energy sector as a whole. This supported the results of Tallinn workshop, in which the working group focused on future development of wind energy in alternative scenarios for Blue Growth. In Delphi rounds 3-4 (2018), the focus was on development of wind energy and other renewable energy sources. On maritime sector, the interviewees were selected among ports and ship owners, as well as their associations and support organisations. In Delphi 2018, the panelists focused on development of the whole maritime cluster. In Tallinn workshop, the maritime working group chose to focus on future of maritime transport in alternative scenarios for Blue Growth.

Regarding blue bioeconomy sector, the interviewees were selected among aquaculture and subsea producers. In Tallinn workshop, the working group chose to focus on fish farming, in particular multitrophic aquculture. In Delphi 2018, the focus was more extensively on development of fishing, aquaculture, fish farming, mussel and algae farming. In the maritime tourism sector, the interviewees were selected representing support and promotional organisations for tourism, tourism companies and specific leisure associations, as well as services for cruise tourism. In Delphi-study 2018, the tourism, culture and services for leisure activities was considered as an entity as well as was decided at the Tallinn scenario working group on tourism.

In total, 33 interviewees were contacted, and 22 of them gave an interview, 16 from Finland and 7 from Estonia.

Most of the interviewees represented maritime sector, followed by tourism. In Finland, two Delphi-panelists were also interviewed, and in Estonia one. The anonymity of respondents was extended into business interviews, too.

The results of the interviews are presented in the other two deliverables mentioned earlier. In the context of the scenarios, the question “Which factors do you think will most affect the long-term economic development of your company…say in 10-20 years (turnover, number of employees)?” was analysed in the context of main drivers for the blue economy sectors. In addition, any mention on drivers in the interviews were included and reported. The factors mentioned by the interviewees were combined with a driver presented before in the scenario process, either by Delphi-panelists or in the scenario workshop. New factors and drivers mentioned by them are reported separately.

In addition, the interviews have been used in the analysis of changes of blue economy sectors, as well as in creating the pathways for the alternative scenarios. The results of the Delphi and workshop are reflected with the interviews..

3.10. Background of Delphi panelists, workshop participants and interviewees

3.10.1. Background in 2017

The Delphi rounds 2017 were participated by 43 panelists, six of which attended also to Helsinki scenario workshop. In addition, 24 experts outside the Delphi panel attended the workshop from various organizations. Total of 67 experts participated either on the Delphi rounds, workshop or both (Table 5) in 2017. The Delphi on-line questionnaire were dominated by the representatives of the public authorities, 26% of the respondents were from private sector and 16% were academics and representatives of NGO’s. The workshop participants were not asked about their opinion of their expertise. However, 10 workshop participants were from organizations that represented spatial planning, regional or environmental

issues. Four of them were academics from the project partner organizations. The rest were organizations dealing with environmental issues and conservation, energy, marine transportation and fishing, 2-3 participants representing each of these fields of expertise. The workshop participants represented more heterogeneously different types of organizations, but among all the panelists and participants, still over half were from public sector and circa third from private sector. The number of private sector representatives increased due to the interviews in the last phase of scenario process, into which the business sector interviewees and business interest and business support organisations contributed with their expertise.

Among the respondents of the online Delphi query, both nationalities were relatively evenly represented. There were 24 Finnish (incl. one group answer from a single organization) and 19 Estonian respondents. Gender division was also rather equal, 22 males and 20 females (the group not included). Two thirds of the respondents announced that they had over 10 years of working experience in their fields of expertize (Table 6). Majority of the panelists announced that they work on national level: 33% both in Finland and in Estonia, respectively. The rest of the panelists worked mainly in the coastal provinces of the project area, 1-3 in each province and one in the EU level.

Over half of the panelists selected 2-5 areas of expertise for themselves (

Table 7Table 6). The number of the fields of expertize were not related to the working experience. Spatial planning (defined very loosely, see Annex I) and environmental issues were most often marked fields of expertise. All the other fields of expertise represented by 5-7 panelists, apart from the subsea construction which was represented only by 2 panelists.

The first row of the

Table 7 shows the fields of expertise the respondents announced and the response rates of the Likert scales questions and map answers on the whole (map answers were evenly distributed in the questionnaire, see the organization of the questions from Annex I). The first question page of the questionnaire, the energy cluster, was answered by all the respondents and almost all had answered to the maritime cluster page. The number of respondents decreases towards the end of the questionnaire.

Table 5. The primary employment organization of the Delphi panelists and the organizations of workshop participants in 2018 (excluding the Delphi panelists and moderators that participated the workshop). National enterprises included state-own companies.

	Delphi panelists		Workshop participants		All	All %
Municipality	2	5 %	0	0 %	2	3 %
Regional/county administration	5	12 %	6	25 %	11	16 %
Government institution	18	42 %	2	8 %	20	30 %
Non-governmental organisation (NGO)	4	9 %	1	4 %	5	7 %
Research and education	3	7 %	4	17 %	7	10 %
International corporation	0	0 %	1	4 %	1	1 %
National enteprise	2	5 %	7	29 %	9	13 %
Business support organization	5	12 %	2	8 %	7	10 %
Association	4	9 %	0	0 %	4	6 %
Other	0	0 %	1	4 %	1	1 %
Total	43		24		67	100 %

Table 6. Years of work experience of the Delphi panelists by their own announcement.

Years of work experience in the field of my main expertise		
< 10 years	8	19 %

10-19 years	12	28 %
20-30 years	16	37 %
> 30 years	5	12 %
N/A	2	5 %

Table 7. The response rate to the Delphi rounds I and II by the panelists and the distribution of their expertises regarding the questions answered. The table shows that each major question has been answered at least by one panelist representing each of the fields of expertise (apart from the open questions regarding weak signals and black swans as well as map questions).

		Fields of expertise respondents selected (several selections possible for one respondent)													
	Highest number of respondents	Spatial planning	Environmental issues, conservation	Energy	Marine transportation	Fishing	Aquaculture	Tourism	Culture and cultural heritage	Societal issues	Politics	Sub-sea construction	Sub-sea resources	Offshore construction, shipbuilding	Other
Chenges of Energy sector by 2050 (all the respondents)	43	13	16	5	7	6	4	4	4	6	6	2	4	4	4
Synergies and conflicts of energy sector with other sectors	41	12	15	5	7	7	4	4	4	6	5	2	4	4	3
Changes of Maritime cluster by 2050	34	8	12	4	7	5	3	4	4	4	4	2	3	3	3
Synergies and conflicts of maritime cluster with other sectors	33	9	13	4	6	5	3	4	4	5	4	1	3	3	2
Changes of bioeconomy by 2050	29	6	11	3	6	5	2	3	3	3	3	1	3	3	2
Synergies and conflicts of bioeconomy with other sectors	29	6	10	3	5	5	2	4	3	3	3	1	3	3	2
Changes of tourism by 2050	27	5	11	3	5	4	1	3	4	1	2	1	3	3	1
Synergies and conflicts of tourism with other sectors	27	5	11	3	5	4	1	3	4	1	2	1	3	3	1
Political drivers	29	6	12	3	5	4	1	3	4	1	3	1	3	3	2
Economic drivers	29	6	12	3	5	4	1	3	4	1	3	1	3	3	2
Social drivers	29	6	12	3	5	4	1	3	4	1	3	1	3	3	2
Technological drivers	28	6	11	3	5	3	1	3	3	1	3	1	3	3	2
Environmental drivers	28	6	11	3	5	3	1	3	3	1	3	1	3	3	2
Legal drivers	29	6	12	3	5	4	1	3	4	1	3	1	3	3	2
Weak signals and/or Black swans	11	3	3	2	3	2	0	0	1	0	0	0	1	1	0
Map answers	8	2	3	1	1	1	0	1	1	0	2	0	1	1	2

3.10.2. Background in 2018 and participation of the experts in scenario process

In Delphi rounds 2018, the questionnaire was sent to 33 Delphi members in Finland and for 24 in Estonia. There were some changes in the membership of the panel. In five organisations, the questionnaire was sent to another person in the same organization, or the panelist asked another expert to reply to the questionnaire. Another reason for new members were changes in working place or tasks within the same organisation. One new member was recruited in the panel in Finland from maritime sector. In Estonia, one member of the panel was replaced and one new member was recruited.

Table 8. The primary employment organization of the Delphi panelists and the organizations of workshop participants in 2017 (excluding the Delphi panelists and moderators that participated the workshop). National enterprises are included in state-own companies.

	Delphi panelists (2018)		Workshop participants (2018)		Interviews (2018)		All	All %
Municipality	1	6 %	0	0 %	0	0 %	1	2 %
Regional/county administration	2	13 %	7	25 %	0		9	14 %
Government institution	4	25 %	11	39 %	0		15	23 %
Non-governmental organisation (NGO)	1	6 %	2	7 %	1	5 %	4	6 %
Research and education	0	0 %	6	21 %	0		6	9 %
International corporation	0	0 %	0	0 %	0		0	0 %
National enterprise	1	6 %	1	4 %	12	57 %	14	22 %
Business support organisation	0	0 %	0	0 %	4	19 %	4	6 %
Association	5	31 %	1	4 %	4	19 %	10	15 %
Other	2	13 %	0	0 %			2	3 %
Total	16	100 %	28	100 %	21		65	100 %

The Delphi rounds in 2018 were responded by 16 panelists, and 6 panelists attended the scenario workshop in Tallinn. Two panelists both replied to the questionnaire and attended the workshop. In addition, two panelists were also interviewed. Total number of interviewed experts was 15 in Finland and 7 in Estonia. In total, 65 experts participated in scenario process in 2018. As in Helsinki scenario workshop, workshop participants of Tallinn workshop were not asked about their opinion of their expertise. However, 13 workshop participants were from organizations that represented spatial planning, regional or environmental issues. Six of them were academics from the project partner organizations. The participants represented similar kind of organizations than in the first scenario workshop in Helsinki: environmental issues and conservation, energy, marine transportation and fishing. Altogether, 105 experts participated in scenario process during 2017 and 2018 (See Table 9).

Table 9. The background information of experts who participated in the scenario process in 2017 and 2018.

	Delphi panelists	Workshop participants	Interviews	All
Municipality	2	0	0	2
Regional/county administration	6	9	0	15
Government institution	18	6	0	24
Non-governmental organisation (NGO)	4	2	1	7
Research and education	3	9	0	12
International corporation	0	1	0	1
National enterprise	3	8	12	23
Business support organisation	5	2	4	11
Association	5	0	3	8
Other	1	1	0	2
Total	47	38	20	105

4. ALTERNATIVE FUTURE SCENARIOS FOR BLUE ECONOMY SECTORS

Introduction

The results of the Delphi rounds in 2017 and 2018, Helsinki and Tallinn scenario workshop and interviews are presented and discussed together in the following chapters by blue economy sectors. The results include changes related to blue businesses and their impact on the sea use in the project area. Main drivers for blue economy sectors, and the alternative scenarios and pathways towards them are presented by sector. All the maps and their methodology are presented in WP3 Deliverable D.T3.6.1. (Roose et al. 2017). Current status and potential of blue economies, as well as main strategies are studied in WP1 Deliverables D.T1.6.1 (De Andres Gonzalez et al. 2018) and D.T1.8.1. Finalizing the input-output modeling of maritime industries in Estonia and Finland (Paas and Tverdostup, 2018). In addition, economic and social networks are presented in WP1 Deliverable D.T1.7.1

In the first phase of scenario process, we created four futures images for each blue economy sector respectively. Based on the responses of Delphi and workshop 2017, draft futures tables and brief descriptions of the alternative scenarios were compiled for blue economy sectors, describing possible alternative developments in 2050. In total, we have sixteen short narratives for Blue Growth. The draft narratives were mostly based on qualitative data gathered from experts, but to some extent also literature (e.g. strategy papers) and other tasks carried out in Plan4Blue project during 2017. Variables for futures tables per blue economy sector were defined according to drivers classified with PESTEL. We have considered different future states for each variable according to the principles described in Chapter 2.3. Thus the futures images are built of the contents of futures tables.

For each sector, four future states and four future images were defined, loosely based on following categories (see Figure 3)

- preferred future (wishful thinking),
- worst case scenario (threat) and
- current state (continuation of business as usual, changes quantitative),
- extensively digitalised future.

Figure 3. Alternative future scenarios of Plan4Blue

The aim of the second phase was to consider, discuss and identify alternative pathways to these futures images. We have applied the backcasting method, which starts from the future images and looks back in order to find out the preferable and avoidable choices, which may lead to the future. In Delphi and workshop 2018, the intention was to gain feedback whether the chosen drivers and variables are those that influence the specific sectors most. In addition, the main drivers were identified and possible missing drivers were surveyed. Pathways were created towards the alternative futures. Finalisation of the scenarios was performed with robustness check: analysis of the interviews for business representatives from the point of view of scenarios. Specific questions were designed to complement the previous phases of the analysis.

In the second phase, the most important subsectors of blue businesses were selected for further analysis (see Table 3) Selection was done as part of the collaboration of project partners based on discussions of the results of the 2017 Delphi and workshop in 2017, and supported by the results of economic analysis (D.T1.1.1). Those selected sub-sectors were in the focus of the analysis in the rounds of Delphi and Tallinn workshop in 2018, as well as in the interviews.

When presenting the scenarios for each blue economy sector, the drivers are presented first, and the consequences of the main drivers are discussed in more detail. Discussion on the selected drivers and themes precedes each futures table. The futures tables and futures images are then presented. Attitudes were presented as variable for all the blue economy sectors, as the background value of the scenarios is sustainability, and attitudes influence decision-making and reflect choices of people. In futures tables (see chapter 3.4.), one column was reserved for remarks and comments in the Delphi round and in the workshop, as well as for the comments of the stakeholders. The weak signals and black swans from the Delphi study and Helsinki workshop are presented after each futures table. The futures tables are presented in this report as final versions, as results of the scenario process, and the main changes are described.

Assessment of the scenarios consist of examination of the impact of existing strategies to the alternative scenarios. Probabilities and possibilities are assessed from the point of view of selected sub-sectors.

4.1. General drivers for Blue Economy

The results of Delphi 2017 and Helsinki workshop are compared in the following tables per PESTEL drivers. Figures 6 and 7 show the distribution of responses to the PESTEL questions in absolute numbers. In the workshop, mentions of drivers were counted and marked in Tables 5-10. In these combination tables, the order of drivers in Delphi study is based to those, which were regarded to have a moderate or significant effect; 4 or 5 on a scale of 1-5 (in % of the respondents). The share of positive or negative is counted as percentage from the responses which considered that the driver has effect (ref. no effect at all).

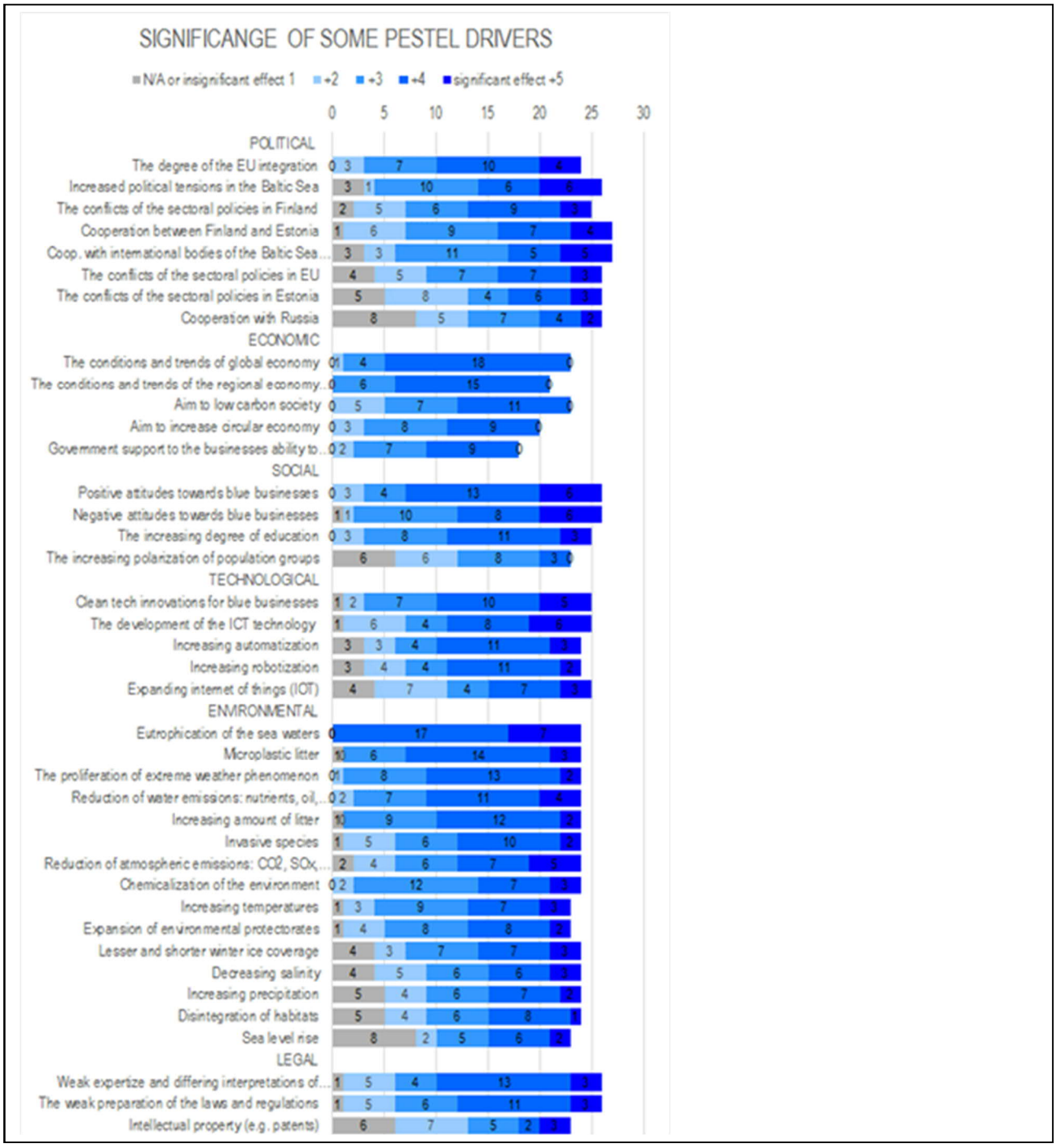


Figure 4. The distribution of the responses of Delphi 2017 in absolute numbers considering significance of some PESTEL drivers related to the future development of the blue businesses in the project area.

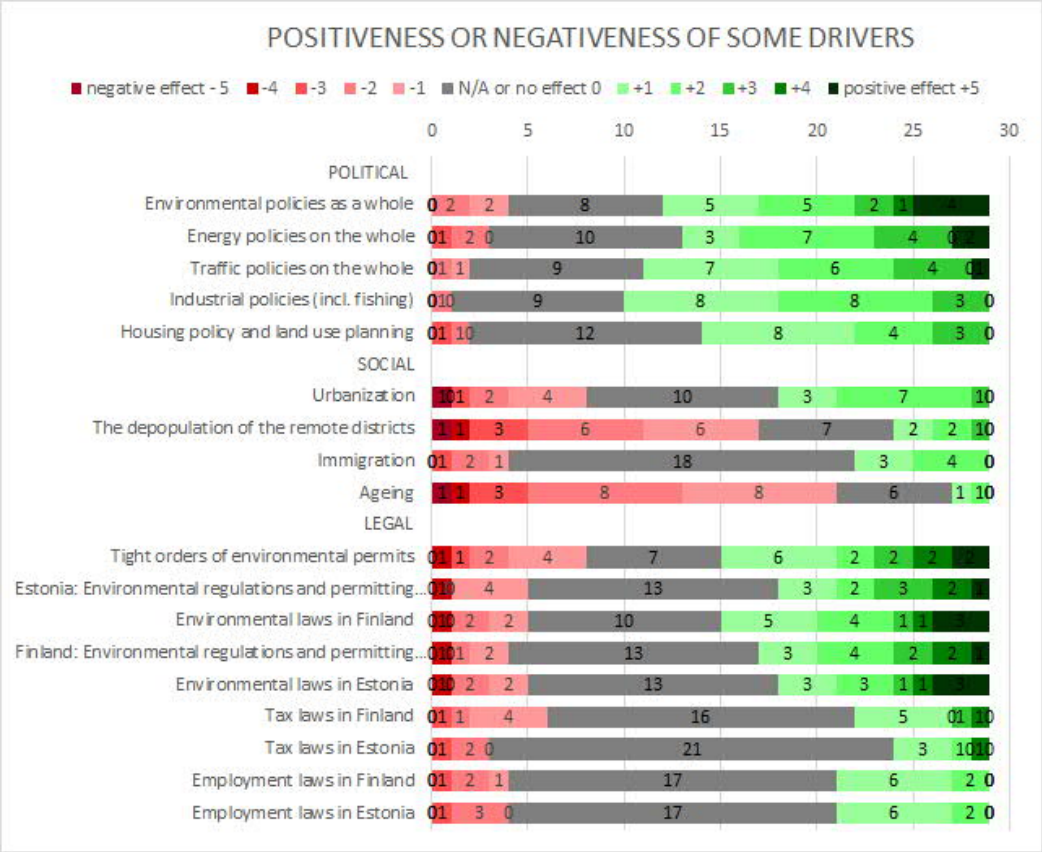


Figure 5. The distribution of the responses in absolute numbers considering those drivers that already have an effect to the future development of the blue businesses in the project: social trends and policy or legal instruments. These were examined in the Delphi rounds in 2017.

4.1.1. Political drivers

Altogether 18 political drivers were presented for discussion in Helsinki scenario workshop (15 from Delphi-questionnaire; 3 added before the workshop by project team). Working groups added 4 more drivers. In the workshop, there were mentions for 16 drivers (total 18 mentions). On the other hand, there were no mentions for 6 political drivers (Table 10).

Table 10. Political drivers. The impacts of drivers assessed in the working groups is marked with + in case of positive and – in case of negative impact was identified.

Political drivers	
Delphi	**Workshop**
Environmental policies as a whole 72% (negative 19%, positive 81%) Traffic policies on the whole 69%, (negative 10%, positive 90%) Industrial policies (incl. fishing) 69% (negative 5%, positive 95%) Energy policies on the whole 66% (negative 16%, positive 84%) Housing policy and land use planning 59% (negative 12%, positive 88%) The degree of EU integration 58% The conflicts of the sectoral policies in Finland 48%	Environmental policies (3) Traffic policies (2) Strengthening EU integration (1) + Increased political tensions in the Baltic Sea (1) – Cooperation between Finland and Estonia (1) Cooperation with international bodies of the BSR (1) Cooperation with Russia (1) Unstable security situation in the Baltic Sea region (1) Energy policies (1) Housing policy and land use planning (1) Industrial policies (incl. fishing) (1) Regional development policies (1)

Increased political tensions in the Baltic Sea 46% Cooperation between Finland and Estonia 41% The conflicts of the sectoral policies in the EU 38% Cooperation with international bodies of the BSR 37% The conflicts of the sectoral policies in Estonia 35% Cooperation with Russia 23%	New drivers presented in the workshop: Cooperation: information sharing; unified systems (1) The conflicts of the sectoral policies between Finland and Estonia (1) Peace (movement) (1) Subsidies to the sector (national / transnational) (1) Global security No mentions in the workshop Threat of terrorism The conflicts of the sectoral policies in the EU The conflicts of the sectoral policies in Finland The conflicts of the sectoral policies in Estonia More stringent environmental policies in the Baltic Sea region Weakening EU integration

Based to Delphi and workshop, environmental policies is the most important political driver and it is considered a positive one (81%) with strong impact. Other sectoral policies were considered important as well, and the share of respondents is almost the same. Traffic and industrial policies are both considered strong positive drivers. Energy policy is almost at the same level and considered a positive driver (84% of respondents). Housing policy and land use planning had in Delphi the lowest share in percent of the drivers, however it was considered a positive driver among those who considered that this driver has an effect (88%).

There are some strong opposite views in particular concerning fisheries policies: in Delphi it was noted that EU fisheries policy (part of industrial policy) has had negative impact on coastal fisheries.

Altogether, co-operation was an important driver considering the share of replies in Delphi and mentions in the workshop.The driver “degree of EU integration” was divided for the workshop discussions to strengthening or weakening EU integration. In the workshop, there were no mentions for weakening EU integration. The degree of EU integration or strengthening of integration is possible only if there is dialogue and co-operation between the member states of the EU. Level of EU integration may variate between

- increasing fragmentation between EU member states
- development of EU as an economic union, with less impact to other sectors
- EU has less impact on member states and policies – increasing power of national states
- federal EU with strong impact on all policies, common foreign policy.

In Helsinki workshop, co-operation was proposed to be combined as one driver. Most important co-operation was noticed between Finland and Estonia, as well as on the level of the entire Baltic Sea. The connection between increased political tensions in the Baltic Sea and strengthening EU integration was notified at the workshop. Also the issue of global security was raised in discussion. The issue of co-operation as driver may be linked with conflicts and synergies. In the futures tables, co-operation in the BSR was formed as one variable.

4.1.2. Economic drivers

Altogether 8 economic drivers were presented for discussion in the workshop (6 from Delphi-questionnaire; 2 added before the workshop by the project team). The working groups added 2 more drivers. Altogether, there were mentions for 8 drivers (total 14 mentions, and no mentions for 2 drivers (Table 11).

Table 11. Economic drivers

Economic drivers	
Delphi	Workshop
The conditions and trends of global economy 78 % The conditions and trends of regional economy in the Baltic Sea 71% The Government's support to the business ability to compete 50% Aim to low carbon society (decarbonisation) 48% Aim to increase circular economy 45%	The conditions and trends of global economy (4) Circular economy (3) The Government's support to the businesses ability to compete (2) The conditions and trends of regional economy in the Baltic Sea (1) Aim to low carbon society (decarbonisation) (1) Unemployment rate (1) New drivers presented in the workshop: Increasing traffic (1) (links to disintegration of habitats) New market niche (1) No mentions in the workshop Increasing protectionism Greed

Both in Delphi and in the workshop, the conditions and trends of global economy was considered the most important driver. In Delphi, it was followed closely by the driver "the conditions and trends of regional economy", which in the workshop was considered to be part of a global economy, as a one combined driver. In Delphi, the economic development of the region in general was discussed.

Aim to circular economy was supported in the workshop as the second most important political driver. The Government's support to the business ability to compete received mentions both in Delphi and in the workshop. In Delphi, it was noted that subsidies can be innovative or stiffening; innovative subsidies may grow new businesses. In addition, it was noted that e.g. activities removing nitrogen and phosphorus from the sea should be supported. To be taken into account is how different sectors are supported (more or less), as well as level of support in Estonia and Finland. Aim to low carbon society is linked to environmental policies, and might be considered both political and economic driver.

New driver mentioned in the workshop; increasing traffic (links to disintegration of habitats) – can be considered a consequence from economic growth more than a driver itself. Also new market niche can be classified as a consequence.

4.1.3. Social drivers

Altogether 12 social drivers were presented for discussion in the workshop (8 from Delphi-questionnaire; 4 added before the workshop by the project team). The working groups did not add any drivers. There were mentions for 9 drivers (total 14 mentions), and no mentions of 3 drivers (Table 12).

Table 12. Social drivers.

Social drivers	
Delphi	**Workshop**
Ageing 79% (positive 9%, negative 91%) The depopulation of the remote districts 76% (positive 23%, negative 77%) Positive attitudes towards blue businesses 73% Urbanization 66% (positive 58%, negative 42%) Increasing degree of education 56% Negative attitudes towards blue businesses 54% Immigration 38% (positive 64%, negative 36%) Increasing polarization of population groups and classes 13%	Urbanisation (3) Ageing (2) Negative attitudes towards blue businesses (2) Leisure interests (2) Depopulation of the remote districts (1) Positive attitudes towards blue businesses (1) Ethical issues (1) Entrepreneurial spirit (1) Interest in nutrition and healthy eating (1) Immigration (discussed at "potential" working group No mentions in the workshop Increasing degree of education Increasing polarization of population groups and classes

In Delphi, a clear majority of the respondents considered ageing an important social driver with negative effect. In the workshop, also positive effects were identified e.g. for tourism. They expected people live longer and they have more money to spend, but this depends on the living standard of the retired people. On the other hand, it was mentioned that the amount of tax-payers is decreasing. Aside ageing, depopulation of the remote districts was considered an important social driver in Delphi. Urbanization and depopulation interact; in the workshop, urbanization was considered the most important social driver.

Attitudes towards blue businesses were discussed both in Delphi and workshop. In Delphi, most of the respondents assessed impacts of positive attitudes towards blue businesses, in the workshop more mentions were on negative attitudes. Leisure interests, ethical issues and interest in nutrition and healthy eating may link together and reflect positive attitudes towards blue economy (tourism, blue bioeconomy). Interestingly, increasing degree of education was not mentioned in any of the working groups, although it had a lot of support in Delphi.

4.1.4. Technological drivers

Altogether 6 technological drivers were presented for discussion in the workshop (5 of them from Delphi-questionnaire; one driver was added by project team before the workshop). 3 drivers were added by working groups. There were mentions for 8 drivers (total 13 mentions), no mentions for 1 driver (Table 13).

Table 13. Technological drivers.

Technological drivers	
Delphi	Workshop
Clean tech innovations for blue businesses 60% Increasing automatization 58% The development of the ICT technology 56% Increasing robotization 54% Expanding internet of things (IoT) 40% New drivers in Delphi	The development of the informations and telecommunication technology (ICT) (3) Expanding Internet of things (IoT) (2) Increasing automatization (2) Clean tech innovations for blue businesses (2) Augmented reality (1) New drivers in workshop

artificial intelligence+ , virtual reality, augmented reality, material technology	Virtual technology (1) Digitalisation (1) New unknown technologies (1) High technology (1) Innovations in energy technologies (1) No mentions in workshop Increasing robotization

In Delphi, clean tech innovations for blue businesses were considered slightly the most important driver. Innovations in energy technologies were also mentioned which may have a link to clean tech. In workshop, new unknown technologies were mentioned as new driver. In Delphi, material technology was mentioned in open comments, expected to have an effect among other things on the energy storage and the endurance of the floating structures.

Altogether ICT-related drivers gained most mentions in Delphi and in the workshop. Specific concepts such as virtual technology and augmented reality were added before the workshop by project team and in the workshop. These kinds of drivers are interlinked and the pace of introduction of technologies is important.

4.1.5. Environmental drivers

16 environmental drivers were presented for discussion in the workshop (all from Delphi-questionnaire). One driver was added by working groups. There were mentions for 15 drivers (total 22 mentions), and no mentions for 3 drivers (Table 14).

Table 14. Environmental drivers. The impacts of drivers assessed in the working groups is marked with + in case of positive and – in case of negative impact was identified.

Environmental drivers	
Delphi	Workshop
Eutrophication of the sea waters 100% Microplastic litter 71% Reduction of water emissions: nutrients, oil, hazardous substances 63% The proliferation of extreme weather phenomenons 63% Increasing amount of litter 58% Reduction of atmospheric emissions: CO2, SOx, NOx, black carbon 50% Invasive species 50% Expansion of environmental protectorates 43% Increasing temperatures 43% Chemicalization of the environment 42% Lesser and shorter winter ice coverage 42% Decreasing salinity 38% Disintegration of habitats 38% Increasing precipitation 38% Sea level rise 35%	Reduction of the emissions to water: nutrients, oil, hazardous substances (3) Microplastic litter (3) Increasing temperatures (2) + / – Lesser and shorter winter ice coverage (2) – Chemicalization of the environment (2) Eutrophication of the sea waters (2) The proliferation of extreme weather phenomenons (2) – Increasing precipitation (1) Decreasing salinity (1) Sea level rise (1) Invasive species (1) – Reduction of the atmospheric emissions: CO_2, SOx, NOx; black carbon, methane (1) New drivers in workshop Climate change as a whole (1)

Delphi-questionnaire and workshop discussed multitude of environmental drivers. In Delphi, eutrophication of the sea waters was considered unanimously the most important driver. Reduction of the emissions to water was the most important driver mentioned in working groups, followed by microplastic litter which was also the second most important driver in Delphi.

Climate change was a driver proposed in the working groups; it is a macro level concept causing certain environmental impacts, which may then be negative or positive for certain sectors of blue industries. Climate change as a driver includes all aspects of the phenomena, e.g. the following individual drivers from Delphi:

- The proliferation of extreme weather phenomenon
- Decreasing salinity
- Increasing temperatures
- Lesser and shorter winter ice coverage
- Increasing precipitation
- Sea level rise

4.1.6. Legal drivers

Altogether, 16 legal drivers were presented for discussion in the workshop (15 from Delphi-questionnaire; 1 added before the workshop by the project team). 1 driver was added by working groups. There were mentions for 15 drivers (total 14 mentions), and no mentions for 2 drivers (Table 15).

Table 15. Legal drivers.

Legal drivers	
Delphi	Workshop
Tight orders of environmental permits 76% (neg.effect 36%, positive 64%) Environmental laws in Finland 66% (neg.effect 26%, positive 74%) Weak expertize and differing interpretations of regulations of the permitting officials 62% Finland: Environmental regulations and permitting processes on the whole (incl. ISO-standards) 55% (neg.effect 31%, positive 69%) Estonia: Environmental regulations and permitting processes on the whole (incl. ISO-standards) 55% (neg.effect 25%, positive 75%) Environmental laws in Estonia 55% (neg.effect 31%, positive 69%) The weak preparation of the laws and regulations 54% Tax laws in Finland 45% (neg.effect 46%, positive 54%) Employment laws in Finland 41% (neg.effect 33%, positive 67%) Employment laws in Estonia 41% (neg.effect 33%, positive 67%) Tax laws in Estonia 28% (neg.effect 37%, positive 63%) Intellectual property (e.g. patents) 22%	Environmental regulations and permitting processes on the whole (incl. ISO-standards) (3); changes and restrictions weak preparation of laws and regulations (3) weak expertize and differing interpretations of regulations of the permitting officials (2) environmental laws in Finland (2) increase of protected areas (2) environmental laws in Estonia (1) New drivers in workshop good MSP planning process (1) No mentions in workshop employment laws in Finland employment laws in Estonia tax laws in Finland tax laws in Estonia tight orders of environmental permits intellectual property protection (e.g. patents)

Tight orders of environmental permits was the most important legal driver according to Delphi, however it was not mentioned in workshop at all. In Delphi, it was said that the knowledge of decision making officials and politicians about what is going on in sea area, its importance and agreed principles, is more important than the content of laws and regulations.

It reflects the discussion in the workshop and the number of mentions of weak preparation of laws and regulations, as well as weak expertize and differing interpretations of regulations of the permitting officials.

According to a study in Finland, environmental impacts are taken poorly into account in preparing the legislation. In 2014, 77 % of the Government proposals did not include any kind of environmental assessment. Only 4 % of them included quantified assessment of environmental impacts. (Kemiläinen and Keinänen, 2018)

Environmental regulations and permitting processes on the whole (incl. ISO-standards) was considered the main legal driver in the workshop. It is actually a concept that combines many of the unique drivers presented in Delphi-questionnaire and in the workshop. Employment and tax law related drivers were not discussed at the workshop. In Delphi they received also less support, but those who considered them saw their impact positive.

4.1.7. Relations between drivers

Because of limited time, links between the drivers were discussed at the scenario workshop in Helsinki only briefly. They were not asked in the Delphi questionnaire 2017 either, because the aim was to map the general views of panelists considering the drivers. However, Helsinki scenario workshop participants' opinion was that blue economy sectors are integrated between each other and the presented drivers are connected. They also noticed that there was not enough variation between the drivers. For example, condition of global and regional economic trends could be combined. It was noted that driving forces may be counteractive, and impacts are different for different blue economy sectors. In addition, it was not possible to say whether a matter is positive or negative; a matter may be good for blue economy, but bad for people or for the environment. Global megatrends can be combined with these drivers.

At the scenario workshop, links between the drivers were identified between the drivers as follows:

- political tension – co-operation – security situation in the Baltic Sea area
- increased political tensions – strengthening EU integration
- increasing traffic – disintegration of the habitats
- invasive species cause economic losses (e.g. fisheries)

In Delphi 2018 and Tallinn scenario workshop (January 2018), the consequences of the selected main drivers were assessed per each blue economy sector. The results give more in-depth indication on the importance of drivers both for specific sectors and for blue economy in all. The results are described in chapters 4.2.-4.5. In Delphi 2018, the panelists assessed possible effects of the three drivers they had selected. The respondents identified both effects, which link clearly with certain drivers, or jointly to several drivers. In Tallinn scenario workshop the participants of the working groups discussed the consequences of drivers for selected blue economy sub-sectors. The interviewees (2018) were not asked about consequences, however their responses are reported in the case that they mentioned issues connected with drivers and their consequences.

4.2. Futures of energy sector

4.2.1. Changes of energy sector and impact on the sea use

The Delphi rounds 1-2 (2017) and the first scenario workshop considered the energy sector as a whole, including all the subsectors (see Table 2). In Tallinn workshop, the working group on energy chose to focus on future of wind energy in alternative scenarios for Blue Growth. In Delphi rounds 3-4 (2018), the focus was on development of wind energy and other renewable energy sources. The interviewees were selected representing renewable energy modes, and one of them represented the energy sector as a whole.

The estimated changes on energy sector by Delphi panelists (2017) are presented in Figure 6 in absolute numbers.

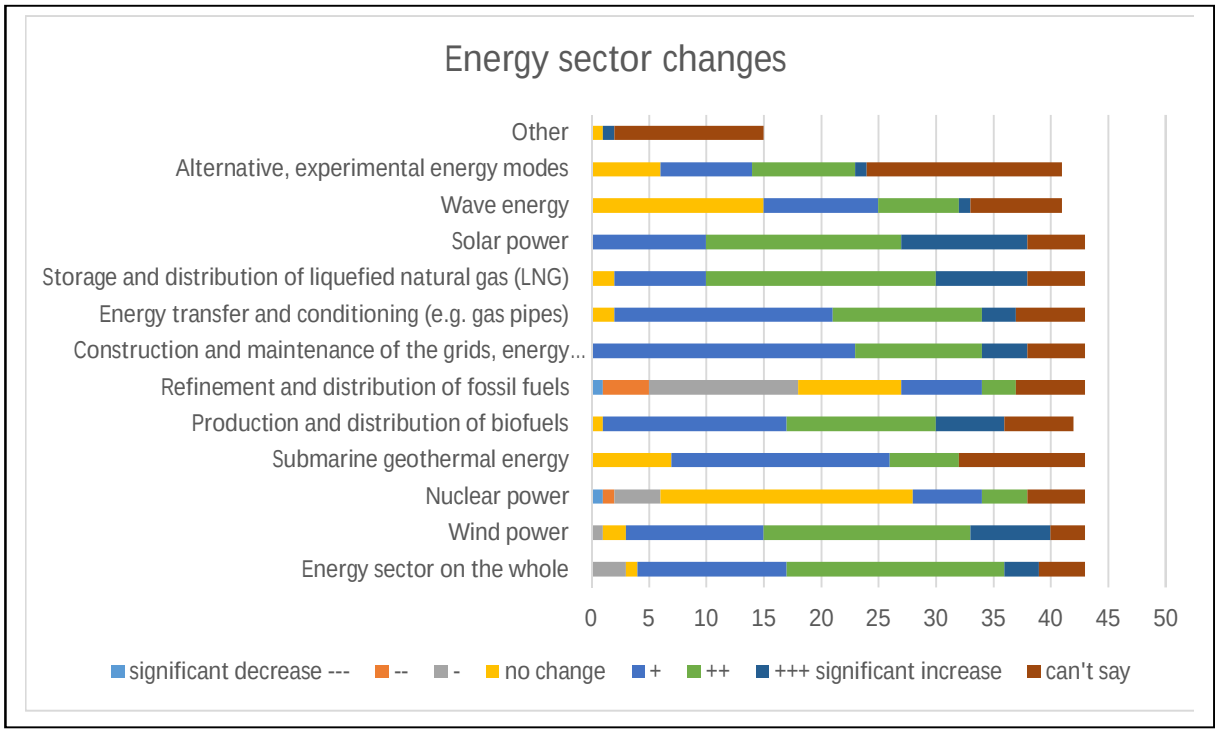


Figure 6. Distribution of opinions regarding the changes of production and other activities of the energy sector in the project area, both on land and on sea (onshore and offshore) by the year 2050. The results of on-line questionnaire from Delphi rounds I and II in 2017 (Annex I).

According to Delphi (2017), the entire energy sector is growing. From the respondents even 81% expect increase. On the scale of + slight increase /++ moderate increase /+++ significant increase, moderate or significant increase is expected by 51% of respondents. Among the energy sectors, solar power is expected to grow most, 88% of the respondents expect increase, and 65% moderate or significant increase. The second is wind energy - planning, building & maintaining, according to 86% and 58% of respondents. For construction and maintenance of grids, 88% of the respondents expect increase, and 35% moderate or significant increase. Storage and distribution of LNG, production and distribution of biofuels, energy transfer and conditioning and submarine geothermal energy are also considered having strong growth in 2050. The only energy sector with negative expectations is Refinement and distribution of fossil fuels, according to 42 % of the respondents. No change was expected for nuclear power by 51 % of the respondents.

Fossil fuels and nuclear power

The production of the renewable energy modes is estimated to increase while the refinement and distribution of fossil fuels should decrease (Error! Reference source not found.). The production of nuclear power should remain the same or decrease. On the other hand, the nuclear energy based on fusion reaction may maintain the share of nuclear energy if it is accepted. In addition, the energy production in dark and cold wintertime may still need nuclear power, if renewable or new forms of energy are not producing adequately energy. Another argument in the context of "Unlimited growth" scenario was that current investments into nuclear power plants will bind for decades (Delphi 2018). One interviewee considered unlikely that nuclear would be completely excluded from energy system. Keeping energy production stable has required fossil fuels: "We've invested a lot in renewable energy and gone back on fossil".

The nuclear power plant currently under construction in Olkiluoto would be still running in 2050 (Tallinn workshop).The current nuclear power sites in Finland, Loviisa and Olkiluoto (outside but near the norther border of the project area) are marked on the maps. No nuclear power is desired to Tallinn area but possible sites are near Kunda and Pakri Islands (Roose et al. 2017: Delphi maps). In "Unlimited growth" scenario, fossil fuel was expected to increase (+++) at Sillamäe-Narva region (Tallinn workshop). However, in Tallinn workshop nuclear energy in Estonia 2050 was considered questionable, due to high price of it. Development of clean technology for small and cheap nuclear power plants might change this.

Wind power

Development of energy consumption and possible innovations in energy technologies (e.g. nuclear fusion energy) influence also the need of building offshore wind energy. Mostly the wind power is marked to increase by the year 2050, while few anticipate no change or decrease (Figure 3). Many potential sites of coastal and offshore wind power were placed on the maps both in online questionnaire and in workshop (Roose et al. 2017: Delphi and combination maps). However, the wind power was also questioned, and the areas where wind power desired to decrease or to be totally banned were especially in the eastern part of Estonia, presumably because of defensive reasons, and in some sites of the Finnish archipelago areas, mostly because of nature or recreational values (Roose et al. 2017: Delphi maps). Possible future areas could be close to ports in Finland (e.g., Hanko, Turku) or near Inkoo which is already marked on Uusimaa regional plans (Roose et al. 2017: combination maps). Wind farms and parks could be developed in the southern part of the Archipelago Sea, which was mentioned as a good area for wind energy.

In Tallinn workshop, the map working group deleted the banned areas from Finland in "Sustainability above all!" – scenario, because in this scenario, the negative attitudes towards wind energy have changed. In addition, new wind power areas to Hanko region were added. Banned areas would still exists at Estonian side, in Sillamäe region for military reasons and because there is not enough wind. Military area between Loksa and Kunda would even extend from the one on "combination base map". In "Unlimited growth" scenario, nothing is banned and there would be no new conservation areas, the existing ones may stay.

In energy working group, it was discussed that potential areas for wind energy development will be mostly in West-Estonia; there is more wind, more shallows in the sea and less ice and better conditions than in Plan4Blue area. With new technologies, e.g. floating wind farms, there might be new ones also in Gulf of Finland, in completely different locations. According to an interviewee, large offshore wind farms far from coastline are needed, as small ones are not cost-efficient; set-up cost for offshore wind mills is high.

Energy transfer activities and infrastructure

The energy transfer activities and infrastructure (construction and maintenance of grids, energy lines and gas pipes) are estimated to increase slightly or moderately along with the increasing production of energy (Figure 3). As these require rather long planning and their lifetime is decades, the currently used and planned subsea gas pipelines in the middle of the Gulf of Finland from Russia to Germany (currently Nord Stream) as well as gas pipelines from Inkoo, Finland to Paldiski, Estonia (Balticconnector) were mentioned by all workshop groups. In addition, two submarine power cables between Finland and Estonia across the Gulf of Finland were mentioned (Roose et al. 2017: Delphi maps).

In Tallinn map working group, importance and use of pipelines was marked to increase in "Unlimited growth" –scenario (Nord Stream ++). New power cable (Estlink 3) to connect Inkoo-Paldiski was added in "Sustainability above all" – scenario, to go through new offshore wind farms and for multiuse purposes.

New interconnections can change the whole picture for energy sector. Desynchronization from Russia is planned through Poland and Lithuania; possible also via marine cables. In addition to Estlink 1 and 2, there could be also connection in the

eastern part of the Gulf of Finland. There could be mesh grid, combinations of several projects to make it economically more viable, e.g. build artificial islands with wind farms in between. For example, grid / cable connection developments from Hanko to Estonia.

Other renewable and alternative modes of energy production

Hamina was mentioned as potential site for LNG in Helsinki working groups, but in Delphi bigger ports in Finland were also marked as LNG sites, while from the vicinity of Tallinn it was wanted to be banned (Roose et al. 2017: Delphi maps). LNG may be seen as a provisional form of energy in particular for shipping.

The production sites of biofuels are marked mostly on shore near big cities and industrial clusters (Roose et al. 2017: Delphi maps). The whole coastal area both in Finland and Estonia is estimated to be covered with smart energy grids/systems. The storage of renewable energy was mentioned.

The use of solar power is unanimously estimated to be increasing (Figure 3). It is supposed to be important both in Estonian and in Finnish coastal areas, e.g. in summer houses. Solar energy would be produced all over, not at marine areas, more along the coast e.g. at rooftops (Tallinn energy working group).

According to Tallinn energy working group, importance of smart energy systems would increase (+++) in "Virtual reality" -scenario. In addition, grid for energy supply would improve.

Submarine geothermal energy is also supposed to increase and it was mentioned as alternative energy mode three times, but on the other hand, it was suspected to be too costly for extensive use.

Energy from waves and currents may be used if technology is to be developed. In the Southern Archipelago Sea there are potential sites of wave energy. This area has relatively high waves regarding the conditions elsewhere in the project area, but outside the most heavily trafficked navigation routes. Also in Delphi 2018, aside wind energy, wave energy was considered a renewable option on a longer time scale; however, it was noted that much development work needs to be done. According to an interviewee, there are few companies with market-ready technology. Recognition in national and international strategies would enable bigger projects and part in international electricity production.

Aside the geothermal (mentioned 3 times in Delphi 2017) and wave energy, other types of alternative energy forms mentioned were heat recovery, pumped hydro-accumulation power plant, energy from moving people, local solutions of circular energy, and solar-hydrogen solutions.

4.2.2. Main drivers on energy sector

In Delphi 2018, the drivers of energy sector as a whole were considered. Then panelists assessed possible effects of the three drivers selected, in particular for development of wind energy and renewable energy sector. In Tallinn scenario workshop (2018), the working group chose to focus on development of wind energy, and the participants discussed the consequences of drivers for wind energy in different scenarios. The interviewees were selected from renewable energy sector, and one interviewee represented energy sector as whole. Table 16 summarises the drivers identified with these methods.

Political drivers were considered the most important drivers for energy sector, according to combined results of Delphi 2018, workshop and interviews. Technological drivers gained second most mentions, and economic drivers third. The factors identified in the interviews for the development of energy sector reflect the same most important drivers, with slightly different order. Among interviewees, factors related to economic drivers gained second most mentions. One Delphi panelist assessed that all the drivers mentioned were extremely important from the point of view of wind energy. Altogether, except "urbanization", which had no votes, the drivers presented gained all mentions among Delphi-panelists. In addition, the respondents added 4 new drivers.

In Tallinn workshop, the working group selected the same five drivers as the most important for energy sector as was the result of Delphi round. They regarded drivers "Main energy options supported by energy and environmental policies" and "Environmental regulations and legal practices" to be partly overlapping, and which could be combined as one driver. Attitudes were considered to connect with policies.

The interviewees noted several factors related to economic drivers: development and changes of energy and electricity market, prices of energy on the market and unclear situation on energy market.

Among political drivers, the level of co-operation and stability on the Baltic Sea area has effect on energy sector, on production, transfer and use of energy sources. Unstable security situation in the Baltic Sea region would change the big picture. Connecting grids are expected to be important in the future. Different effects of climate change are drivers for energy and environmental policies, as well as aims to improve good state of environment. Environmental policies and legislation affect the scale of fossil or renewable energies used. In addition, government policies influence the main energy sources favored in Estonia and Finland. Relationship with Russia has an important role in energy policies. Global economy affects according to economic trends, as well as price development of energy.

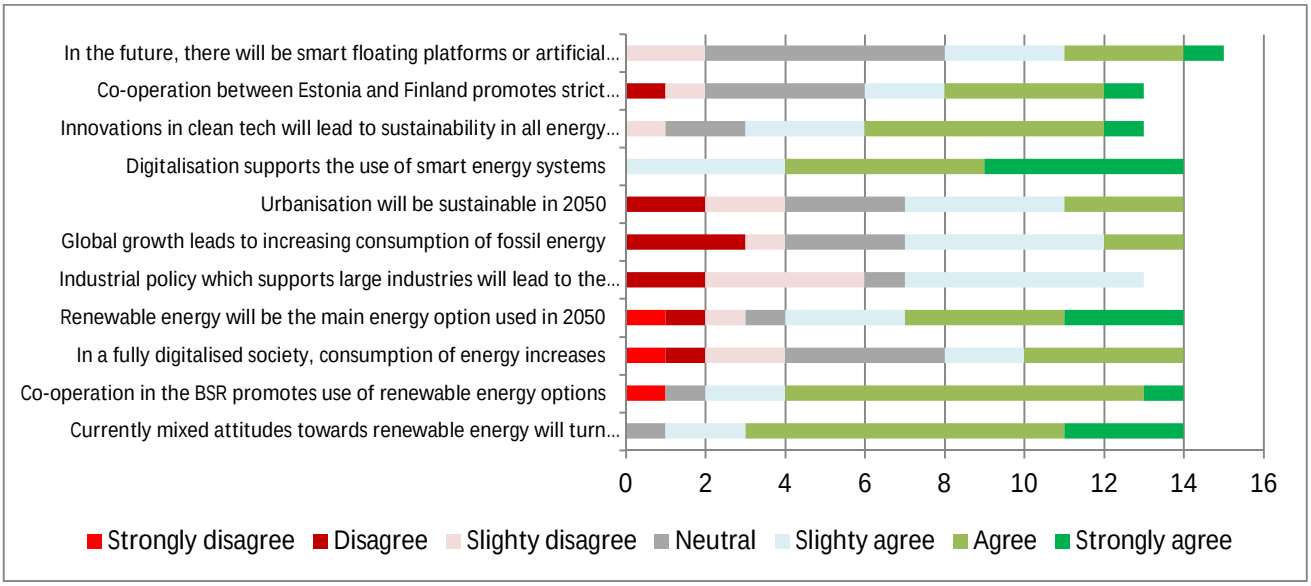
Table 16. Main drivers for energy sector

Driver	Delphi N=15	Tallinn workshop (main drivers)	Interviews N=3
Clean tech innovations for energy	8	1	3
Attitudes	7	1	1
Main energy options supported by energy and environmental policies	7	1	7
Environmental regulations and legal practices	6	1	2
Conditions and trends of global economy and globalization	3	1	1
Regional economic situation	3		
Co-operation in the BSR	3		
Industrial policy	2		
ICT – digitalization	2		2
Urbanization	0		
Other variable not mentioned above, please specify			
Subsidies	1		1
Price of energy, costs of energy infrastructure	1		2
Fiscal policy instruments, incl. taxation and subsidy policies	1		
Climate change, mitigation and adaptation	1		
New drivers from interviews			
Development of the energy and electricity market			4
Total	45	5	2

The attitudes of different stakeholder groups were mentioned: governments, officials (e.g. ministries), local communities, people, individuals, representatives of other sectors. They were considered to affect to what kind of regulation will be created, and whether renewable energy would be accepted as a new use for marine areas. Positive attitudes towards renewable energy sources would increase their demand on individual level. If electricity consumers become active partners, they will have more bargaining power, and energy companies have to consider more the wishes of consumers (interview, 2018). Political will of states and municipalities affects at least in some extent to investing and planning decisions.

At the workshop, attitudes were considered the most problematic force against development of wind energy in the sea and in coastal areas, both in Finland and in Estonia. Furthermore, it was estimated that people would not be against development of wind energy as such, but it is a NIMBY problem (not-in-my-backyard). Location of wind mills raises conflicts: "ruins businesses or tourism, military is also against it". Participants said that finding appropriate locations for wind farms is an issue and thus also part of MSP. Majority of Delphi-panelists, 79 %, assessed that attitudes towards renewable energy will turn mainly positive in next decades (see Table 17).

Table 17. Result of Delphi 2018 statements on statements for energy sector



Synergies for local people would solve attitude problems. It was assumed that in Finland all islands have national grid, and because of that wind farms would not be needed there. In Finland, the attitudes were considered to focus mostly towards location of windmills, not based to views on nature conservation. There are some wind farms in protected areas in Finland and they are generally accepted, whereas in Estonia there is a principle that no wind farms can be built in protected areas.

Main energy options supported by energy and environmental policies were considered to constitute a framework to which we are heading, and link with Environmental regulations and legal practices. Without any changes in the framework, the practices will not change. Low carbon or carbon neutral energy production was expected to be in focus in the future. Energy market is a regulated market, and thus regulation would be needed to conduct changes towards environmental goals. Regulation may set obstacles or give freedom for development towards carbon-neutrality. Renewable energy sector could be supported by a progressive energy policy, and legislation in the field of renewable energy might be enforced. Energy options supported and regulation, as well as ICT and digitalization, may provide options for safe energy and side products, as well as create markets for new technology including cleantech. Another impact would be less pollution, saving of energy and smart energy production. Statement "Renewable energy will be the main energy option used in 2050" was supported by majority of respondents of Delphi, 71 %.

Expansion of wind energy could be one possible consequence of policy and regulative drivers, combined with innovations in clean tech. Various tariff scenarios and their effects, growth pace of wind and renewable energy, and global competitiveness of energy intensive industries were also discussed as consequence of policies and regulation. In addition, price of carbon was proposed to be linked in promoting different alternatives. One Delphi-panelist stated that mainly the environmental sector should understand that renewable energy could co-exist with environmental restrictions, renewable energy being the most environmentally friendly way for energy production.

Regional economic situation and the economy altogether were considered important factors, in particular by the interviewees. Poor economic situation may be a limiting factor, with fewer possibilities for development. Economic reality was considered to determine doing and supporting; "alternatives which are not cost-efficient cannot be forever supported". On the other hand, subsidies were discussed as positive drivers: continuing subsidies for renewable energy would give entrepreneurs a necessary guarantee and added value for renewable energy production. Without large-scale support (investment subsidies, wind feed-in tariff) would the wind power not have been built as much as has been done so far. An interviewee noted that onshore wind has stabilized commercially, thus support should go to non-commercial, unstable technology to mature the offshore wind power to the same extent that onshore wind power is. Subsidies link economy

with policies, and with economic and policy drivers. Linked to industrial policy, one respondent assumed that production costs and development of electricity prices dictate potential methods of production.

Cooperation (in the Baltic Sea Region) was considered important, in particular in transferring knowledge about new systems: the more information the less anxiety. Cooperation will advance bringing different kind of EU politics to the national level, for example, between countries with functioning renewable energy systems. "Co-operation in the BSR promotes use of renewable energy options" was agreed or strongly agreed by 71 % respondents in Delphi 2018. Statement "Co-operation between Estonia and Finland promotes strict enforcement of environmental legislation" received support, too, but with less in per cent, 38 %, agreed or strongly agreed. "We are becoming much more integrated with other countries and moving towards producing energy where it is most efficient".

At the workshop, cooperation was considered difficult to grasp as driver; it was linked to discussion on energy policy. Geopolitical situation was mentioned to matter development of wind energy in Estonia. On the maps, ban areas marked for wind farms in Eastern-Estonia are for military reasons. EU has also impact on cooperation, depending on its existence in 2050. In Finland, wind power is discussed in the context of security of supply. Currently, 70% of wind power built in Finland is under Finnish ownership (interviewee, 2018).

Environmental drivers were not included into the draft futures table. They were not added by the Delphi-panelist or in workshop either. One interviewee added climate change, mitigation and adaptation as a factor affecting the development of the sector.

Table 18. Futures table for energy sector

Future images 2050	Sustainability above all!	Unlimited growth	Sustainability dilemma	Virtual reality
Attitudes	Positive attitudes towards renewable energy.	Attitudes towards environment and e.g. renewable energy options are negative or careless.	Polarization of opinions: e.g. wealthy / education urban population for renewables, others against	Enthusiastic attitudes towards new energy products and technologies; will solve sustainability crisis.
Co-operation in the BSR	Intense, good co-operation of all BSR states. Politically stable and secure BSR. Co-operation in energy production and transfer, energy networks.	Increased political tensions in the BSR. Nationalism. Less co-operation. Local and national energy sources used.	Co-operation in BSR (between the EU member states and Norway), with less participation from Russia. Regional co-operation in energy issues, with selected partnerships.	Virtual world has decreased emphasis of traditional international relations. Transnational relationships between individuals, groups, and business are important.
Main energy options supported by energy and environmental policies	Favoring of renewables in energy production. Decarbonisation.	Traditional fossil fuels used; favoring of centralised energy production e.g. nuclear.	Mixed policies, new and old energy production exist side by side, hybrid energy sources.	New renewable technologies in use (e.g. fusion energy). Increasing need for energy and smart systems.
Environmental regulations, legal practises	Strict environmental legislation is in effect, and enforced by the authorities.	Environmental legislation is not in the focus, and enforcement is weak. Weak preparation of laws and regulations.	Strict environmental legislation is in effect, but it is enforcement is weak and interpretations vary.	Changed needs for legislation; ad hoc – legislation.
Industrial policy	Service-based society.	Favoring of big industrial plants and production sites which need massive amount of energy.	SMEs and local production supported.	Digitalised society
Conditions and trends of global	Local production, saving of energy.	Global growth, increasing need for energy.	Poor global economy, self-sufficiency in energy.	Global growth based on services and virtual products.

economy, globalization				
Regional economic situation	Blue growth in BSR	Degrowth in BSR.	Modest blue growth, struggling blue business.	Virtual economic flourish in BSR.
Urbanization	Sustainable urbanisation and centralisation of population.	Rapid, unsustainable urbanisation and centralisation of population. Polarisation of populated areas to "good" and "bad".	Balancing between urbanization and living on countryside.	Slow urbanisation process, distant and flexible working from remote areas.
ICT – digitalization	Efficient interaction of different "smart" technologies (ubiquitous).	Development of "ict", "digi" and "smart" but no interaction between the systems e.g. in Finland and Estonia, in the BSR.	Distributed systems: small energy units used in remote districts; self-sufficiency	Automation, robotics used on energy sector.
Clean tech innovations for energy	Innovations in energy technologies (e.g. nuclear fusion energy); floating wind farms and solar power stations, hybrid solutions use wave energy. Smart energy grids.	Few innovations, current technologies used in energy sector. Use of old technologies e.g, nuclear, centralized energy production.	Slightly modernized technologies used. Offshore wind energy.	New unknown technologies; smart energy grids.

Weak signals for energy sector:

Enlargement of areas with nature conservation restrictions, more strict rules (including over-regulating of use of water and water areas)

Energy consumption – different fuels and energy sources.

Black swans for energy sector

Dependency on energy; energy transmission systems are a possible target for terrorist or crime - terrorism towards power plants

Environmental activism or terrorism, serious disturbances in the distribution of electricity

Substantial oil accidents

Nuclear disaster

Major collapses (e.g. EU collapse, collapse of a nation, overall society collapse for various reasons, environmental catastrophes). Big crisis – global disaster!

Crisis that does not result in total collapse

4.2.3. “Sustainability above all!” - scenario on Energy sector

Main drivers for the sector	Future image	Pathway
Clean tech innovations for energy Attitudes Main energy options supported by energy and environmental policies Environmental regulations and legal practices Conditions and trends of global economy and globalization	Strong environmental policies and legislation have led to decarbonisation. Smart, distributed energy production; renewable energy sources are used. Saving of energy; optimization of energy use. Innovative clean-tech –based energy production.	The attitudes of all, citizens and political decision makers, will change remarkably. Decisions will be based on scientific knowledge. Strong environmental policy and legislation will be introduced: new stricter targets and environmental taxes. New innovations for saving energy.
“Environmental awakening”		

Opinions of Delphi-round, scenario workshop and interviewees

The draft sustainable scenario was accepted by the experts, with no specific opinions against it. To reach this scenario, attitudes, both of citizens and political decision makers should change sufficiently and extensively among people. The attitudes will change as people will realize that decarbonisation and reduction of emissions is needed to gain the good state of environment and to slow down climate change. The scientists and the decision makers of the future will get a solid scientific base towards sustainability already at school. There will be new innovations for saving of energy; for example personal energy calculators which promotes responsibility of people and business. Regional and local awareness increases. Decisions will be taken towards sustainability: strong environmental policy and legislation will be introduced; new stricter targets will be agreed on; and environmental tax system will be introduced. State(s) will develop hybrid grids. In 2020, Pan-European energy auctions will be arranged. High CO_2 price will promote sustainable development policy. Further major technological innovations for wind energy will be introduced in 2035; e.g. floating offshore wind farms, which will be located in the middle of the sea. Efficiency will be increased. Wind farms will be ice-proof, which will considerably widen the choices for possible locations. In 2040, no fossil fuels will be used anymore, but totally renewables, which may happen earlier because of the price.

Upheaval in energy production and consumption would be needed. For that, energy saving campaigns should be realized. To enable people to lower their energy consumption, companies could support that with their products and applications, e.g. digital systems which survey energy consumption. Immediate political decisions would be needed to promote renewable energy. Altogether four Delphi panelists argued that change of attitudes would be the key to change towards sustainability. However, reason for this kind of change in attitudes of consumers might be environmental catastrophe. “Environmental awakening” would e.g. restrict the use of plastics and recycling of plastics would be daily and ordinary. In order to achieve and strengthen the goals on sustainability, the scientists and the decision makers of the future should get a solid base already at school. The change would start from children – they are the key to our future. If electricity consumers become active partners, they will have more bargaining power, and energy companies have to consider more the wishes of consumers.

Four respondents in Delphi 2018 argued that a regulative way will be needed to proceed: strong environmental policy and legislation. Not only campaigns but environmental tax system was proposed, which would drive consumers vigorously to energy saving. Society would have to tax natural resources: energy and raw materials. It was even proposed that instead other taxes, all governmental budget income should be collected from energy and natural resources tax. Implementation of this tax would lead people to start optimizing their systems and saving energy immediately, as energy would cost 2-3 times more for final consumer, and for the business sector. Another proposal was that fossil, wood, wind and other not- or half clean energies production must be taxed with energy tax. Two interviewees discussed on stronger regulations and

policies: "Sufficiently strong renewable energy growth objectives for 2030 and 2050 would change the situation, not individual trial-type projects. According to one interviewee, energy market is a regulated market, regulation is needed to reach and conduct the changes towards environmental goals. Another interviewee noted that climate policy will be more strict, and carbon price more expensive.

Abolition of all subsidies, direct and indirect, to fossil fuel industry was also proposed to take place; instead, there should be promotion of investments in sustainable energy for innovations in cleantech and investments in smart grids. E.g. support for renewable energy pilot programs, such as DG Energy's support package for islands (https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-eu-islands). According to one respondent, solar-hydrogen solutions, hydropower from natural rivers (like in Norway) and nuclear energy should be the only supported energy sources. Green energy sector should be strong. An interviewee stated that support should be dedicated to offshore wind; to non-commercial, unstable technology to mature the offshore wind power to the same extent that onshore wind power is. Otherwise, the interviewee considered that support mechanism for renewables is in the end and production would be by market terms and conditions.

"By scientific base, without political limitations". Science-based policy and incentives were called for - confessing the fact of photosynthesis by growing biomass / vegetation as a main solution to remove CO_2 from the atmosphere, and the way to carbon-neutral energy. Decarbonization should be seen as recarbonization, recycling of carbon by renewables. The Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (LULUCF, https://ec.europa.eu/clima/lulucf_en) would give space for CO_2 removals. In addition, it was mentioned that emission allowance price seriously guides energy production.

Cooperation with other sectors and between other countries was also proposed as leading to "Sustainable above all!" scenario, which would be reachable only through global agreements. Timing depends on a global wake-up call and US policies. Possibility for decarbonisation was considered smaller globally than in the Baltic Sea Region.

In the workshop, energy sources in sustainable scenario in 2050 were discussed. Offshore wind farms would not be the only option; there would be a renewable energy mix, aside wind also other sources like biomass would be used. Fuel from algae (biodiesel) + cleaner water – some pilot projects are already ongoing. The nuclear power plant in Olkiluoto currently under construction would be still running in 2050. Probably no completely new ones would be built.

Pathway towards "Sustainability above all!" from the point of view of wind energy

- Compromise between nature conservation and wind power will be reached in 2020's, which means that areas will be easier to be found for offshore wind energy. This will enable easier planning policy. New protected areas would not exist only if there will be data which is needed to establish them.
- In 2020, Pan-European energy auctions will be arranged. CO_2 price will go up (or other policy), which will promote sustainable development policy. Large scale demand side management.
- Year 2025 will be the turning point. Grid parity will be reached, which means that offshore wind energy can be produced without subsidies, against the market price. There will be new innovations for saving of energy – for example personal energy calculators which promotes responsibility of people. Also regional and local awareness increases. 2000MW offshore wind will be reached and state will develop hybrid grids.
- In 2030: there will be technological innovations in turbine and radio surveillance, and due to that decreasing number of collisions with birds and bats. New détente will be reached: geopolitical change with reduced political tensions with Russia. Geopolitical conflicts between wind farms and radar surveillance will be solved.
- Further major technological innovations for wind energy will be introduced in 2035; e.g. floating offshore wind farms, which will be located in the middle of the sea. Efficiency will be increased. Wind farms will be ice-proof, which will considerably widen the choices for possible locations.
- There will be more hybrid power cables, e.g. from Hanko to Paldiski, and some wind farms on the way will be connected with them via additional synchronising cable through wind farm.
- In 2040 no fossil fuels will be used, but totally renewables, which may happen earlier because of the price.

- 2045: magic innovation technology; e.g. invisible wind turbines; technology avoiding collisions with bats and birds

There could be some multi-use platforms.

4.2.4. "Unlimited growth" - scenario on energy sector

Main drivers for the sector	Future image	Pathway
Clean tech innovations for energy Attitudes Main energy options supported by energy and environmental policies Environmental regulations and legal practices Conditions and trends of global economy and globalization	Economic growth is based on the use of traditional fossil and nuclear energy. Heavy industrial production maintains centralized energy production, current and old technologies are used. Weak environmental legislation.	No commitment to promote sustainability via international agreements or EU regulations. Because of fast economic growth existing energy infrastructure will be used. In Finland, current investments into nuclear power plants will bind for decades and hinder the development of renewable energy production
"Nothing will be done, no decisions will be made, and thus the current state will continue"		

Opinions of Delphi, workshop and interviewees

This scenario received critical comments in particular at the workshop. It was considered too caricatured, because the draft scenario was based only on fossil fuels. Using old technologies and lack of innovations if there is economic growth was not considered logical. On the other hand, majority of respondents in Delphi did not propose any changes into the scenario. In fact, one Delphi-panelist considered "This description is quite near to "business as usual". Only one respondent did "not believe in these statements". Workshop participants argued that the scenario might be realized but the combination is unrealistic, just a combination of existing threats. More 'smart thinking' was called for into this scenario. Talsinki and tunnel, bridge or dam were also proposed to be added. Slight changes were done to draft of "Unlimited growth" scenario based to expert opinions; the cell in futures tables was changed to include "Few innovations" and rapid, unsustainable urbanisation was added in the futures table.

However, the aim of this alternative scenario is to remind on possibility of negative, unsustainable developments. When knowing about possibilities leading to worse developments, they may be prepared for, and they might also be avoided. "Nothing will be done, no decisions will be made, and thus the current state will be continued" would lead towards this scenario. There is no political will to develop sustainability on energy sector or lead to society towards sustainability. Attitudes would not matter as planning is not anymore democratic. The international agreements and commitments exist, but environmental legislation will weaken; there will be very creative application of impact assessment. There is no commitment to promote sustainability via international agreements or EU regulations. Uncommitted decision makers do not dare to look forward, instead they conveniently follow old patterns and stay in the way of the development. Status quo will lead to a path of least resistance, i.e. traditional energy production. "Post-truth" knowledge, which is not natural science based.

Currently, fossil carbon has no price in climate agreement. Policy instruments are not used in pricing of carbon, or to introduce a "user pays" principal.

Another reason for Unlimited growth –scenario (Delphi 2018), would be very fast economic growth, fossil fuels would continue to be used, as otherwise there would not be enough energy available. In addition, the infrastructure supports centralized production. This was also noted by one of the interviewees: "The rules of the energy market were built for the old world where there was centralised production between few parties…Now the market share of the renewing and varying production will grow strongly." Use of biomass from forest would reduce the need to use marine energy sources as renewable energy. In addition, damaged infrastructure would lead to this, as biomasses needs to have infrastructure to be removed. This comment may be linked with poor state of road infrastructure, in particular on the countryside of Finland, which has been discussed a lot recently and which may impact on transport of biomasses from the forests.

Current investments into nuclear power plants will bind for decades. Nuclear power will continue to be used, and Hanhikivi nuclear power planet will be built in northern Finland. It was noted that in any case nuclear would stand for a major part of energy production – as was written in the scenario. This might be the case in Finland. In the workshop, nuclear energy in Estonia 2050 was considered questionable. It is not competitive because of high price, and because of this, even weak environmental legislation would not change the situation. Development of clean technology for small and cheap nuclear power plants would change this. In Finland, small scale nuclear energy has been discussed. (HS 13.2.2018).

In "Unlimited growth" scenario, more support would be granted for fossil energy and there would be less support or investments for renewable energy solutions or innovations. One Delphi panelist referred to continuation of non-transparent tax, grant, support and other EU-current financial systems, which "supports energy and resource wasting, bureaucracy and irresponsible behavior of organizations and persons". Cheap fossil energy delays change. Energy above all others – attitude matters: there is no common effort to reduce energy demand.

Related to attitudes, consumption-based lifestyle will continue. Popularity of air travel has increased exponentially, and it is available for great masses. Nobody wants to restrict increasing tourist flows from China, as tourism has become an extremely important business for Finland - the backbone of national economy. Protection of some areas will be resolved, and new ones will not be established.

Pathway – Unlimited growth of wind energy

"Compromise between nature conservation and wind energy is not needed"

- Already in 2020 grid parity will be reached. This will lead to kick-off for development of wind energy, to major interest of banks to finance wind energy. Huge public subsidies were not considered a likely option.
- Unlimited support from the government for renewable energy - not monetary support, but rather political support and lobbying. Support for wind and wave energy.
- Environmental legislation will weaken: all legislation on impact assessment will be abolished or there will be very creative application of impact assessment; it is carried out but it does not have any impact on decisions. Attitudes do not matter as planning is not democratic anymore in "Unlimited growth" scenario. There are no more protected areas, or no new ones will be established.
- Better and extended grid (grid enforcement) will be realized in 2025, to enhance unlimited growth of wind energy.
- Technological innovations will allow making production of wind energy cheaper – higher turbines, longer blades. More wind is ensured because of climate change as of 2025. Because of good wind energy technology, EU will prohibit all fossil fuels and nuclear energy. No oil shale will be used anymore.
- Peaceful situation, all the other sea uses except wind energy will be banned in Gulf of Finland. No military surveillance will be needed, as Russia will join NATO. There will be no need for strategic military areas, and wind farms can be located everywhere. Russia will give up pumping gas and therefore no gas pipeline will be needed. The situation is so positive that we have joined Russia by a democratic decision and Russia has adopted wind energy strategy.

4.2.5 "Sustainability dilemma" on energy sector

Main drivers for the sector	Future image	Pathway
Clean tech innovations for energy Attitudes Main energy options supported by energy and environmental policies Environmental regulations and legal practices Conditions and trends of global economy and globalization	New and old energy production exist side by side, decarbonisation has not succeeded. Aim to self-sufficiency in energy production. Slightly modernized technologies used.	Political budget-support and financial systems are too interlinked, corrupted, and there is no interest in change. Weak development of global economy will affect development. The political situation in neighboring area leads to highlighting energy self-sufficiency, slowing down development of alternate production and its promotion.
"Balancing between different interests"		

Opinions of Delphi, workshop and interviewees

This scenario had firm support both from Delphi panelists and at the workshop. It was described as "Description of the current state of affairs"; "I can imagine this scenario be realized if we do not actively work against it. If we just continue the way the development is heading this is where we land". "It's happening already today, balancing between different interests"

The reasons mentioned were international differences, on which path to choose, and policies used to steer towards sustainable future. International agreements will not proceed due to geopolitical disputes. Political budget-support and financial systems are too much linked, corrupted, and not interested of change. Political situation in neighboring area leads to highlighting energy self-sufficiency, which slows down development of alternate production and its promotion.

Such as in "Unlimited growth -scenario", the views reflect that weak political will, or not enough common will to lead towards sustainability. Targets are not clear, and there is no devotion on piloting of cleantech innovations. As a reason for this was mentioned that political budget-support and financial systems are too much linked, corrupted, and not interested of change. "All decision-making positions have been manned with people who are not able to understand what they decide or too fearful to decide at all". "If energy sector would understand, that the only option is to change to clean and sustainable production or pay their asses off, they would invest in new technologies".

Decision makers are unwilling to change old systems; young people primarily interested in economic growth at the expense of environmental issues; there is no willingness to co-operation. Lack of knowledge. With increasing energy efficiency and evening out production peaks (carrot and stick for the citizens – fiscal guidance) it is tried to decrease emissions of fossil energy.

Economic reason pointed out was weak development of global economy that has taken ground on development. ROI of smart and green energy investments is not enough to overtake fossil energy. CATNAP attitude (cheapest available technology narrowly avoiding prosecution). While this is possible, no one will invest more than the minimum to meet the requirements. Continuing use of fossil fuels is based to their advantage that they can be stored and easily used, although they are imported energy.

4.2.6. “Virtual reality” scenario - extensively digitalized future – on energy sector

Main drivers for the sector	Future image	Pathway
Clean tech innovations for energy Attitudes Main energy options supported by energy and environmental policies Environmental regulations and legal practices Conditions and trends of global economy and globalization	Extensively digitalised society: need to use natural resources changes because of changing human behaviour. Enormously increasing need for energy. Major breakthrough in smart grids has been reached.	Strong governmental support for digitalization and virtual solutions leads to further digitalization and greater need for energy. Internet of Things monitors energy consumption in every device and spot. Later a fully digitalized future means a decrease in energy consumption, due to decrease in mobility. Smart, decentralized systems, grids and pipelines will be developed. Support for rural areas and expanded opportunities for distant working will increase. People consume much less.
“Extensively digitalized society”		

Arguments of Delphi, workshop and interviewees

In Delphi, this scenario was considered as a bit Sci-Fi scenario. Fast population increase was mentioned as one reason for development towards “Virtual reality”.

There were varying opinions on the amount of energy needed at a full digitalized society. At the workshop, it was discussed that reason for enormous increase of energy need might be that each type of energy is needed if energy demand is high. Need to energy depends on how IT technology will be developed. Need for electricity may increase because of digitalization, although in principle, technology development should increase energy efficiency and decrease the need of energy. Decrease in mobility might mean decrease in energy consumption. Strong governmental support for virtual solutions would lead to further digitalization and greater need for energy. One interviewee noted that need for electricity will increase e.g. due to replacing fuels in transport with electricity. In Delphi 2018, statement “In a fully digitalized society, consumption of energy increases” was agreed by 43 %, whereas of the respondents 29 % disagreed. 29 % of the respondents had a neutral opinion on this.

Another reason for increased energy mentioned was that new digital technologies would increase so fast that there is no time to pay attention to consumption of energy of these technologies. On the other hand, producers have pressure to minimize energy consumption e.g. due to battery endurance. In a virtual scenario, people would consume much less. Internet of gadgets will monitor energy consumption in every device and spot. “And there must be always a person, who is financially responsible for consumption - a payer of energy tax. When this is done, wasting of energy is gone.”

In the case of renewable energy is used more extensively, the grid needs to be partly renewed. There will be more energy interconnections, grids, and links; big grid is the best battery. One major breakthrough in smart grids would be needed, which will provide compelling evidence. Infrastructure, broadband access is available everywhere. Resource efficiency is very high. Rural areas are active. There is greater support for rural areas and expanded opportunities for distant working. Software development will be needed to support this. Strong focus on renewable energy technology at universities and colleges, and granting of excellence resources for programs supporting that would also support pathway towards “Virtual reality”.

Full or extensive digitalization may enable development of massive energy efficiency, but makes systems very vulnerable to disturbances. This may be exploited in uncertain global situation. Society is stagnated time to time, until the systems will get operational again. Electrification has been taken extremely far, however that does not mean emission-free production of electricity.

4.2.7. Assessment of the alternative scenarios on energy sector

In Tallinn workshop, the participants of energy working group assessed that the future in 2050 would be "something between" scenarios "Sustainability above all" and "Virtual reality". No decisions done may lead to scenario "Unlimited growth" or to continue the business as usual, "Sustainability dilemma". Notably, "Unlimited growth" was understood to be a "business-as-usual" scenario by one Delphi panelist. The responses may reflect that the policies, support system is unclear or biased towards different energy modes, as written by one Delphi panelist: "Instability and uncertainty give rise to attitudes not striving to Blue Growth." One reply referred to "continuation of non-transparent tax, grant, support and other EU-current financial systems, which supports energy and resource wasting, bureaucracy and irresponsible behavior of organizations and persons". In scenario "Unlimited growth", attitudes are careless, they will not change positively towards sustainability.

In Delphi 2018, most of the respondents considered that "currently mixed attitudes towards renewable energy will turn mainly positive in the next 10-20 years" which would indicate development towards the scenario "Sustainability above all". In addition, renewable energy was considered to be the main energy option used in 2050 by majority of Delphi-respondents. Also different strategies support decarbonisation and use of renewable energy. By 2050, the EU aims to reduce greenhouse gas emissions by 80-95 % by 2050 compared to 1990 levels (COM, 2017b). In addition, the aim of the EU is to meet half of the EU's energy needs by renewables by 2030, from 29% in 2014 (COM, 2016b). Figures of Finland and Estonia on meeting the aims of EU towards use of renewable energy support this trend. The share of renewables in Finland is 39.3 % and in Estonia 28.6 % (Eurostat 2017).

However, share of renewables from marine sources is tiny. In total energy consumption, the share of wind power is still 1.3% (source). Marine energy and wind energy are not at focus of the Finnish government's report the National Energy and Climate Strategy for 2030 (TEM 2017), nor enlisted in the actions of to achieve EU 2030 objectives (Energiateollisuus web page 2016). The greatest opportunities are seen in liquid biofuels and biogas (TEM 2017). In Estonia, the "Renewable Energy Action Plan Until 2020" foresees an investment support for marine wind farms installed but only by 2020. (Majandus- ja Kommunikatsiooniministeerium, 2010). The Estonian National Development Plan of the Energy Sector until 2030 (2017) aims to reach the targets without additional national support, under open electricity or heat market conditions.

International agreements and regulation matter. Cooperation with other sectors and between other countries was considered to lead to "Sustainable above all!" scenario, which would be reachable only through global agreements. "Co-operation in the BSR promotes use of renewable energy options" was agreed by 71 % respondents.

Continuation of global growth might lead to scenario "Unlimited growth". Statement "Global growth leads to increasing consumption of fossil energy" was agreed by 50 % of the respondents, and disagreed by 29 %; in this case, 21 % had a neutral stand. There was no clear opinion on how the size of industry matters. "Industrial policy which supports large industries will lead to the continuing use of fossil energy" received varying opinions: none of the respondents agreed or strongly agreed, 46 % slightly agreed, 31 % slightly disagreed and 15 % agreed or strongly agreed with the statement.

In Delphi, it was discussed that current energy modes chosen, in particular decisions on nuclear energy will reflect into the future. There were varying views in workshop discussion regarding position of nuclear energy in 2050, and situation is different in Finland and Estonia. In Finland, Olkiluoto is being built, and Hanhikivi planned. In Unlimited Growth scenario at tourism sector, new nuclear power station would need to be built.

One interviewee mentioned that nuclear capacity will "at some point come to the end of the road", and their operation has not been indicated. Nuclear energy (depending on the political and public support) is one of the main solutions to fighting climate change according to BASREC 2012. (ref. 1.8.1.) The report states also that wind power will likely "play a much greater role" in the Baltic Sea Region in the future, both onshore and offshore.

According to one interviewee, a lot has been invested in renewable energy, and simultaneously we have gone back to fossil because production needs to be kept stable. Another interviewee assessed that bioenergy is a big renewable energy source in Finland, hydropower has been installed and wind power has a good chance to increase it. The interviewee considered that it would be unlikely to abandon nuclear, and it is optimistic to say that it would be completely excluded and replaced by renewable energy in 2020-2030. One of the interviewees said that use of renewable energy sources will increase (biomass, wind, solar) as energy storage measures will be developed. In Estonia, oil shale would be used more for producing oil than for electricity. One interviewee noticed that energy production at sea should not be only discussion of offshore wind, and harmful effects of energy production. There are positive impacts, too, such as that wave energy installations work as a sort of artificial reef for fish and sea animals that stimulate the local greener.

On the other hand, "Digitalization supports the use of smart energy systems" was agreed by 71 % respondents (agreed or strongly agreed). This might lead to use of several energy options in case of the scenario "Virtual reality". In Finland, Digital infrastructure strategy 2025 by the Ministry of Transport and Communications "specifies Finland's technology-neutral broadband objectives for 2025 and the means by which they will be achieved". "The strategy is in line with global development trends, such as augmented reality, the Internet of Things, automation, artificial intelligence and M2M communication." Thus in Finland, there is strong governmental support for virtual solutions, which was noticed in the context of "Virtual reality" scenario.

Position of wind energy in the alternative scenarios

Position of wind energy was discussed at Tallinn workshop. In scenario "Sustainability above all! ", offshore wind farms would exist, but there would be a renewable energy mix, other sources like biomass would be used. In "Unlimited growth" scenario, wind energy might have a strong position, unlimited growth of wind energy. On the other hand, if nuclear and fossil energy would be used as energy options, there would probably be no wind energy at all. In "Sustainability dilemma" scenario, balancing between fossil fuels and renewables would be possible with some expansion of wind energy, but not as much than in scenario "Sustainability above all!". Facilities will be much more modern and less polluting because the old power plants will have to be replaced by 2050, and there will be innovations.

Floating offshore wind is now ready to be deployed into the market (Wind energy in Europe).

According to Estonian energy sector development plan until 2030, part of the energy used will be fossil; also probably in 2050, however, efficiency of using fossil fuels will be doubled. No big industrial wind farms in protected areas. "Aim to self-sufficiency in energy production" in "Sustainability dilemma" may also promote or increase the share of wind energy. Limits of growth for producing wind energy in Estonia was noted: by 2050 several offshore wind farms will be most probably built in Estonia that produce 2 000-3 000 MW, which is enough energy – there will not be much room for new power plants. However, Estonia has the aim to achieve energy independence by 2030 (ENMAK 2030) which may affect to decisions on wind energy onshore and offshore.

In "Virtual reality" scenario, new unknown technologies, or current technologies will be developed further, e.g. safer and cleaner nuclear energy – or maybe only "virtually safer". Wave energy is not possible with current technologies, but major innovations in future would change the situation. E.g. technologies which would make short waves more efficient.

For wave energy, recognition in national and international strategies would enable bigger projects and part in international electricity production (interviewee, 2018).

According to business interviewee, the period is unstable. There is uncertainty regarding how electricity prices and market prices will develop, and production investments have a long lifespan. "The old doesn't work but the new hasn't been brought in yet". In this situation, investing is incredibly difficult because of uncertainty on e.g. development of electricity

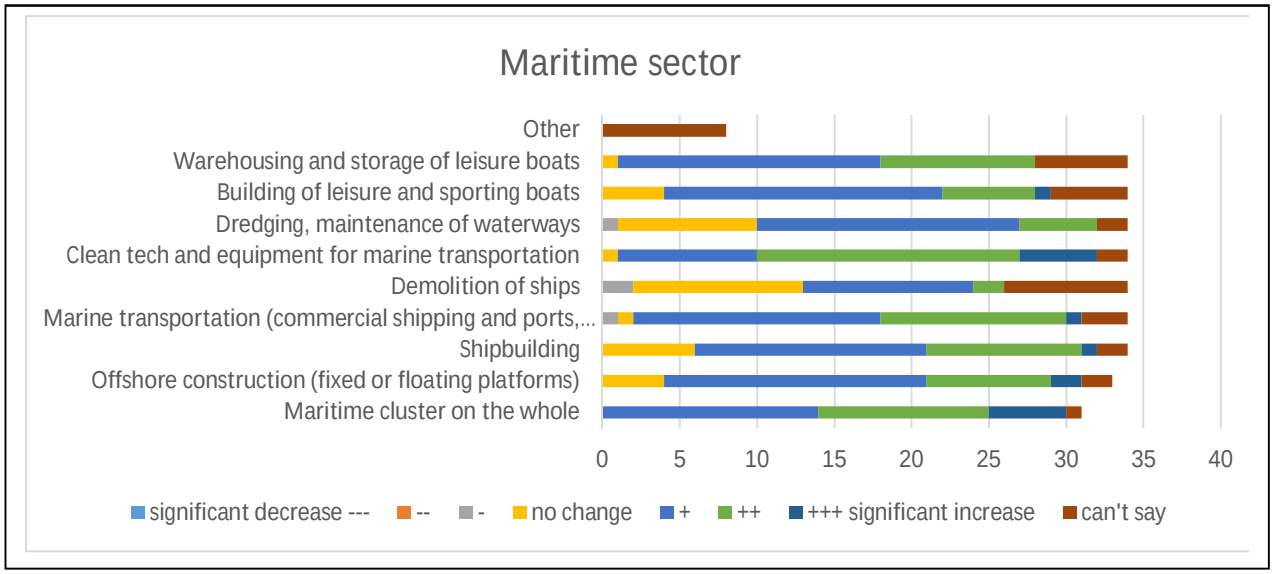
prices and market prices. Sufficiently strong renewable energy growth objectives for 2030 and 2050 would change the situation, not individual trial-type projects.

4.3. Futures of maritime cluster

4.3.1. Changes in maritime cluster and impact on the sea use

The Delphi rounds 1-2 and the first scenario workshop considered the maritime sector as a whole, including all the subsectors (see Table 2). In Tallinn workshop, the maritime working group chose to focus on future of maritime transport in alternative scenarios for Blue Growth (see Table 3). In Delphi 2018, the panelists were asked to focus on development of maritime cluster in general. The interviewees were selected among ports and ship owners, and their associations.

Figure 7. Changes in maritime sector (result of Delphi 2017)



The activities of the maritime cluster as a whole were estimated to increase until the year 2050 (Error! Reference source not found.). Growth is expected for the entire maritime cluster by 97% of respondents and 52% of them consider the growth moderate or significant. Strongest growth is expected among the sectors of cleantech according to 91% of the respondents, 65% consider it moderate or significant. It is followed by marine transportation; 85% of the respondents expect growth, and 38% of them consider it moderate or significant. For offshore construction, 82% of the respondent expect growth; however, only 27% of them consider that moderate or significant. For shipbuilding, 74% expect increase and 32% consider that moderate or significant. Warehousing and storage as well as building of leisure and sporting boats are also expected to be strong growth sectors. For dredging, maintenance of waterways, 65% of the respondents expect growth, however, only 15% expect the growth to be moderate or significant. Demolition of ships was not considered a growth sector, only 38% of the respondents noted increase. Also the interviewees considered the future of shipping positive, depending on the economic factors.

Ports

The increase of the activities of the maritime sector as a whole were indicated in the vicinity of Turku and Naantali, Hamina and Kotka region as well as near Loksa (Roose et al. 2017: Delphi maps). It was suggested in Helsinki workshop that the number of the Finnish ports would probably decrease by the year 2050, because the Finnish population probably centralizes in southern Finland. At least the big ports of the Southern Finland should remain in 2050, in particular those ports that have passenger traffic: Hamina-Kotka, Helsinki and Turku. Ports were estimated to remain also in Loviisa, Sköldvik, Hanko, Naantali and Uusikaupunki. Use of cargo ports would increase at Uusikaupunki (++), Naantali (+), Hanko (++), Loviisa (++) in “Unlimited growth” scenario (Tallinn maritime working group).

Ports of Inkoo and Kantvik were questioned by Helsinki workshop participants. Tallinn maritime working group deleted cargo port of Inkoo in “Sustainability above all!” scenario. The changes of the industrial production in Finland affect the marine transport and the ports (e.g. the changes of the paper and wood industry because of the digitalization was suggested in the workshop).

Also in the interviews, enlargement of the ports and specialisation of smaller ports was mentioned. Demand for port was considered to remain even in the future.

On the Estonian side the ports of Tallinn, Sillamäe, Kunda, and Paldiski were thought to remain in 2050. The main fairways from ports are connected to these ports (Roose et al. 2017: combination maps). Total ban for expanding a port was posed for Paldiski. (Tallinn maritime working group). Passenger transportation to Port to Hanko, maybe to Paldiski was estimated in "Unlimited growth" scenario. (Tallinn maritime working group). Loksa would not be a passenger port in "Virtual reality" scenario (Tallinn maritime working group).

Altogether, new service possibilities were identified at Tallinn working group, consisting of multiuse of (bigger) ports and mobility for:

- energy: serving offshore wind power plants (maintenance); ports as smart energy distribution points
- offshore platforms with several functions – connection with ports; or floating ports (wave energy); artificial islands
- circulation, e.g. ports may produce energy from collected material; reuse of waste in ports
- new fuels: electricity, energy out of waste and trash, may be reused in ferries. Ships running on algae are possible (Wärtsilä). Tests of different fuels have been financed by the EU.
- different, new kind of cargo, for example waste as cargo
- new transport routes: cargo through Finland from the north (Arctic passage) – railway, pipeline…
- fossil fuels from the Arctic
- Russian / Eastern transit cargo
- fairways: traditional and autonomous shipping routes
- tourism: more coastal cruises

Shipping and use of sea space

Intensity of commercial shipping was estimated to increase in the middle of the Gulf of Finland in direction to St. Petersburg area by 2050 in two workshop groups, in particular in case that transit shipping via Estonian and Finnish ports to Russia would decrease and the transit cargo is lost to Russian ports or changed to polar routes (e.g., Murmansk). Ultimately, the shipping serves other businesses and industrial production, and the future volumes and routes were not estimated as they are to large extent dependent on the transport needs of the trade and industries. Maritime transport is in general estimated to grow globally and in the Baltic Sea with increasing ship size and developing automatization of the ships (e.g. HELCOM 2018, OECD/ITF 2017, Baltic Lines 2016, WWF 2010). Traditional shipping routes would be autonomous was estimated in "Virtual reality" –scenario (Tallinn maritime working group). Intelligent fairway ("Älyväylä") project was mentioned in the interviews.

In Tallinn workshop, maritime working group estimated that in "Unlimited growth" scenario most of the key fairway areas would increase (++): Uusikaupunki, Turku-Naantali, Hanko, Helsinki, Loviisa, Kotka-Hamina, Kunda, Tallinn. Altogether, the use of deep water navigation would increase (++) in this scenario.

Helsinki-Tallinn transportation route was estimated to exist still in the 2050 (Roose et al. 2017: combination maps). However, more traffic routes across the Gulf of Finland of cargo and passenger shipping were anticipated by two groups, e.g. between Sillamäe and Kotka, if Russia agrees the passing of its economic zone. This was estimated to decrease marine traffic between Helsinki and Tallinn. Research on a new roro-route between Loviisa and Kunda, with direct connection without the need to pass Russian waters, was mentioned in an interview (see also REFEC, Central Baltic Interreg). In "Unlimited growth" –scenario, the use of ports would be so intense that all ships cannot enter the port at same time. Anchoring sites would be in front of all main passenger and cargo ports.

A planned tunnel under the Gulf of Finland between Helsinki and Tallinn was also mentioned by two groups, but because of the loading and unloading are the most expensive part of transport, shipping were suspected to be more economic for companies also in future. Another reason mentioned in an interview was bigger loading potential of ship compared to train. Heavy investments in the main traffic corridors (Rail Baltica and Via Baltica) were estimated to benefit the ports, which are connected to them on the Estonian side. Smelting of ice in the Arctic was mentioned as a reason for more Northern traffic by one interviewee. Altogether, development of land transport capacity was considered to make maritime transport volumes more intense.

Maintenance of waterways was seen to increase almost all around the Gulf of Finland with ++ increase: Turku-Naantali, Kantvik, Helsinki, Sköldvik (+), Kotka, Kunda, Loksa. (Tallinn maritime working group).

Shipbuilding and related businesses

Maritime industry is an important part of the blue economy, but in the project area shipyards and attached businesses are mostly located on land near coastline, thus not affecting largely on the uses of coastal and marine areas. The sensitivity to economic fluctuations of maritime industry (shipbuilding) was noted both in Delphi comments and in the workshop 2017. The growth of the maritime cluster is expected to be strong until circa the year 2025 but the development and situation of the maritime industry in 2050 was thought to be difficult to estimate. The number of shipyards were not estimated to increase and the future of it in the project area were suspected to be replaced by production elsewhere. In two working groups, the future of shipbuilding in Turku-Naantali area were questioned, as the location of the shipyard is difficult logistically and close to the protected areas. In the Estonian side, the future of current ship repair businesses were questioned. The potential locations for demolition of ships were placed near the maritime clusters (Roose et al. 2017: Delphi maps). In "Virtual reality" –scenario, one ship demolition site near Tallinn was deleted.

Demolition of ships was connected to the cleantech symbol at Turku-Naantali and Kotka-Hamina in "Sustainability above all!" –scenario. In addition, more cleantech was added at least in Hanko and Sillamäe. Related to more extensive cleantech production, four new markings for pilot areas of new innovations were added: two in Finland and two on Estonian side In "Unlimited growth" scenario, new shipbuilding and demolition site was added to Inkoo-Kantvik area. (Tallinn maritime working group).

Offshore platforms

Offshore platforms were considered as smart energy system distribution systems for energy supply. These would increase and have new locations in Hanko and Tallinn.

4.3.2. Main drivers for maritime cluster

In Delphi 2018, it was asked about the possible effects of the three drivers selected, in particular for development of maritime cluster. The replies included both effects, which were linked clearly with certain drivers, or jointly to several drivers. In Tallinn workshop, the participants discussed the consequences of selected drivers for maritime transport in the alternative scenarios.

Economic-related drivers gained most mentions both in Delphi-panel, workshop and interviews, followed by technological and political drivers. According to Delphi 2017, globalization affects especially maritime industry via demand for maritime transport. Global economy emphasizes significance of ports and affects on the volume of maritime transport as well as the volume of shipbuilding orders. Marine transport affects also at the regional level in a positive way. Global economy will have positive effect on maritime industry. In the case of maritime cluster, attitudes of customers and shippers impact on the sustainable development of the sector.

In Helsinki scenario workshop 2017, working groups mentioned digitalisation, high technology solutions and safety/security issues to be important for the development of the maritime cluster in the project area. This involves both the development of marine transport and ports. In the interviews, changes were expected due to digitalisation and environmental issues. Ships size is expected to increase and containerisation would continue.

The level and extent of co-operation in the BSR is linked with safety situation and stability on the Baltic Sea. Different levels of co-operation – e.g. relationship with Russia affects maritime transport via ports of Finland and Estonia, and to the future of transit cargo via Estonia and Finland. Environmental policies affect e.g. fuels used in shipping. Transport policy has impacts for ship owners and ports. On the other hand, strict environmental regulation provides good markets for clean tech and marine construction.

Table 19. Main drivers for maritime cluster

Driver	n=14	Tallinn workshop N=4	Interviews N=8
Environmental regulations and legal practices	8		3
Conditions and trends of global economy, globalization	6	4	9
Clean tech / emissions from maritime cluster (energy efficiency)	6		
Fuels used in shipping (environmental policy)	5		1
Regional economic situation	4		
Level of co-operation in the BSR - safety situation and stability in the Baltic Sea area	4	1	
Attitudes of customers and shippers	2	3	1
ICT, digitalization	3	2	6
Transport routes	1		4
Climate conditions	1		
Other drivers added in Delphi 2018			
Development of autonomous ships (without crew)	1		3
New factors raised in interviews			
Changes concerning business models			1
Government's support and tax policies (for shipping)			2
World politics			1
Technological trends, especially in shipping			1
Environmental topics, resisting climate change, sustainable development			3
More competition for skilled marine workforce			1
Centralisation of the population will continue; centres and polarization			1
Total	41	**10**	37

Environmental regulations and legal practices were regarded the most important driver in Delphi. In Tallinn workshop, they were not chosen as main driver, but environmental friendly shipping was taken as an all-encompassing issue in the discussion, and attitudes towards sustainable shipping were discussed. Attitudes gained two mentions in Delphi. One interviewee mentioned that there is clear interest of customers to know about the emissions caused by transportation, they do not only want their product transported from one place to another.

According to Delphi, Environmental regulations and policies affect at least which fuel will be chosen, and indirectly into affordability of routes and ports. Because the marine sector uses a lot of fuel, fuel plays a major part in what kinds of emissions are emitted. Fuel price levels have been recognized to have a great impact on the current structure of the sector, since a large share of the costs consists of fuel costs. (ECORYS, 2012.) Use of low carbon fuels supports carbon neutrality. Energy efficiency and clean air were considered important drivers. In addition, accurate optimization of transport routes, timetables and loading of vessels can reduce the need for traffic. Continuous control of pollution and higher taxes for polluting will drive companies towards clean operation. On the other hand, strict environmental regulation provides good markets for clean tech and marine construction (Delphi 2017). Big regulation-related demands at port sector were mentioned by an interviewee, pointing to other regulation demands in addition to the environmental ones.

Trends of global economy and globalisation were noticed as an important driver, which always guides the state of maritime cluster. The interviewees regarded economy related factors most important, related to transport demand, status of international competition and industrial competitiveness. Marine transport is very much dependent of global economy - progress in global economy will support marine transport. However, at the workshop global growth was considered to affect more Asia and third world countries than the BSR. Global economy emphasizes significance of ports and affects on the volume of maritime transport as well as the volume of shipbuilding orders (Delphi 2017). Regional economic situation will promote cooperation. The better situation, the greater the increase in shipping. Safety and stability will increase co-operation in the Baltic Sea area. Economic situation controls supply and demand, and cost of transport modes affect to which mode is chosen. Government's support and tax policies for shipping were mentioned by one interviewee.

Environmental possibilities were considered to be gained through economic development and growth: the more economic growth in the region, the more the economic benefits should be addressed to the same region.

Global shipping was seen to mean global solutions, more sustainability and cleantech, request for environmental friendly profile of vessels, and new cargo types. Connection with other transportation types is crucial: growth in ship size and

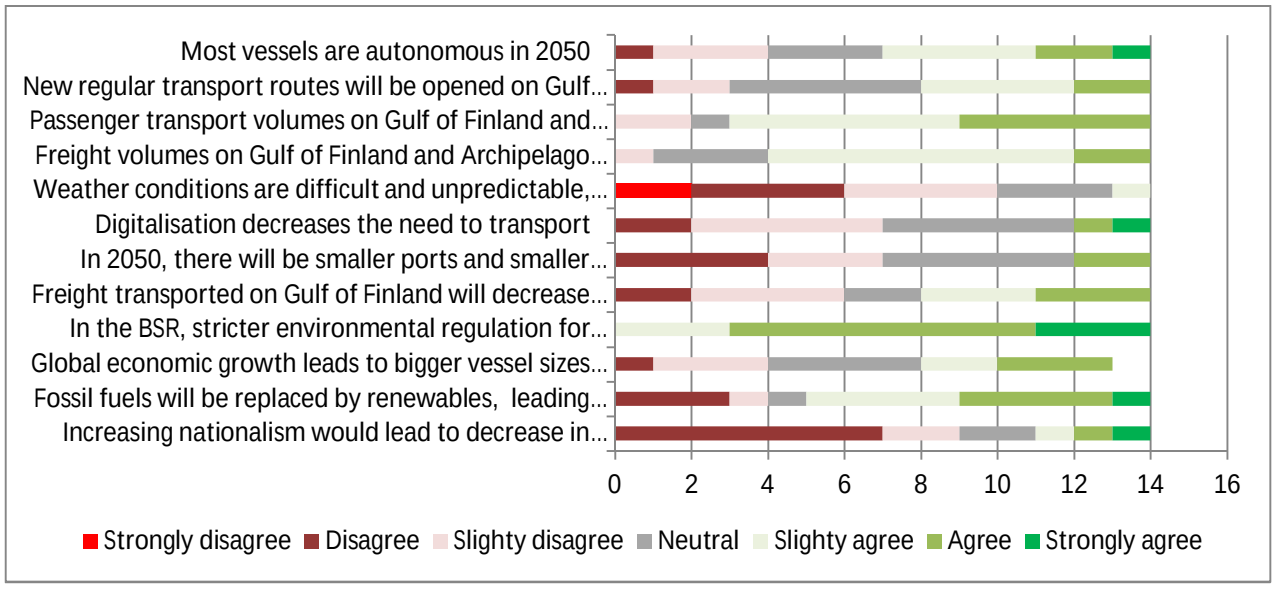
growth in cargo volume requires larger port areas, deeper fairways, areas on land and better infrastructure, as well as ports' hinterland connections. Land-sea interaction should be sustainable, linked to other transport modes and rail services as Rail Baltic. Future multifunctional vessels have requirements on port infrastructure (ref. automatized vessels).

Statement "Freight volumes on Gulf of Finland and Archipelago Sea Area will increase by 2050" was agreed by a clear number of respondents, 71 %, as well as "Passenger transport volumes on Gulf of Finland and Archipelago Sea Area will increase by 2050" by 79 % of the respondents. At the workshop, it was expected that there would be fewer and larger ports in the future and smaller ports would specialize. It was expected that there would not become big vessels on BSR or Gulf of Finland. Larger port areas on land, and deeper fairways would be needed, but ports' opportunities to expand were considered difficult because of e.g. conservation areas (NATURA 2000). Correspondingly, Delphi respondents supported the statement "Global economic growth leads to bigger vessel sizes in the BSR", which was agreed by 38 % of the respondents, disagreed by 31 % and 31 % had a neutral opinion on this statement. However, 50 % of the respondents disagreed with the statement "In 2050, there will be smaller ports and smaller vessels on Gulf of Finland and Archipelago Sea Area"; 36 % had a neutral opinion in this matter. Distributing on smaller ships, services: in case of bigger vessels or platforms?

Public pressure was expected to affect ship owners to invest in cleantech and fuels. Attitudes of different cultural background may play a role on operations at grass root level and on attitudes on the environment. This issue was linked with co-operation. It is also geopolitical issue, which affects environmental legislation. EU- and BSR level information and motivation is needed via media to raise awareness. Official and unofficial activities were both considered important.

ICT/ digitalization will enable new kind of business and efficiency in maritime cluster. At the workshop, it was estimated that amount of passenger transport would decrease, and on the other hand, digitalization would lead to autonomous shipping. Interviewees mentioned digitalization as the second most important factor, and intelligent fairway project in Finland as an example of digitalisation. "Digitalization decreases the need to transport" was disagreed by 50 % of the respondents, whereas 36 % had a neutral opinion on this statement.

Table 20. Results of Delphi 2018 statements on maritime sector



Autonomous ships would revolutionize shipping altogether even if the need for crew e.g. in archipelago areas would remain. The autonomous vessels would be at least cargo vessels in a couple of decades. In Delphi, statement "Most vessels are autonomous in 2050" was agreed by 50 % of the respondents, 21 % agreed or strongly agreed, whereas 29 % disagreed and 21 % had a neutral opinion. When autonomous vessels become more general, it will lead to standardisation of ports,

and to automatization of seaport operations. Sensors and monitoring will be needed to avoid collision risk between autonomous and regular vessels. Service centres for surveillance and monitoring of the vessels (like VTS centres) would be established; satellites to survey smaller vessels or leisure boats; and drones operating from artificial or floating islands. Advanced digitalization may change the cargo types– for example waste and its handling. MaaS - Mobility as a Service was estimated to be introduced in maritime transport, linking it more efficiently with land transport. All this development in the field of digitalization would require pilot areas for new innovations, established also in the project area. Autonomous shipping and automatisation in shipping have impacts on MSP.

Level of co-operation in the BSR - safety situation and stability in the Baltic Sea area, Regional economic situation and Environmental regulations and legal practices were considered to have extremely big relevance both to the amount of cruise passengers in the BSR as well as for transport of cargo. Good economic development means increasing number of travelers, and larger vessels. When the safety situation remains good, it attracts tourists into the area also from farther away e.g. the Far East. On the other hand, people want to maintain the fragile ecosystem of the Baltic Sea, and environmental legislation and stricter demands force to think about new solutions. Factors related to transport routes and corridors were mentioned in particular by the interviewees, reflecting the development of land transport.

Level of co-operation in the BSR - safety situation and stability in the Baltic Sea area, cleantech / emissions from maritime cluster (energy efficiency) and Environmental regulations and legal practices were considered as the most important components for sustainable marine management.

Climate conditions as a driver were mentioned by only one Delphi-panelist: ice cover, storms etc. affect what kind of freight vessels can be operated for example in BSR. Statement with most disagreement was “Weather conditions are difficult and unpredictable, which leads to decrease in maritime imports and exports from the Northern parts of the BSR”, with 71 % of disagreement, and 43 % replied strongly disagree / disagree”.

More competition for skilled marine workforce was mentioned by one interviewee (2018). Another social driver mentioned by another interviewee was centralization of the population, which was assumed to continue with centers and polarization.

Table 21. Futures table for maritime cluster

Futures table – maritime cluster				
Future images 2050	Sustainability above all!	Unlimited growth	Sustainability dilemma	Virtual reality
Attitudes of customers and shippers	Positive attitudes towards renewable fuels (among customers and travelers).	Attitudes towards environment and e.g. renewable fuels options are negative or careless.	Polarisation of opinions; e.g. wealthy urban population for renewable fuels, industries and producers prefer fossil fuels.	Enthusiastic attitudes towards new fuels, products and technologies; will solve sustainability crisis.
Level of co-operation in the BSR - safety situation and stability in the Baltic Sea area.	Intense, good co-operation of all BSR states, incl. with Russia. Politically stable and secure BSR. Increase in maritime transport, new routes on eastern Gulf of Finland. Transit cargo via Finnish and Estonian ports.	Increased political tensions in the BSR. Nationalism. Less co-operation makes shipping more difficult. Only necessary maritime transport (security of supply).	Co-operation in BSR, with less participation of Russia. Quite stable safety situation. Increasing transport, except decreasing Russian transit.	Virtual world has decreased emphasis of traditional international relations, transnational relationships important between individuals, groups, and business. Stagnation of maritime transport.
Fuels used in shipping (environmental policy)	Mainly renewable fuels used in shipping (decarbonisation); zero emission policy	Fossil energy as the main fuel option (incl. LNG).	Mix of renewable and fossil fuels used. Extensive LNG network.	Innovations in sustainable fuels.

Conditions and trends of global economy, globalization	Global growth, high level of globalization, increasing volumes in maritime transport. Specialisation of smaller ports.	Increasing volumes in maritime transport. Few investments to new fleet. Bigger vessels sizes, deepening of fairways.	Poor global economy, degrowth. Stagnating maritime cluster, cleantech based products.	Global growth based on services and virtual products. Increasing automatization, 3 D printing.
Regional economic situation	Sustainable blue growth in BSR; circular economy, clean tech. Zero emission shipping, good markets for clean tech products.	Degrowth in BSR. Sustainability is not paid attention. No innovations in shipping or cleantech.	Unsustainable economic growth. Few investments to new fleet.	Modest growth, struggling blue business e.g. cleantech.
Transport routes	Land-based transport corridors with mainland Europe. Helsinki-Tallinn tunnel and rail corridor have been built - demand for maritime freight transport for has decreased.	Intensive maritime transport routes for freight, Motorways of the Sea in Europe. Large transport hubs, smaller ports disappear.	Increasing use and transport volumes in Gulf of Finland - transport corridor.	Increasing use of drones and other similar vehicles. Smaller ports and smaller vessels in BSR.
ICT, digitalisation	Cleantech and modern shipbuilding. Advanced intelligent maritime systems, autonomous vessels operating on BSR. Internet of Things.	Development of "ICT" and "smart" but no interaction between the systems. Poor markets for intelligent maritime systems.	Well working, unified ICT systems, digitalization. Booking online reduces maritime transport units/vessels needed.	Extensive digitalisation e.g. new emerging technologies, local production such as 3D printing, and optimization have drastically reduced the need for maritime transport.
Clean tech / emissions from maritime cluster (energy efficiency)	Innovations in shipbuilding technologies – cleantech in use.	Minimum requirements fulfilled, less innovations, current technologies used in maritime cluster.	Slightly modernized technologies used.	New unknown technologies.
Climate conditions	Almost ice-free navigation year round on the Gulf of Finland on and the Archipelago.	Colder winters in northern hemisphere.	Difficulties in maritime transport due to extreme weather phenomenon.	Abrupt events e.g. Golf-current slows down, "ice-age"
Environmental regulations, legal practices	Environmental policies towards zero emission shipping in place. Extremely strict environmental legislation in effect, enforced by the authorities.	Environmental legislation is not in the focus, and enforcement is weak. Weak preparation of laws and regulations of the permitting authorities.	Strict environmental legislation is in effect, but its enforcement is weak and interpretations vary.	Changed needs for legislation; ad hoc – legislation.

Black swans – maritime sector

Results of Delphi and workshop

- improved battery technology – a game changing innovation
- de-globalization, protectionism, self-sufficiency.

4.3.3. "Sustainability above all" -scenario on maritime sector

Main drivers for the sector	Future image	Pathway
Environmental regulations and legal practices Conditions and trends of global economy, globalization Clean tech / emissions from maritime cluster (energy efficiency) Fuels used in shipping (environmental policy) ICT, digitalization	Zero emission policies - low emission renewables used in shipping. Strong environmental leadership. Modern shipbuilding and innovations: the environmental impact of ships is designed to be as small as possible. Ports and ships use their waste at the maximum level. Advanced intelligent maritime systems used, autonomous vessels operate in the Baltic Sea.	Policy will towards sustainability will lead to global climate agreement and strong legislation proposing zero emissions will be introduced. Strong environmental leadership. Environmental thinking will be strengthened in maritime education: it will create more favorable attitudes among the people in the industry. Technological solutions, ICT and digitalization will support sustainability. Most vessels are autonomous and cargo handling will be automatized to optimize cargo transport, and to minimize the environmental impact of shipping.
"Zero emissions"		

Arguments of Delphi, workshop and interviewees (2018)

This scenario was accepted by the majority of Delphi and workshop. A Delphi panelist noted "Low emission renewables, modern shipbuilding and innovations and advanced intelligent maritime systems. Also environmental incentives could be a productive way. One thing to bear in mind in the BSR area as well as in any shipping line development is that ships always sail between different areas and regions and all action (environmental and other) needs to be fitted to all of the destinations." Another respondent stated that lesser consumption is of advantage for all; however, it is not expected to be realized with use of major part of renewables (current share almost zero).

Policy will, strong environmental leadership and legislation, and global climate agreement were estimated to leads to "Sustainability above all". Legislation that proposes zero emissions would be needed, which could lead to sustainability in 15 years. Adaptation to climate change. More and strengthened environmental thinking in maritime education would create more favorable attitudes among the people in the industry in 7 years. Technological solutions, ICT and digitalization will lead to sustainability in shipping. Most vessels are autonomous and automatisation is used in cargo handling. In 2040 no fossil fuels are allowed to be used in shipping, only renewables will be used (algae, electricity, waste and garbage as energy source). In 2045, ports and ships use their waste in maximum level (circulation).

One respondent considered that it would be difficult to see sustainability happening by the demands of citizens (e.g. people on cruises/ferries are currently more interested in buying cheap beer from Tallinn). "We will need strong environment-based policy instruments, maybe due to an aftermath of a catastrophe." Biofuels of good quality will be used in maritime traffic and in vehicles for heavy cargo – electric cars are more common, automatization has increased efficiency in loading and unloading cargo. Another respondent called for a general flat energy tax to every resident, company or organization, ASAP.

Devoting to pilot environmental solutions and enabling digitalization with agile regulation. Automatized (independent) vessels, apparently planned on main routes only. In addition to automatization of vessels, expected also that automatization of cargo management will continue to increase further. Innovations are needed; resources need to be allocated to STI, and platforms for collaboration. Wind will be used as a new way as an energy source; modern sail systems are available already (ref. Viking Line).

Cooperation on all levels: governments, industry, companies would lead to sustainability in 10 years. Baltic Sea Region needs to be globally competitive, it cannot act alone. Co-operation in developing business models.

4.3.4. "Unlimited growth" scenario on maritime sector

Main drivers for the sector	Future image	Pathway
Environmental regulations and legal practices Conditions and trends of global economy, globalization Clean tech / emissions from maritime cluster (energy efficiency) Fuels used in shipping (environmental policy) ICT, digitalization	Increasing global consumption and heavy maritime traffic. Minimum environmental requirements are fulfilled in shipping. Current technologies used in the maritime cluster. Mainly fossil fuels and other unsustainable fuels used in shipping.	Today's support and fiscal policy will continue, with small reforms on taxation, EU-support and local political systems. Low awareness of environmental problems, more consumption and production, bigger vessels, people buy more. Fossil fuel from Arctic: oil and LNG. Multifunctional ships will carry new cargo types, such as waste. There will be more offshore services, port congestion and new waiting areas.
"Do nothing and continue in an old-fashioned way"		

Arguments of Delphi, workshop and interviewees

The scenario was accepted in Delphi. One respondent in Delphi agreed that in growing world economy, increasing consumption increases also traffic on sea; "however, is it credible that environmental regulations would be loosen? " In "Unlimited growth" scenario, maritime cluster has concentrated into certain regions, in which there is ship building, cleantech etc. Increasing, heavy maritime traffic causes more traffic on deep water route (East-West) and leads to port congestion. Because of that new "waiting areas", anchorage areas near the hub ports are needed; maybe dedicated for several ports together. In addition to Helsinki and Turku, more passenger transport ports would exist in Finland, e.g. Hanko, and Paldiski in Estonia. In most of the key fairway areas, the intensity would increase: Uusikaupunki, Turku-Naantali, Hanko, Helsinki, Loviisa, Kotka-Hamina, Kunda, Tallinn; as well as "deep water navigation", Sillamäe.

In "Unlimited growth" scenario, maritime cluster will continue to develop in an old-fashioned way. After 2025, fossil fuel, oil and LNG from the Arctic will be drilled and consumed more. In 2030, the quality of service worsens because of growth in cargo volumes. Requirements of providers, compromises concerning different licences etc. In 2040, multifunctional ships will be built to carry also new cargo types, such as waste. Ports will specialize for different cargo types. There will be more services on sea (offshore) by 2050. Strong interests of fuel companies are in the way of development towards sustainability.

Reasons for "Unlimited growth" mentioned were for example the following: regulation is not ambitious, or global, or economic growth or cargo is not regulated at all. All opportunities will be available and no licenses will be needed. There is more production, vessels are bigger, and people buy more. "Freight volumes on Gulf of Finland and Archipelago Sea Area will increase by 2050" was agreed by a clear number of respondents of Delphi 2018, 71 %.

Traffic is increasing on BSR because of global consumption: the growth of new developing areas (e.g. in Africa) might lead to need of raw materials and/or products from the BSR. Ports will not be able to respond to growth; there are limits for growth because of urbanisation (conflict between ports and housing development). More land infrastructure will be needed. In Finland, also the northern ports have capacity to grow; they are connected with the railways. In Estonia, growth will take place only in the northern part of Estonia.

In this scenario, awareness of environmental problems is low and there is no co-operation between the countries and media. No policy will and commitments, no strategy with vision of sustainable economy, only short-term decisions, lacking of knowledge. No environmental leadership. All the environment-based demands are considered to restrict "freedom of the seas" and there is no mutual understanding between states. Money talks and capital and consumers move from one country to another – no one has courage to intervene in "international" operations and consumerism. No support for programmes in universities - leads to fewer innovations and less involvement. Strong interests of fuel companies are in the way of development. No devotion or investments to piloting environmental solutions. Parochialism, insufficient support for STI. No interest in optimizing ship traffic. Possible changes in geopolitical situations and geo-economics were also mentioned as a fact to consider.

4.3.5. "Sustainability dilemma" scenario on maritime sector

Main drivers for the sector	Future image	Pathway
Environmental regulations and legal practices Conditions and trends of global economy, globalization Clean tech / emissions from maritime cluster (energy efficiency) Fuels used in shipping (environmental policy) ICT, digitalization	Mix of renewable and fossil fuels used. Attitudes impact on choices: some shipping companies use renewables, others use traditional fossil fuels. Economic revenues are considered more important than sustainable values.	Lack of regulation, or no common regulation. Inconsistency in energy, environmental policies and legislation. No strategy with a vision of sustainable economy in the long-term. Political systems and businesses are too closely interlinked. Profit drives business, both politicians and businesses are beneficiaries of the current system and there is no motivation to change the system. No price on carbon in climate policy.
"Profit drives business"		

Arguments of Delphi, workshop and interviewees

This scenario was agreed by the Delphi (2018) and Tallinn workshop. A Delphi member commented that "Seems a credible scenario (to me)."

There is no common line with decision makers, which leads to that no new laws will be established. Conflicts at decision -makers' level is confusing for companies, which therefore do not dare to invest fully in renewable fuels and in more modern and environmentally friendly ships. Political systems and businesses are too closely linked. Profit drives the business and both politicians and businesses are beneficiaries of current system, and there is no motivation to change the system. Environmental friendliness and sustainable operations are assets, though their advantages are simultaneously measured with strictly economic criteria. Not strong enough policies combined with too low rate of return on investment (ROI) of green fuel investments. Low investments to development. Weak environmental leadership.

"Prerequisite is that environmental attitudes in private, public and industrial etc. sector need to change/develop. Attitudes (mindset) have not changed. Damage to planet is not too visual yet. Some garbage in sea may look bad, but extinction of hundreds of species is not visual in everyday life. No one wants to be first to give up

amenities and pay for changes. It must be radical, inevitable and rapid for every member of the society. And who pollutes / consumes more, must pay more; personally." A view of Delphi-panelist (2018)

Environmental was linked to economic growth: not enough economic growth to be able to keep up with environmental targets: if economic growth is not stable, all eyes will be in the environmental issues only if they are thought to eat profit. If the price of renewables is somehow competitive in the future, they might be used for imago reasons. Good bet is passenger vessels, in particular if the particle etc. emissions of renewables will be kept in control.

Renewable energy will used where it is reasonable and possible to use. Different alternative fuels, e.g. LNG have been taken into use where it is technologically reasonable to replace marine diesel. Also renewable diesel is extensively used in maritime traffic, if liquid bunker is being used. Ship engines have been developed vastly, and energy efficiency has increased in the operations also otherwise. Environmental friendliness and sustainable operations are assets, though their advantages are simultaneously measured with strictly economic criteria.

4.3.6. "Virtual reality" scenario - a fully digitalized future on maritime sector

Main drivers for the sector	Future image	Pathway
Environmental regulations and legal practices Conditions and trends of global economy, globalization Clean tech / emissions from maritime cluster (energy efficiency) Fuels used in shipping (environmental policy) ICT, digitalization	Extensive digitalization, local production such as 3D printing, and optimization of logistics have drastically reduced the need for maritime transport, except raw materials. Unmanned vessels operate on the Gulf of Finland and Archipelago Sea. Internet of Things in cargo handling.	Autonomous transport will be enabled by regulations, and by providing the best conditions for testing and trial runs of new technologies and solutions. Development and innovations at universities in close cooperation with the industry. A greater need for new technology creates the conditions for new companies to develop and create the required equipment. 3D printing develops with an unexpected space and with no problems. Renewal of business models.
"Autonomous shipping will be enabled by regulations"		

Arguments of Delphi, workshop and interviewees (2018)

One Delphi-panelist noted that this scenario would realize in 30 years. Another Delphi respondent stated: "I am not sure, if full and complete digitalization with unmanned ships would help. Perhaps it would be place for compromises and keep sailors on board. Commercial sail ships may be attractive places to work. Do we want that? Half automated sounds better and more reliable."

"Digitalization may have decreased cargo traffic, but simultaneously people and goods are moved between countries on record levels. Far Eastern tourists increase the number of travelers, and they want to experience the fresh climate and beautiful islands in the Baltic Sea. Automatization combined with digitalization has done

a breakthrough in all transport and in travel chain. Because of this, vessels' turnaround times are short and traveling efficient.

"Unmanned vessels were trialed, but the result was that even when the navigation system is automated, manning is needed to control (possible) deviations. This happened after an unmanned oil tanker hit a rock next to natural conservation area south of Hanko. " A view of Delphi-panelist, 2018.

4.3.7. Assessment of the alternative scenarios on maritime sector

Nearly all views related to scenarios were for increasing of maritime transport. "Freight volumes on Gulf of Finland and Archipelago Sea Area will increase by 2050" was agreed by a clear number of respondents, 71 %. Only digitalization was considered to decrease amount of passengers. Because of this result, the interviewees on maritime sector were asked, what could change the current growing traffic trend, in other words, what could decrease the amount of cargo or passengers? Most of the interviewees considered the future of maritime transport positive. The general economic development could decrease the amount of cargo or passengers. Among the other reasons were black swan –kind of situations, for example political circumstances, various crises and sanctions, sudden actualization of threats, the changing world situation, or the use of force in the surrounding areas. Weakening security position could change the situation, particularly in terms of passengers. Economic consequences of politics were mentioned, such as trade war, custom tariffs, trade embargos (e.g. Russia, the food industry). In addition, raw material streams and the location of manufacturing, as well as tunnel projects could have an impact. Environmental issues and uncertainty, changing rules were also mentioned.

The aim of EU's White Paper on Transport is to shift 30% of cargo load from roads to water transport by 2030 and 50% by 2050. Maritime transport has (had) a strong position in the EU's transport policies. Possible new roles and services linked with globalisation were expected for ports, which has impact on port planning (spatial impacts). Potential synergies exist between cargo, passengers, energy; land-sea interaction and link to other (sustainable) transport modes. Cleantech may locate in ports or in their vicinity; e.g. maintenance of the equipment offers opportunities for cleantech. Also the BaltSea Plan Vision 2030 (BaltSea Plan 2011) – states that "Port locations benefit from new offshore uses and offer a wide range of industrial production facilities".

Finnish maritime strategy emphasizes smooth functioning of Finnish imports and exports year-round, and safe and healthy Baltic Sea. It also links with the entire maritime cluster and provision of sustainable logistic concepts while "identifying opportunities in innovation in the energy efficiency of vessels, alternative fuels and emission reduction technologies". Responding Estonian strategies cover also safety and sustainable targets, and in addition, development of transit traffic. Estonian Marine Policy covers also aspects of marine tourism, and marine construction sector. Objectives include increasing the competitiveness of both subsectors: shipbuilding and repair as well as recreational craft building and repair. Notably, Estonian Marine Policy and Transport Development Plan include also quantified targets, e.g. for cargo in different segments. In addition, monetary targets are set.

These strategies have sustainable aims, but they do not include clear targets towards that. However, maritime transpot is regulation with international and global regulations, in particular IMO's Marpol convention. Recently, IMO has adopted an initial IMO strategy on reduction of GHG emissions from ships (13 April 2018). The aim is to reduce total annual GHG emissions by at least 50 % by 2050 compared to 2008. It includes also reduction of CO_2 emissions per transport work, as an average across international shipping, by at least 40 % by 2030, pursuing efforts towards 70 % by 2050, compared to 2008. (IMO, 2018). In Baltic Sea, the restrictions are stricter and the respondents of Delphi considered that stricter environmental regulation for shipping will continue, supporting clean tech production (see Table 20). "Fossil fuels will be replaced by renewables, leading to zero emission shipping in 2050" was agreed by 64 % of the respondents, 36 % of the respondents replied "agree or strongly agree".

Related to Virtual reality scenario, "Most vessels are autonomous in 2050" was agreed by 50 % of the respondents, 21 % agreed or strongly agreed, whereas 29 % disagreed and 21 % had a neutral opinion. IMO is the main

regulator for international maritime transport; without IMO there would be no progress in this issue nor possibilities to expand autonomous navigation in international waters. IMO announced in May 2018 that discussions on how to address maritime autonomous surface ships have begun at the Maritime Safety Committee (MSC); including how to proceed with a regulatory scoping exercises; including the human element, safety, security, interactions with ports, pilotage, responses to incidents and protection of the marine environment, for different levels of autonomy. An inter-divisional maritime autonomous surface ships taskforce within the IMO Secretariat will be formed to support the "work on this important matter." (IMO, 2018) http://www.imo.org/en/MediaCentre/WhatsNew/Pages/default.aspx ; http://www.imo.org/en/MediaCentre/IMOMediaAccreditation/Pages/MEPC72.aspx

Related to discussion on transport routes, in particular in the maritime scenarios, the North Sea-Baltic Corridor as part of Trans-European Transport Networks (TEN-T) connects the Baltic Sea with the ports of the North Sea. The corridor's most significant project is Rail Baltic: a European standard gauge railway connecting Estonia, Latvia and Lithuania to Poland. The corridor starts in the port of Helsinki, and passes via Tallinn to the North Sea. Status as a transport corridor "guarantees" the financing for development projects on the corridor. Helsinki is located on another transport corridor, too: the Scandinavian-Mediterranean Corridor starts from the Southeastern coast of Finland, and leads via the ports of HaminaKotka, Helsinki and Turku to Stockholm and further to the Mediterranean. In Finland, ports of HaminaKotka, Helsinki, Turku and Naantali belong to the core network. In the Plan4Blue project area, Hanko and Sköldvik belong to the comprehensive network. In Estonia, Port of Tallinn belongs to the core network and Ports of Paldiski and Sillamäe to the comprehensive network. https://ec.europa.eu/transport/sites/transport/files/ten-t-country-fiches/ten-t-country-fiches-et_en.pdf https://ec.europa.eu/transport/sites/transport/files/themes/infrastructure/ten-t-guidelines/doc/maps/dk-ee-lv-lt-fi-se.pdf

The corridors are linked with the probability of Helsinki-Tallinn tunnel, while part of its financing might come from the EU sources. According to Helsinki – Tallinn tunnel task force (Ministry of Transport and Communications 5/2018), Finland and Estonia should jointly work together to ensure that the tunnel connection is included in the TEN-T Core Network when the network is revised in 2023. "The tunnel could create a unique opportunity to achieve structural industrial renewal not only related to new technologies and governance structures but also based on more efficient transport connections to Europe and Asia." Artificial islands planned in the context of the tunnel are linked with MSP.

Recently, the European Commission has proposed extension of the North-Sea Baltic Corridor to connect the Finnish rail network (from Helsinki) with the Swedish core port of Luleå. The latter is currently not included in the corridor network. The proposed extension anticipates growing importance of the Arctic policy. https://ec.europa.eu/transport/sites/transport/files/2018-06-06-cef-annex-memo.pdf [7.6.2018]. This is indication of realization of the tunnel as there would be landside connection also in Finland.

4.4. Futures of blue bioeconomy and subsea resources

4.4.1. Changes in blue bioeconomy and exploitation of sub-sea resources and impact on the sea use

The Delphi rounds 1-2 and the first scenario workshop considered the blue bioeconomy and subsea sector as a whole, including all the subsectors (see Table 2). In Tallinn workshop, the working group chose to focus on fish farming, in particular multitrophic aquculture in the alternative scenarios for Blue Growth. In Delphi 2018, the focus was on development of fishing, aquaculture, fish farming, mussel and algae farming. Interviewees were selected among aquaculture and subsea producers. In EU's Blue Growth Strategy (COM 2012), aquaculture has been recognized as one of the five most potential blue growth areas, along with maritime and coastal tourism, marine energy, marine mineral resources and blue biotech.

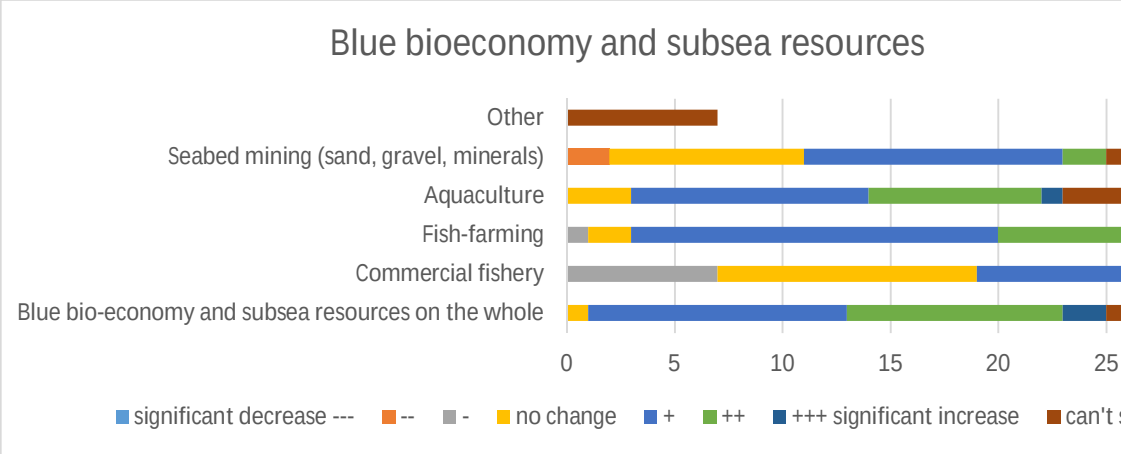


Figure 8. Changes in blue bioeconomy and subsea resources (Delphi-panel 2017)

In Delphi 2017, Blue bioeconomy and subsea were considered to increase according to 92 % of respondents. On the scale of + slight increase /++ moderate increase /+++ significant increase, moderate or significant increase is expected by 50 % of the panel. However, developments are expected to be different on the sectors. Aquaculture is expected to grow according to 73 % of the panel, and 46 % expect moderate or significant increase. Fish farming is expected to grow according to 85 % of the panel; 26 % expect that the growth is moderate or significant. Similarly, the interviewees considered the future of fish farming and processing positive.

Fishing sector is considered to stay on the same level: 46% of the respondent expect no change, 27% of them expect decrease and 23% increase. Similarly, in economic analysis presented in D.T. 1.6.1., greater growth potential was identified in the development of aquaculture solutions and services. According to the interviews conducted in the project, the future perspectives of the fishing industry overall are considered positive in Finland and there are continuous cooperation opportunities with Estonia (D.T. 1.6.1).

Tallinn working group worked with all scenarios. The combination map was chosen to represent Sustainability dilemma - scenario.

The development of blue bioeconomy and subsea resources in general

The activities and production of blue bioeconomy and the use of subsea resources were estimated to increase or remain the same as a whole, while commercial fishery, seabed mining and fish-farming thought to be decreased in the study area (Figure 8). However, in Helsinki scenario workshop fishery was estimated to be important also in 2050, but the methods will probably develop and change. Areas for the seabed mining did not be placed on the map, but otherwise the new claims or increase of the aquaculture, fish-farming and commercial fishing were placed mostly in the middle and outer archipelago areas and open sea in Finland, while in Estonia there were few clusters near coastline (Roose et al. 2017: Delphi maps).

Fishery

In two of Helsinki scenario workshop groups it was estimated that fishing takes place throughout the study area also in 2050. Pelagic fishing is mostly trawl fishing of herring and sprat. Fishing policy is similar in Estonia and Finland, and fishing is regulated in terms of time and space, licenses by quanta and species: herring, sprat, cod, salmon, white fish etc. The fishing was required to be regulated more in future to conserve the fish stocks. In Estonia, pelagic fishing, i.e. trawling is not regulated, but electronic data is being collected according to the workshop participants. Fishing reaches the pelagic areas and there used to be some communication between the Finnish and Estonian fishermen. According to the interviews, there are continuous cooperation opportunities with Estonia (D.T. 1.6.1).

Natural and planted or artificial reefs were suggested in the Estonian coast in order to promote the fish species. In coastal areas, mostly trap net fishery and net fishery is performed. On the Estonian side, the entire coastal area is suitable for fishing, but fishing is prohibited in shallow waters (<20-25 m in depth). In the Finnish side of the study area, the Archipelago Sea is the most important region for coastal fishing and fisheries. In addition, the sea area off Uusikaupunki, sea areas off Hanko and Raasepori, from Porkkala peninsula to east side of Helsinki, sea area off Loviisa and Porvoo and sea areas off Kotka were estimated important for fishery (Roose et al. 2017: combination maps).

In Tallinn working group, in “Sustainability above all!” scenario for blue bioeconomy, two new key fishing areas to the Estonian coast, one to the west and one to the east were added. These areas would also have two sites for industrial fishing. In “Unlimited growth” scenario, four new key fishing areas were added evenly along the Estonian coast. Industrial fishing would increase along the western side of Estonian coast. In “Virtual reality”, three new fishing areas were added.

In Tallinn blue bioeconomy working group, restoration of fish rivers were discussed. In “Sustainability above all!” scenario, restored fish rivers were indicated also to the Estonian side of Gulf of Finland, but these were not same fish rivers that would be restored in other scenarios. E.g. in “Unlimited growth” scenario, five restored fish rivers were pointed out.

Aquaculture

Potential areas for aquaculture were estimated to locate in the Archipelago Sea and the coast of the Gulf of Finland also in 2050, however estimating that restricted areas, such as natural protected areas are not available for aquaculture. The western Archipelago Sea and Southern Bothnian Sea form the largest aquaculture area in Finland. It was estimated that the development of aquaculture is possible towards the Bothnian Sea, outside the project area. Helsinki workshop participants mentioned that more offshore aquaculture developments are already planned and those were estimated to be desirable, especially with smart solutions for aquaculture production and new offshore aquaculture technologies. The other group anticipated also that would be developed until 2050, but did not specificity this more. Two groups marked potential aquacultural sites in pelagic open sea areas (Roose et al. 2017: combination maps).

In “Unlimited growth” scenario, three fish farming sites along the east coast of Estonia were added, and two aquaculture sites to Toila-Sillamäe region. In “Sustainability above all!” –scenario, the coasts of Helsinki and Tallinn gained new aquaculture sites. In “Virtual reality” –scenario, fish farming and aquaculture would be located everywhere, as the units would be movable fish farming platforms that would sink under ice at winter time.

Fish food production is connected to aquaculture and fish farming. Processing industry and transport of the food to production sites were estimated to take place in the coastline in future: e.g., Helsinki, Kasnäs, Narva, Paldiski. Production facilities may be located on land or at sea, similarly that fish farms are probably more land-based in 2050 with large or high-rising fish tanks or as independent (floating) aquacultural units. Aquaculture as such was estimated to be part of the circular economy. The production of algae were estimated to be possible in the future in the project area; currently the main production is located south of the project area, in Väinämeri region.

In Tallinn blue bioeconomy working group, development of blue bioeconomy, in particular aquaculture, was linked with scenarios of transport. In “Sustainability above all”, two new routes/tunnels were drawn to connect Hanko-Paldiski and

Loviisa-Kunda. In this scenario, passenger and cargo transport would be in the tunnels or airborne and thus the front of Tallinn and Helsinki could be used as aquaculture sites.

New tunnel from Tallinn to somewhere between Inkoo and Helsinki was placed in "Unlimited growth" –scenario.

Seabed mining and mineral extraction

Subsea sand, gravel and mineral areas in Estonia are in Haapsalu, where currently mud bath spas are a tourist attraction. Mud is dug close by from the nearby sea area and from Hiiumaa. Naissaar was tought to be a potential area for sand mining, but on the other hand, plenty sand and gravel is available on land, thus it was estimated that there is less need to sub-sea mining in future (Roose et al. 2017: combination maps). Sand digging from the sea areas is currently performed on some areas (for example in the areas of Jurmo, Utö, Hanko. In Finland the gravel and sand taking is also located mostly outside the project area and on land. However, potential sites for mineral, e.g., iron was mentioned to locate south of Örö. In Finland dumping is permitted and in Estonia the dumping and digging sites should be investigated, as they are some areas left from earlier times.

Banned areas were not deleted, so the unlimited growth is not so unlimited after all. (Tallinn blue bioeconomy working group).

4.4.2. Drivers for blue bioeconomy and subsea resources

The results of blue economy drivers from Delphi study 2017 and Helsinki scenario workshop, linked with blue bio-economy and subsea sector are reported below, and they are combined with results of expert opinions of Delphi study 2018 and Tallinn workshop.

In Tallinn workshop, fish farming, in particular multitrophic aquculture, linked with circular economy was selected as the focus of discussion. In Delphi 2018, the focus was on fishing, aquaculture, fish farming, mussel and algae farming. The interviewees were selected from fish farming and subsea sectors.

Political drivers gained most mentions in total, followed by environment-related, technological, and legal drivers. Policies concerning the use of natural resources where considered the most important driver according to Delphi-panelists (see Table 22). A clear majority, 87 %, of the respondents supported the statement "Blue bio-economy is supported in the national policies of Estonia and Finland" (see

Table 23). In Tallinn workshop, it was noted that ministries are supporting the development of multitrophic aquaculture in Finland and Estonia. On the contrary, EU fisheries policy was considered to have had negative impact on coastal fisheries (Delphi 2017). One interviewee noted that functioning of the chain could be strengthened with that preconditions for operations are in better condition. In Delphi-study 2017, state subsidies as part of the structural support provided in Finland were regarded a significant positive element for example in developing fish farming. Related to Estonia, also subsidies of EU Fisheries Fund/Maritime and Fisheries Fund were mentioned to have positive impact. However, the application process was seen very bureaucratic.

Impact of the global economy on coastal fisheries was considered "definitely negative" in Delphi 2017. Both for commercial fishing and fish farming, a negative effect via superpower policies was considered to exist. However, in Tallinn workshop, the economic potential of the local circular aquaculture system in the global markets was identified in "Sustainability above all!" scenario.

Table 22. Drivers for blue bio-economy sector

Driver	n=15	WS mentions	Interviews
Policies concerning the use of natural resources	10	1	2
Clean tech innovations for blue businesses	9	1	
Environmental regulations and legal practices – industrial policy	8		
State of the environment	7	1	1
Attitudes	3	1	
Attitude towards blue bioeconomy as a profession	2		
Ethical issues / interest on nutrition and healthy eating	1		
Conditions and trends of global economy, globalization	1	1	
New drivers mentioned	2		
Creating new business to exploit resources	1		
Environmental restrictions	1		
New factors mentioned in the interviews			
Too much focus on protection, overprotecting			1
Employment of skilled people is difficult, big challenge			1
Domesticity			1
Uniqueness			1
Total	43	5	8

Attitudes may influence that blue economy will be promoted by policies. Without positive attitudes, no development would take place; attitude can cause major effects in many areas. However, it was estimated that attitudes are likely to become more dispersed in future, which will be reflected in the overall policy frameworks. The results will depend on the political climate prevailing.

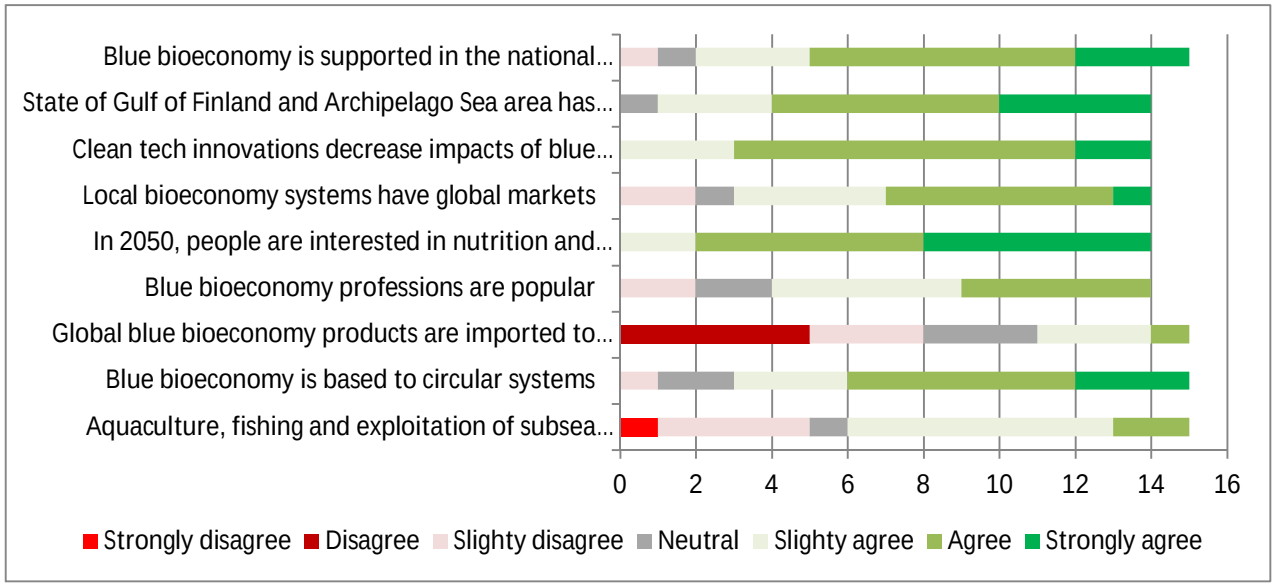
Aside policies, it was considered that if environmental regulations and legal practices change in favor of the development of the blue bio-economy, that will give people a signal about that blue bio-economy is something really important, and perhaps change attitudes in a more positive direction. Environmental permissions e.g. for fish farming were considered important drivers in Delphi 2017. An interviewee in blue bio-economy sector noted that environmental issues are a challenge for fish farming; there is too much focus on conservation, overprotecting, which hampers the sector. However, the interviewee understood that you must take care of the environment.

One Delphi panelist stated "We need not only national, but BSR level regional convention, that no fine-tuning or more regulations will solve the issue. Only energy / material consumption based tax system can make governments and people to change behavior."

State of the environment has a strong impact on the possibilities of the blue growth on the Baltic Sea. To reduce eutrophication, biomasses from the sea need to be used much more. Mussels may be used in filtering out the nutrients; in closed system, they just use the nutria from fish. In shallow areas, the mussel use the seabed nutrients. Unhealthy marine resources lead to an ineffective bio-economy. According to a Delphi-panelist, the Estonian Marine Strategy Plan identifies three most important pressure factors in the Estonian Maritime Area: eutrophication, hazardous substances and fisheries. Fishing is particularly marked by biological disturbances and selective fishing. Therefore, environmental protection work is very important for fisheries. We have a responsibility to maintain marine areas and fish stocks for the future, for future generations. Equally important is the sustainable management of aquaculture, fish farming, mussels and algae cultivation. Aquaculture farms are largely exposed to both nutrients and hazardous substances, which in turn increases the eutrophication of water bodies. Invasive species as environmental drivers were mentioned to cause economic losses (e.g fisheries, Delphi 2017). Fisheries management can change instantly depending on the state of environment.

However, within Delphi-panel (2018) there was a strong believe in cleaner sea in the future. Even 93 % of the Delphi-panelists considered that "State of Gulf of Finland and Archipelago Sea area has improved by 2050". On the other hand, environmental restrictions were mentioned as a new driver by one Delphi-panelist, meaning that there are not enough suitable marine areas and resources for bio-economy.

Table 23. Results of statements from Delphi study 2018, blue bio-economy sector



New technologies in fisheries and aquaculture were regarded to have positive effects on businesses. With clean-tech solutions, independent (floating) aquaculture units and automation in blue bio-economy and subsea sectors would be possible, as well as reduction of eutrophication – it would enable the more extensive use of biomasses from the sea. However, ice-conditions may have an impact to different structures and platforms located on the sea for a long time, though the average sea-ice area would decrease because of climate change. "Clean tech innovations decrease impacts of blue bio-economy on sea" were unanimously agreed by the respondents in Delphi-panel 2018. One Delphi-panelist stated that if clean tech innovations are adopted in e.g. fish farming, the state of environment can be maintained or even improved and at the same time, attitudes towards bio-economy on sea will be improved.

Driver "Ethical issues and interest in nutrition and healthy eating" was linked with selfishness of people. "A selfish interest in nutrition and healthy eating can also highlight the issues on a more general level" by one Delphi-panelist. The statement "In 2050, people are interested in nutrition and healthy eating" was unanimously agreed by the respondents. An attempt to substitute meat is a strong driver in food sector.

One interviewee linked increasing needs for renewable and clean energy to substitute oil (even partly) with blue bio-economy and subsea sector. This need drives to study marine ecosystems and e.g. use of algaes as a raw material of biofuels, exploiting of wave energy, heat recovery, offshore wind farms etc. Strong policy instruments are also drivers to these developments, and even internationally the joint understanding has been reached, which encourages global operators to invest in research, development and innovation in these sectors.

In addition, the health services provided by the nature (well-being from nature, green care – blue care) may have a positive effect on blue economy.

Table 24. Futures table for blue bioeconomy and subsea resources

Futures table – blue bioeconomy and subsea resources				
Future images 2050	**Sustainability above all!**	**Unlimited growth**	**Sustainability dilemma**	**Virtual reality**
Attitudes	Positive attitudes towards blue bioeconomy – "willingness to pay"	Attitudes towards environment and sustainability are negative or careless.	Polarisation of opinions; e.g. urban population for sustainability and circular economy; others don't care	Enthusiastic attitudes towards new sustainable technologies and solutions; will solve sustainability crisis.
Policies concerning the use of natural resources	Heavy restrictions for fishing, aquaculture and exploitation of subsea resources to conserve and improve the state of environment.	Policies do not restrict heavy exploitation of subsea resources or fishing & aquaculture.	Fishing and aquaculture supported by the policies.	Digital-based production and circular economy supported by the policies.
Conditions and trends of global economy, globalization	Local bio-economies, fish and aquaculture products, circular economy predominant. Systems sold to global markets.	Unsustainable global growth, over-exploitation of natural resources, e.g. fish stocks. Fierce competition.	Struggling fishery, global imports of bioeconomy products.	Global growth based on services and virtual products.
Attitude towards blue bioeconomy as a profession	Growing interest to cultivate one's food and self-sufficiency of households because of global effect of climate change.	No interest to blue bioeconomy as a profession; hard work and low income.	Professions that are connected to the ecosystem services are popular e.g. experience tourism, recreational fishing popular.	New innovative ways to use ecosystem services; new professions have emerged.
Ethical issues / interest on nutrition and healthy eating	New bio-based products cultivated in the sea (e.g. algae-based products). Interest in local, near produced food.	Low interest in the origin of the food.	Interest on nutrition and healthy eating. "Health boom and foodies"	Low interest in the origin of the food. Individual choices possible.
Clean tech innovations for blue businesses	Innovations in bioeconomy technologies. Circular fish-farming, and subsea mineral extraction. Efficient interaction of different "smart" technologies (ubiquitous).	No innovations, current technologies used. Low level of synergies and interaction between the systems.	Slightly modernized technologies used.	New offshore aquaculture technologies. Independent (floating) aquaculture units. Automation used in blue bioeconomies and subsea.
State of the environment	Improving state of environment: air and sea. Decreasing pollution of environment and eutrophication.	Worst case climate change scenario has come true. Difficult circumstances for all blue bioeconomy sectors due to the deteriorating	Climate change seems to proceed fast.	Overwhelming digitalization has increased the need for natural resources, unexpected impacts to the environment.

		of the environment. Disintegration of habitats threatens species.		
Environmental regulations, legal practices – industrial policy	Fishing and subsea mineral extraction is restricted and highly regulated on the whole area.	Low level of regulation and weak law enforcement.	Natural protected areas are not used for fishing or any other blue bioeconomy activities. Other current practices.	Changed needs for legislation; ad hoc – legislation.

Weak signals for blue bioeconomy and subsea resources

Fish spawning areas are destroyed/disappearing also in the sea. If they are not restored in the right time then some important fish species might disappear.

Black swan

fish farming and aquaculture on land, circular systems

4.4.3. "Sustainability above all" -scenario in blue bio-economy and subsea sector

Main drivers for the sector	Future image	Pathway
Policies concerning the use of natural resources Clean tech innovations for blue businesses Environmental regulations and legal practices – industrial policy State of the environment Attitudes Conditions and trends of global economy, globalization	Sustainable, circular economy based blue bioeconomy. New bio-based products are cultivated in the sea. Systems are sold to global markets. People are interested in locally produced food. Environmental policy and legislation restrict the emissions caused by blue bioeconomy and the subsea, and the over-exploitation of subsea resources.	Countries will start immediately and efficiently to implement the UN Sustainable Development Goals. Cleantech and innovations in bioeconomy technologies, e.g. multitrophic aquaculture. Circular fish farming and subsea mineral extraction. Efficient interaction of different smart, ubiquitous technologies.
"We don't pollute"		

Arguments of Delphi-panel, scenario workshops and interviewees

The main aspects of this scenario were accepted by Delphi-panel and participants of Tallinn scenario workshop. "The only remaining factor not agreed in sustainability is the time span and pace. This is very dependent on the technical innovations. "

Local bio-economies and products (global economy could also be sustainable!), fish and aquaculture, circular economy are predominant in sustainable scenario. Ministries in Finland and Estonia are supporting the development of multitrophic aquaculture. There is economic potential from the local system that can be sold and exported to global market. "And suddenly we have the massive ecologic (and economic) value!"

No climate change at all in the draft scenario was considered maybe too unlikely. Environmental response to the climate change should be included; even if we stop all the emissions to air now, climate change will continue to act in the nature. State of the environment would be clean or improving, in the air and sea. Decreasing pollution of environment and eutrophication: in multi-trophic aquaculture (circular fish-farming) mussels or algae are consuming nutrients that are released from fish farming. Cleantech and innovations in blue bio-economy technologies is needed to gain multi-trophic aquaculture, and efficient interaction of different "smart" technologies (ubiquitous). Aside fish farming, subsea mineral extraction would also be circular.

Huge technological leaps have been taken, and for this reason the opinion was that into some extent the sustainable scenario is already happening (e.g. autonomous offshore fish cages). Floating offshore aquaculture is developed towards a closed system. Availability and price of energy, and targets to reduce greenhouse gases regulate closed circuit aquaculture. Nowadays circular economy may have an impact on blue economy, however a Delphi-panelist argued it is difficult to anticipate whether this enthusiasm lasts until 2050.

Strong environmental leadership and innovation is needed to promote "Sustainability above all!" Radical change of tax system was proposed by a Delphi-panelist. At present, different policy areas include sustainability aspects to various degrees. However, often this is still seen as counterproductive to the 'green thinking' represented by the green movement or Ministries of Environment.

Commitment that permeates the whole community is needed; a willingness of both fishermen and decision makers to develop sustainable models that allow fishing in the region to remain without harming the environment. Greater efforts are needed in schools to develop understanding of circular economics and ecosystems.

"Goal: sustainable world in 2050, all actors contribute to it all time."

"Tallinn-Helsinki railway tunnel has decreased maritime traffic on the Baltic Sea. The level of protection of the Baltic Sea has risen remarkably and the Baltic Sea will be exploited very exclusively regarding raw materials (mostly to the needs of cosmetics industry, local food in a small scale etc.) Extremely extensive liabilities have been placed on mechanical littering and degradation of environment, and extensive co-operation is carried out jointly with all Baltic Sea region states regarding monitoring and vessels' waste management, seaworthy and monitoring of the emissions." View of a Delphi-panelist (2018).

Cargo and passengers will be moved through Helsinki-Tallinn tunnel or airborne. This will allow establishing a huge open aquaculture area to Gulf of Finland. Not a traditional fish farm – but zooplankton and fishing.

- 2018: The starting point towards the sustainable future is that the countries start immediately to implement the UN Sustainable Development Goals (SDG) effectively.
- Since 2020 there will be massive investments (e.g. states have willingness to invest). Financial investments will be allocated to new technologies:
- closed systems for fish farming
- cleaning the Baltic Sea
- 2020-2025: Innovative new multi-trophic fish farming technologies will be developed. The goal is to find out how to farm fish and algae together – but also other products as well as utilization of the waste (residual resources utilized in other sectors), and how we can use lower trophical levels for the nutrients. New food products will be developed, as well as products for other sectors.

- 2025-2030: Coordinated actions will be introduced between sectors (and also regions) – engineers, and sectoral discussions etc. Expertise on every level from all the countries will be used, not acting on the local only. And to have effect on the whole world/global ecosystems.
- In 2030, it is possible to sell the technology (to global markets).
- Awareness rising actions have improved the status of the sea, better knowledge on the resources and their dynamics in 20 years.
- By 2050 Ministries of Environment will cease to exist as being unnecessary.

4.4.4. "Unlimited growth" scenario on blue bioeconomy & subsea sector

Main drivers for the sector	Future image	Pathway
Policies concerning the use of natural resources Clean tech innovations for blue businesses Environmental regulations and legal practices – industrial policy State of the environment Attitudes Conditions and trends of global economy, globalization	Subsea resources and fish stocks are overexploited. Aquatic flora and fauna suffer from deteriorating of the environment and the consequences of climate change. The production and availability of blue bioeconomy has decreased. Attitudes towards the environment and sustainability are careless.	No environmental leadership. No focus on environmental thinking in schools. No control of the overall picture, poor cooperation. Decision makers are not educated on issues related to blue bioeconomy. Accelerating of economic development and continuing economic boom will increase the flow of tourists in the BSR, and will also have an impact on the unsustainable over-exploitation of the sea space. The building of the Helsinki-Tallinn tunnel will increase sand and gravel extraction, more fish farms will be established on the coasts.
"Do nothing, pretend everything is under control with some more regulations and reforms"		

Arguments of Delphi, workshop and interviewees

Two Delphi panelists did not believe in "Unlimited growth" scenario.

No environmental leadership was mentioned as a reason, which would lead to "Unlimited growth". "Do nothing, pretend everything is under control with some more regulations and reforms. No focus on environmental thinking in schools. No control of the overall picture, poor cooperation. Decision makers are not educated on issues related to blue bioeconomy."

For the timing being, apparently, the regulation is working and prospects are positive when it comes to the quality of the water. Decline of state or state of emergency might turn the development into another direction? In current fish farming, diseases and eutrophication are big problems, which might culminate is some time scale if e.g. the closed circuit system will not be taken into use.

Accelerating of economic development and continuing economic boom which has increased the flow of tourists in the BSR, would influence also on unsustainable "over-exploitation" of the sea space in many ways. Building Helsinki-Tallinn tunnel would increase sand and gravel extraction, and there would be more fish farms on the coasts. The existing MPAs (Marine Protected Areas) vs. many new developments were discussed. Restoration of rivers will take place also on the Estonian side.

Pathway towards "Unlimited growth" by Tallinn scenario workshop

- 2018: the awareness of the problems.
- 2030: EU legislation and strategies and international agreements affect until that. After this, there will be big changes.
- Around 2040: population increasing, quality of environment is decreasing (somewhere), political tensions due to the resource crisis by 2040.
- In 2050, resources and stocks are overexploited.
- Affects to markets (trend graph)

4.4.5. "Sustainability dilemma" on blue bio-economy & subsea sector

Main drivers for the sector	Future image	Pathway
Policies concerning the use of natural resources Clean tech innovations for blue businesses Environmental regulations and legal practices – industrial policy State of the environment Attitudes Conditions and trends of global economy, globalization	Awareness of the environmental problems and their impacts on blue bioeconomy, but old technologies are used instead of innovative systems. Old customs and consumer habits prevail. Conflicts of different sea use continue. Small measures addressing environmental impacts despite concerns and sea pollution.	Weak environmental leadership and no innovation. No common focus on circular economy. The Baltic Sea Region states will proceed in different timing in their operations. The price of new technologies continues to be high.
"Weak environmental leadership"		

Arguments of Delphi, workshop and interviewees

Scenario "Sustainability dilemma" was considered to lead towards "Unlimited growth". A Delphi-panelist mentioned lack of co-operation between countries, and lack of knowledge share and common views for sustainability. These will last 10 years from now, but gradually the scenario "Unlimited growth" will be reached.

Another reason mentioned was that Baltic Sea Region states proceed in different timing in their operations, and part of the states uses this as an advantage and is on the move in the "mentality of foray" whereas the others (e.g. Sweden and Finland) do their best to protect the fragile marine ecosystem.

Currently there are no big conflicts on the Gulf of Finland sea area, as the pressure to exploit the sea areas is small. Eutrophication and quality of water are the biggest problems. This panelist wondered what would specifically hinder the use new technologies, and mentioned price and when it comes to floating platforms, depth and ice conditions.

"Maybe protest of younger generation - when they understand, that resources are over and they cannot enjoy luxury leisure, travel, big cars and other wasting lifestyle things like their grandparents did 1970-2000."

4.4.6. "Virtual reality" scenario

Main drivers for the sector	Future image	Pathway
Policies concerning the use of natural resources Clean tech innovations for blue businesses Environmental regulations and legal practices – industrial policy State of the environment Attitudes Conditions and trends of global economy, globalization	Resource wisdom: digital-based production and circular economy. New, digital offshore aquaculture technologies are used, for example independent, floating aquaculture units. Automation used in blue bio-economies and the subsea.	EU funding is provided for experimental projects and for risk investments. New product and service models are being built. Environmental legislation will be changed so that permits to moving platforms can be granted.
"New product and service models are being built"		

Arguments of Delphi, workshop and interviewees

All components of virtual reality scenario were considered to exist. Aquaculture is doing well in this scenario. In Tallinn workshop, "Virtual reality" scenario was considered happening quickly, already in around 3 years. The year 2050 was considered excessively far for the draft future image storyline. Into some extent, these things are happening already. A contradictory view of a Delphi panelist was an argument that research and development, policy, and financial instruments would lead to this scenario only in 50 years. In addition, another Delphi-panelist stated that ice conditions have a strong impact on implementation of floating platforms, and currently may hinder the floating wind power plants. In this case, the panelist doubted that the situation would change in the next decades.

Innovation was considered to have a strong impact on reaching "Virtual reality" scenario. Huge technological leaps have been taken (autonomous offshore fish cages). There could be self-moving aquaculture platforms that move according to environmental conditions and demand for fresh fish. During the winter, they would sink under the ice cover. Several platforms could be maintained from one large vessel as the platforms move to the service vessel. Innovations would make it possible for aquaculture to locate on marine conservation areas (zero emissions).

Environmental legislation need to be changed so that permits to moving platforms can be granted. Today the permits are location specific. It takes around 30 years to see what is really happening.

Extension of fish farming and aquaculture everywhere, where there is no conservation area or it is not forbidden otherwise; small scale commercial fisheries.

Development of "Virtual reality" scenario needs IT-solutions, building of new models, business and enterprises should take risks, and risk investments – with support of EU funding. Everything developed is open source, the development is faster and open and possible for everyone. Investment and innovation opportunities in blue

bio-economy need to be promoted widely in the society to make actors in other sector interested. Digital communities are easier to motivate to make statements.

According to a Delphi respondent, "the trend will be towards more practical oriented digitalized world from the present 'mantra' type of belief. No digitalization unless it will provide added value. This will happen a bit by bit as people gather understanding." Much focus on digital solutions in universities and colleges. Funding aimed at digital development. Most focus on the individual, not on the society and the environment as a whole.

General attitude (mindset) and concern on the state of marine environment, added with on the one hand on legislation which guides the operations and on the other hand, with legislation that restricts unsustainable operations. This would create multitude of new enterprises to consider more sustainable modes of operations to exploit marine ecosystems.

Close circulation fish farming on land!

Pathway towards this scenario from Tallinn scenario working group

- 2018-20: IT-solutions (digitalization) are developed. Business and enterprises should take risks. EU funding is applied and provided for experimental projects and for risk investments. New product and service models will be built. Actors involved are aquaculture enterprises, scientists, and engineers.
- 2020 – 2025: Environmental legislation will be changed so that permits to moving platforms can be granted. Today the permits are location specific. Sensors and satellites.
- Between 2030-2035 it is possible to produce "sustainable and effective aquaculture and different products, with no emissions! "
- Another possibility is shellfish and mussel farming to rivers to filter the water?
- In 2050: effective and sustainable aquaculture, there are different products (not only fish): medicine, algae.

4.4.7. Assessment the alternative scenarios on blue bio-economy & subsea sector

Scenario "Sustainability dilemma" was considered to lead towards "Unlimited growth".

In Tallinn scenario workshop, the opinion was that "all components of virtual reality scenario exist". This view was also reflected in the timeline exercise, in which the necessary activities were concentrated in the near future (mainly in 5-15 years). The reasoning was that "we cannot wait until 2050".

In virtual reality scenario, aquaculture is doing well. There is good closed-circulation technology development and good potential. Baltic Sea is quite small; success with management of problems in the Baltic Sea could lead to management of problems elsewhere, providing possibilities to export the technology. This reflects the opinion on Baltic Sea region as a testbed, such as mentioned in the context of adaptation to maritime environmental regulations in context of more stricter sulphur regulations. Aside "Virtual reality" –scenario, cleantech is linked to development of "Sustainability above all!" scenario: "If we cannot solve/start cleantech innovations business/processes, to produce food, no sustainability or better quality of environment cannot be reached". Cleantech enables clean food production and more clean and healthy environment.

For development of aquaculture, land-based production was reported as a weak signal.

EU's Common Fisheries Policy (Regulation (EU) No 1380/2013) aims to support the traditional European fisheries sector by making fishing sustainable and simultaneously, to improve the economic and social situation of fishermen. In Delphi study, some strong opposite views were posed on negative impacts of fisheries policy on coastal fisheries. In D.T.1.6.1., greater growth potential was identified in the development of aquaculture solutions and services.

The goal of EU Commission's strategic guidelines for sustainable aquaculture is that "fishing and aquaculture activities are environmentally sustainable in the long-term … with the objectives of achieving economic, social and employment benefits…" (EU2013a, Article 2(1)). European Commission (2017) Vision 2030 points out to "Clear regulatory framework in place". "According to the EU Commission's strategic guidelines for sustainable aquaculture (2013b), the goal is to grow significantly". Currently, out of the EU consumption of fishery and aquaculture products (13.2 million tonnes), 25% comes from EU fisheries, 10% from the EU aquaculture, and 65% from imports. (D.T.1.6.1.)

The national level strategies of Finland and Estonia include clear targets, however, only until 2020 / 2022.

Estonian aquaculture strategy 2013 sets high targets for Estonian aquaculture production to achieve more than 50 % share of Estonian internal market and more than 5 Million Euro export of aquaculture products by 2020. This means increase of total Estonian aquaculture production to more than 4 300 tonnes by 2020 (including more than 3 000 tonnes for internal market and more than 1 300 tonnes for export), from starting point of production of 870 tonnes in 2017. According the sources identified in D.T.1.6.1. there are no functioning marine aquaculture in Estonia, some test pilots are ongoing.

In the Finnish aquaculture strategy (2014), the target is that Finnish aquaculture would grow from current 13 000 tonnes to a yearly production level of 20 000 tonnes by 2022. The Finns eat 80 000 tonnes of fish a year, of which Norwegian salmon accounts for half and one third is Finnish (MMM 2014, 4).

The strategies support the aims of the "sustainable" scenario in general, but without clear long term targets, "Sustainability dilemma" scenario and business as usual may continue in blue bioeconomy sector.

4.5. Futures of tourism, culture and services for leisure activities

4.5.1. Changes in tourism, culture and services for leisure activities and impact on the sea use

In Delphi-study 2018, tourism, culture and services for leisure activities and their sub-sectors were considered. Tallinn scenario working group discussed tourism sectors mentioned in Table 3. The interviewees were selected representing support and promotional organisations for tourism, tourism companies and specific leisure associations, as well as services for cruise tourism, and the focus was on the subsectors mentioned above.

Sea and coastal tourism is the largest sub-sector of tourism, the largest single maritime economic activity and the key economic driver in many coastal regions and islands in Europe (COM, 2014c; see DT1.8.1). Coastal tourism is considered one of the key blue growth industries also in the Plan4Blue project area: Gulf of Finland and Archipelago Sea (D.T 1.6.1.)

In Delphi 2017, the sector "Tourism and culture, services for leisure activities" on the whole was considered to increase by 2050 by 100% of the respondents. All the subsectors of tourism, culture and the services for leisure activities are estimated to increase or remain the same as currently (Figure 9). Also the interviewees (2018) considered the future of tourism positive, and future growth steady. Tourism was expected to increase in particular from Far East. India was also mentioned in the interviews. On the other hand, domesticity and locality were also mentioned as trends. Growth of tourism is expected both from national and international sources, and from different kinds of tourism.

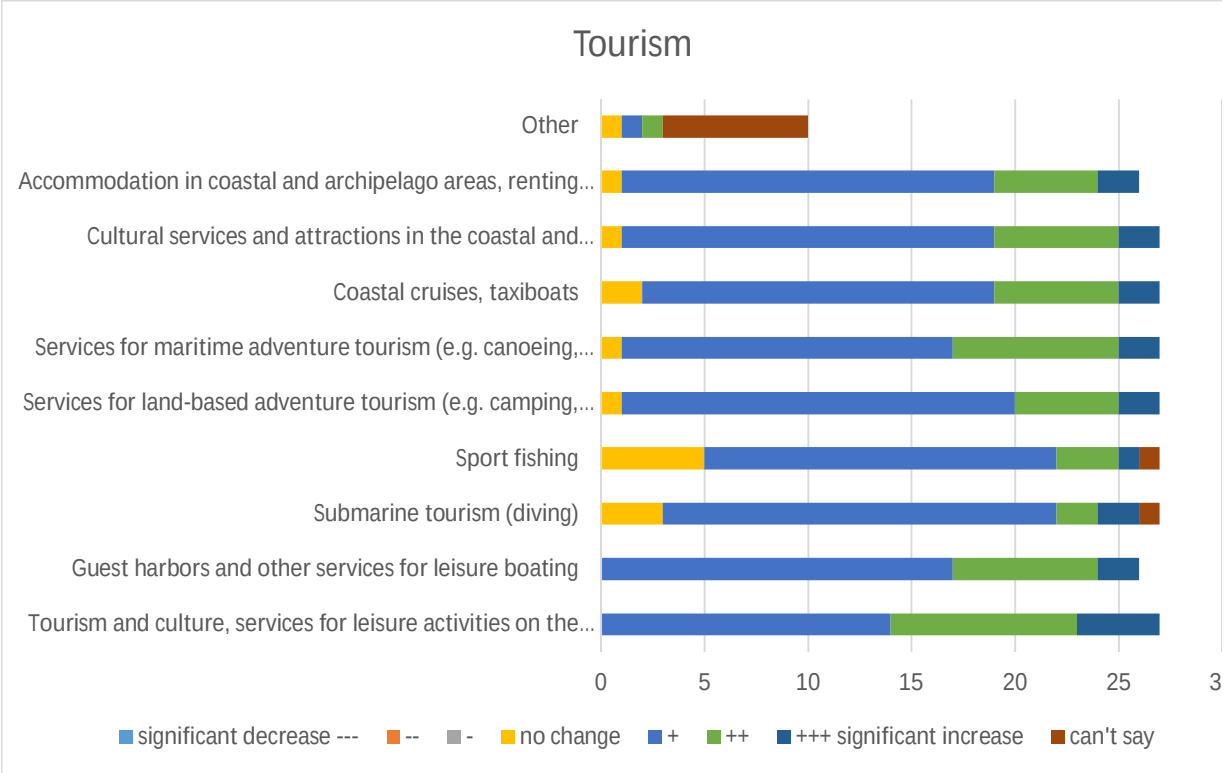


Figure 9. Changes in tourism sector (results of Delphi 2017)

On the scale of + slight increase /++ moderate increase /+++ significant increase, moderate or significant increase is expected most for "Services for maritime adventure tourism (e.g. canoeing, surfing, water-skiing, "jet skiing")", according to 37 % of the panelists, and according to 35 % of respondents, for subsector "Guest harbors and other services for leisure boating". Leisure boating was expected to increase by the interviewees, too; however changes in ownership were expected: sharing economy and co-ownership may step in boating sector.

70 % of the panelists expect slight increase for the subsectors "Services for land-based adventure tourism (e.g. camping, hunting, visiting nature parks)" and "Submarine tourism (diving)". "Accommodation in coastal and archipelago areas, renting vacation homes" is expected to have slight increase according to 69 % of the panelists. "National park boom" was mentioned by an interviewee. Trips to islands and on coastal area were expected to increase. Ecological trends, and touristic activities such as snorkeling and diving have been identified to create future potential for tourism development in Estonia and Finland (Ecorys, 2013).

The views of the experts follow the same positive development indicated in the quantitative economic analysis of Plan4Blue, supported also by the views of business interviewees, as well as several reports referred to in D.T.1.6.1. Digitalisation and self-service development were identified as drivers, which may influence the high predictions of employment negatively.

Of all the blue economy sectors, impacts of tourism were most difficult to assess spatially. In particular "Virtual reality" scenario was considered difficult to illustrate on a map. Tallinn tourism working group worked with two scenarios – the best case and the worst case. The combination map was chosen to represent "Sustainability dilemma" -scenario. The maps are constructed in a very different way than other sectors maps. In "Unlimited growth" scenario, tourism was expected to have extensive spatial impacts, in case that all the different planned transport options are realized: Rail Baltic, Helsinki-Tallinn tunnel, possibly other tunnels. In this scenario, various kind of cruises and small boat routes would go all around Gulf of Finland. There would be artificial islands near Tallinn, and new nuclear power station would have to be built.

Sport fishing

Sport fishing is centralized around Tallinn while it is almost absent in Finnish side (Roose et al. 2017: Delphi maps). Valuable fish species in rivers were mentioned in one group, as hydropower and dams have prevented and still hinder fishing tourism in many rivers. Restoring river water systems in order to restock and open ways to the valuable fish species such as migrating salmonids (or bivalves) would increase the leisure fishing in future.

On the Finnish side, rivers that would need dam removal were mentioned in Helsinki workshop: rivers Kiskonjoki, Mustionjoki, Vantaanjoki, Porvoonjoki, Kymijoki. In Estonia, this is poorly regulated and rivers on the Estonian side are not marked on a map. In Delphi, one suggestion was to regulate and monitor fish stocks, especially salmonids. If required, hobby fishing should be banned in rivers that are spawning sites for salmonids.

Tourist attraction areas

The centers of culture and accommodation are the middle Archipelago Sea and the vicinity of Tallinn (Roose et al. 2017: Delphi maps). Current tourist attractions in Estonia were estimated to remain also in coming decades in Saaremaa, Hiiumaa, Haapsalu, Noarootsi and Pärnu outside the project area. The entire Estonian coast was mentioned to be potential for tourism, e.g. Paldiski area, while the services and infrastructure needs to be developed. These may attract for instance more bird watching tourism from Germany. Haapsalu region has very popular mudbath spas. Tallinn, Loksa area, Pakri and Väike-Pakri are used for recreation for locals from Tallinn region. Recreation infrastructure development was mentioned to be growing in Estonia. Tourism working group (2018) noted that traditionally used areas would be always used.

The eastern coast of Estonia and Narva-Joesuu were estimated to become important tourist area by all workshop groups. The value of North-Estonian coastal areas for local people as well as tourists is the pristine nature and maintenance of traditions of coastal life. Narva-Joesuu and Toila are popular especially among Russian tourists. Potential tourist area is very remote area left from Narva-Joesuu, which has many nice beaches and is peaceful, but it is currently lacking service infrastructure. Suursaari is available for access as well.

Areas of touristic interest in Finland are places quite close to population centers where services and infrastructures are ready to serve tourism and recreation. In the project area, all groups estimated that the tourist attractions would be concentrated around the Archipelago Sea and its biosphere area / national park, Örö and areas around it as well as the Archipelago Trail. All groups estimated also that Helsinki city and its archipelago, as well as areas around it both to east and to west would remain as important tourist attractions also in future. The Archipelago Sea and coastal areas of Finland are

important for domestic tourism, in particular recreational summer houses. In the Bothnian Sea, tourism and recreational use might increase in future, because of clear and cleaner waters than in southern sea areas.

Coastal cruising may create more synergy with tourism and ports, for example waterbus routes site-to-site along the Finnish coast (Roose et al. 2017: combination maps). New eastern ferry line between Finland and Estonia was also mentioned.

International tourism

Both in Delphi and in workshop the increasing number of international tourists, especially from Far East and Asian middle class, is seen to increase. They are interested in pristine nature and pure water. Flights to/from Asia-Helsinki were estimated to increase tourism also to Tallinn, while the behaviour after retirement is difficult to estimate. Asian tourists were estimated to focus on bigger cities and readymade package holidays, but they were not estimated to spread further to coastal destinations, such as national parks or beaches. For international tourists it is also important that the area is considered secure. Cruise tourism was estimated to increase in the Baltic Sea Region and its importance to grow by two groups, but on the other hand, its attractiveness among young generations was questioned. Luxury tourism was mentioned as well. Aside current cruises on summertime, winter cruises were mentioned as a new trend by an interviewee.

All three groups estimated that Helsinki and Tallinn are important tourist destinations also in future. Two groups mentioned Helsinki-Tallinn tunnel, which was estimated to be a possible additional connection for tourists to Tallinn. Rail Baltic would also increase tourism connected to tunnel. In addition, commuting between Helsinki and Tallinn was estimated to be increased by the Helsinki-Tallinn tunnel. In Finland, Kotka-Hamina region were mentioned one of the key areas of tourist development. In addition, the hyperloop between Turku – Stockholm and Helsinki –Tallinn was mentioned, but not marked on the map.

Culture and nature destinations

Public right of access prevails in Finland and in Estonia, even though there are some differences: approaching the coastline is allowed for all only by foot in Estonia, and there are restrictions in some places for example because of noise. This makes possible the increase of the "easy access nature tourism" in future, e.g. sites close to cities with marked paths and good infrastructure. National parks were estimated to be important areas of tourism in the project area both on land and in water areas. With increasing leisure time and tourism in water areas, noise may be an increasing problem, especially when water scooters or jet skis are used.

Conflicts were identified at the coastline between summer cottages and free shoreline by Tallinn tourism working group in "Sustainability above all" – scenario. In "Unlimited growth" –scenario, cultural heritage along all environmental values are ignored.

Underwater cultural heritage and in particular on-land was mentioned as a resource for tourism by two groups (Roose et al. 2017: Delphi maps). Because wood preserves in brackish water, underwater cultural heritage areas were thought to be important in the Baltic Sea region also in future. In the eastern part of the project area, there are underwater resources that are currently investigated. Diving in the underwater cultural destinations will probably increase, e.g. in archaeological sites such as the Kronprins Gustav Adolf Underwater Park in Helsinki. However, in the eastern part of the project area, off Kotka and Narva, the problem is poor underwater visibility. There are some underwater destinations in the Estonian side, but their usability as tourist destinations should be developed.

Leisure boating

The number of small boats in Estonia is increasing and the suggested increase or claim new areas were mostly in the Estonian coast as the leisure boating is estimated to grow (Roose et al. 2017: Delphi maps). In Finland, leisure and small boating is already very popular. Thus both Estonian and Finnish leisure boats were estimated increasingly cross over the Gulf of Finland, which indicates that the need for marinas is evident in Estonia. The number of guest harbours was desired to increase spatially evenly in Finnish and Estonian side, especially in the outer coast (Roose et al. 2017: Delphi maps). Also Tallinn tourism working group considered that use of small boats increases, and there would new routes all around the project area, and yachting along the coast is common.

Increasing leisure boating across the Gulf of Finland also means that the safety issues in leisure boating will be an issue in future, as the region is one of the most heavily trafficked areas in the world by commercial shipping (e.g. HELCOM 2018, Baltic Lines 2016, WWF 2010). The commercial shipping is guided by VTS (cf. Roose et al. 2017: background maps). When small boating /yachting is increasing in the busy Golf of Finland, the navigation and other skills of the boaters and yacht crews was estimated to be better. Captains of small boats are not educated for navigation, which creates increasingly risks, for example with commercial shipping. In Pärnu, there are already sailing areas. However, in 2050 there will probably be

available mobile applications and other portable or wearable technology for all people, including better interactive map applications etc. Thus, everybody would be able to see the current situation and locations of other people, vessels, and small boats, as well as restrictions and warnings on land and at sea.

4.5.2. Drivers for tourism, culture and services for leisure activities

Tallinn scenario working group discussed drivers for tourism sectors mentioned in Table 3: "Nature tourism" – recreation, camping, outdoor activities etc.; cottages and camping; offshore water sports: diving, fishing, canoeing; cultural heritage and history and boating and sailing, including guest harbors. The interviewees were selected representing support and promotional organisations for tourism, tourism companies and specific leisure associations, as well as services for cruise tourism, and the focus was on the subsectors mentioned above.

Altogether, according to PESTEL classification, social drivers gained most mentions in this sector, followed by political and environment-related ones. Among the individual drivers, state of the environment was considered the most important driver for tourism sector in Delphi 2018, followed by safety and security in Baltic Sea region (See Table 25). State of the environment is crucial for maritime tourism and connected strongly with the driver attitudes of tourists. Pure nature will be even more valuable resource in future; it defines whether Baltic Sea region or Gulf of Finland is attractive. People enjoy clean environment and nature, and they are more and more interested in spending time outdoors. Without a healthy environment, there is nothing to enjoy. If the sea is eutrophic and it is not possible to swim in it, the visitors will avoid the area. Because of climate change, Central Europe could be too hot by the 2050 and the cool climate attracts the tourists because of more stable weather. The majority of the respondents of Delphi had a positive forecast of state of the environment in the Baltic Sea region: 86 % of them considered that in 2050 "BSR is clean and attracts more tourists to coastal and sea areas." (Table 26) On the other hand, an interviewee noted that seasonality is a problem for small ports. Bad weather can be a serious setback for tourism companies.

Safety and security affects all travelers, and global security has even more impact on the development of tourism at a global level, affecting e.g. incoming tourists from Asia. Global terrorism or wars lead to less secure environment to traveling, different traveling destinations, and it may affect whether travelers choose close or distant destinations. Another safety aspect mentioned in interviews was flight accidents. As black swan, terrorism against cruise vessels has been discussed (e.g. BSR Forum 2018, Turku).

High level of safety and security in the BSR can attract large amount of tourists as people need safety to relax. Cleanliness, quality and safety are important, because many people prefer to travel with children. Safety would lead to more growth of global tourism; more money spent and more individual, tailor-made traveling, increasing need for flexible and fluent travel chains. "BSR region is a safe and secure tourist destination" (in 2050) was unanimously agreed by the respondents of Delphi 2018.

Social drivers have strong influence in tourism sector. The social drivers identified for blue economy as a whole: ageing population, urbanization and depopulation of remote districts interlink with each other. A big challenge to employ people was mentioned by one interviewee as one factor for development of tourism, which may link to depopulation of remote districts, and to seasonality of tourism business in Baltic Sea region. The lack of suitable skills and competences as well as an ageing workforce have been identified as the problems for the future development also in EU's Sustainable Blue Growth Agenda for the Baltic Sea Region (COM, 2014b).

Increasing decree of education among the younger tourists is expected to affect their travelling interest. In Delphi 2017, for example a "back to the nature" trend among younger was identified. In addition, urbanization may lead to interest to experience nature destinations.

Leisure interests mentioned in the interviews were strong development of ecotourism, the will to experience domesticity and locality, and interest in local culture, nature and meeting local people. More interest towards local destinations vs.

touristic hubs was indicated also in the opinions of Delphi 2018. "Tourists prefer local and regional destinations" was agreed by 71 % of the respondents. "International tourists visit mainly touristic hubs in the BSR was agreed by 50 % of the respondents", 21 % disagreed slightly and 29 % had a neutral opinion. This indicates a tendency towards locality in tourism sector.

A Delphi panelist argued that sustainable development needs to be emphasized related to continuing growth of traveling and its future development, including all the pillars of responsibility and sustainability of cultures. Clean air, nature, food and water will become more valued and wanted, and traveling in the BSR may grow remarkably. Without preparing to that, tourism may even become uncontrolled. The change in global traveling – in consumer behavior will be big. Services for traveling are being planned, reserved and paid online, and peer reviews have a big importance. Experiencing of daily local routines will affect more also to daily life of the locals and hospitality experienced by the tourists. To be able to cope with in this situation, the enterprises have to invest in digital services and know-how. Marketing of traveling will change and regional marketing companies will become more destination development marketing and managing organisations.

Related to attitudes, a Delphi panelist noted that tourism needs good communication and advertising - people need knowledge. "It is imperative to offer interesting and exciting challenges for the prospective client in marine and coastal areas. If we have some interesting solutions, then people want to get more around and get involved with exciting events in coastal regions. Leisure interests matter today even more; people have very specific hobbies, which they prefer to exercise on vacation". Extreme tourism is an example of different leisure interests: places that are not safe can also attract tourists (e.g. Chernobyl).

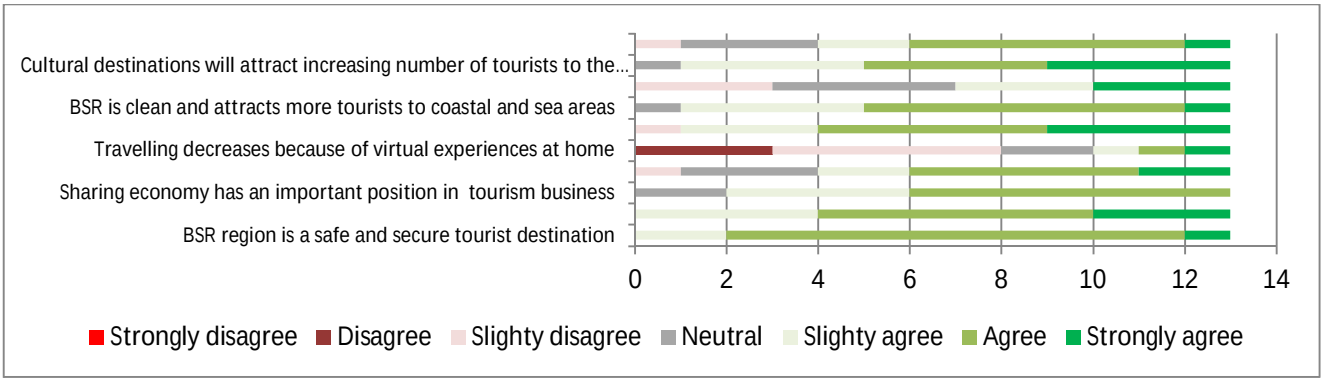
Table 25. Drivers for tourism, culture and services for leisure activities. The drivers selected in the workshop were all given one mention as all the working groups did not vote.

Driver	n=14	Tallinn workshop	Interviews, N=7
State of the environment	9	1	2
Safety and security in BSR region	8	1	3
Attitudes of travelers / tourists	7	1	1
Conditions and trends of global economy	4	1	1
Leisure interests	4		4
Tourist destinations in areal development	3		
ICT - digitalisation	2		2
Globalization	1	1	
New drivers mentioned in Delphi and Tallinn workshop 2018	4		
Accessibility of services	1		
Economic wellbeing	1		2
Accessibility	1		2
New ways of traveling: technologically changing opportunities			
Climate change			
New factors mentioned in interviews 2018			
Sharing economy			1
Sustainable development and responsibility			2
Energy efficiency			1
A big challenge to employ people			1
Overall employment of young people in Estonia			1
Total	41	7	71

Attitudes and tourists routes can change through time, and more information may change attitudes of the tourists. Globalization brings new attitudes via different cultures. People are searching new places, where mass-tourism is not yet so popular and create then new mass-tourism areas and change the environment also through that. Discussions about sustainability of tourism will define what forms of tourism will grow in future. In Estonia, increasing awareness about the sea was noticed by an interviewee, in particular because of the Year of the Maritime Culture.

Statement "Global growth leads to increasing number of global tourists in BSR" was unanimously agreed by the respondents of Delphi 2018. Tourism and local entrepreneurship were considered to have affected coastal regional economy in a positive way. Economic wellbeing has impact on tourism: the more well off people are, the more they will use the sea for recreational purposes, if they also have more free time. In the interviews, increase of income was mentioned to affect buying more boats. On the other hand, it was noted that boats are expensive, and sharing of boats as well as chartering was expected to increase in the future. People want more different kind of services. Sharing economy is expected to have an important position in tourism business.

Table 26. Statements on development of tourism, culture and services for leisure activities



Another reason towards individualized leisure interests is digitalization. The statement "Digitalization leads to individualization of travelling and interest in unique travel destinations" was agreed by 93 % of the respondents. ICT – digitalization means that tourist wants to search, book and pay online. Digitalization and self-service development may influence negatively high predictions of employment (see D.T.1.6.1). In addition, one interviewee mentioned that due to digitalization, there may be less employment, aside new solutions and faster sharing of information.

Helsinki-Tallinn tunnel would create and encourage new ways to travel. It is globally known and connected area, and may attract wealthy people from Central Asia. Currently Estonia has very good ferry connections but flight connections are not that good. In Delphi 2018, it was noted that if tourism industry services are developed in such a way that they are accessible and attractive, the sector is able to grow in a long run. On the other hand, if the general trend is to protect the environment, sustainable tourism in smaller areas closer to the consumer will become more popular.

"BSR and islands provide in 2050 "something totally different" for incoming tourists, a climbs of "old time" experience of nature. It takes much time to find nature so clean than here, and globally there is an enormous trend to get back to "primeval" life. Amount of Far Eastern people with high income has increased enormously lately, thus there will be a lot of travelers, thus it is important to take care of that tourism does not stress too much the nature, that there will be space for more thousands and thousands of those willing to quay access to restricted tourism experiences in the islands". (Delphi-panelist, 2018)

According to a report in the context of 10th Baltic Sea Tourism Forum 2017, the most significant barrier to hinder or even prevent a desirable future of tourism in Baltic Sea region was considered to be the lack of relevant skills, expertise and education (Parkkinen, 2017)

In the futures table below (Table 27), the main variables (based on the identified drivers) and their futures states are presented.

Table 27. Futures table for tourism, culture and services for leisure activities

Futures table – tourism, culture and services for leisure activities				
Future images 2050 / Variables	Sustainability above all!	Unlimited growth	Sustainability dilemma	Virtual reality
Attitudes of travelers / tourists	Positive attitudes towards decarbonisation, sustainability and responsibility among travelers.	Attitudes towards environment and sustainability are negative or careless.	Polarisation of opinions; e.g. others for sustainability, others against	Enthusiastic attitudes towards new experience tourism.
Safety and security in BSR region	Safe and secure BSR enables development of sustainable tourism.	Low level of co-operation. Unstable security situation in the Baltic Sea region. Only few tourists.	Safe and secure BSR attracts tourists from Far East and all around the world.	Tourism decreases because of virtual tourism.
Conditions and trends of global economy, globalization	Good global economy enables global travelling and mass tourism.	Strong growth, less international tourists because of poor state of the environment.	Global tourism increases, various means of travelling and destinations.	Global growth based on services and virtual products. Sharing economy, service based traveling, renting and sharing the accommodation.
Leisure interests	Responsible tourism; ethical issues important; sustainable nature tourism favored. Long-distance air travel opposed.	Increasing number of tourists prefer traditional package holidays and cities as destinations.	"Back to the nature" trend among the young generation. Leisure interests in traveling in close sustainable destinations (in the vicinity of cities) "easy access tourism"	No need to travel because of virtual experiences.
ICT - digitalisation	Well working, unified ICT systems, digitalization allows easy use of travel related data for e.g. planning, reservations, and information on the destination.	Traditional means of traveling, as "ICT" and "smart" have not developed. Unsustainable ways of travelling prevail.	Availability of different "smart" technologies; their usability and advantages have not realized, fragmented.	Augmented reality is used as a tool to enhance one's experience on the destination.
State of the environment	Clean environment, air and sea attract more tourists.	Decreasing air quality, pollution of environment and eutrophication do not attract tourists.	Relatively good state of the environment compared to global urbanized areas attracts tourists.	Development of new types of blue care, health services from the sea.
Tourist destinations in areal development.	Restrictions for tourists to enter certain conservation areas. Local people benefit from tourism.	Development of touristic hubs. Conflicts with local people.	Many smaller tourist destinations scattered to coastal areas.	Plenty of cultural heritage sites in 5D, virtual 3D models. airn'b'b.

Weak signals for tourism, culture and services for leisure activities

- Sharing economy is growing: renting, using services increases among the now young generation.
- Popular movies, series attract tourists to unexpected locations! https://yle.fi/uutiset/3-9951085

Black swans

- military situation, the purity of nature, disaster

4.5.3. "Sustainability above all" -scenario in tourism, culture and services for leisure activities

Main drivers for the sector	Future image	Pathway
State of the environment Safety and security in BSR region Attitudes of travelers / tourists Conditions and trends of global economy Leisure interests	The safe and secure Baltic Sea Region has enabled the development of sustainable tourism. Restrictions for tourists to enter certain conservation areas. Well working, unified ICT systems; digitalisation allows easy use of travel related data for planning, reservations, and information on the destination.	The attitudes of the travelers themselves towards sustainability will change. A ranking-price system based on the impact and pressure to the environment will be introduced; tourists pay for the externalities that their actions cost. Areas of mass tourism and restricted areas will be determined and specific sectors for travelers will be established. Sustainability will be developed by co-operation of sectors. Sustainable energy for travelling will be used.
"Tourists participate in activities for sustainable tourism: rebuilding ecosystems, reducing nutrients"		

Arguments of Delphi-panel, scenario workshops and interviewees

Sustainable futures scenario was accepted by Delphi-panel and in scenario workshop, without any contradictory comments. In sustainable future pathway, change in attitudes of the travelers themselves towards sustainability was considered the key issue. Sustainability is developed by co-operation of sectors. One Delphi panelist stated "the sector needs same kinds of tools for development as any other."

Pathway towards sustainability, Tallinn tourism working group

"Traditionally used areas cannot be deleted or avoided, they will be always used"

- 2018-2020: Grassroot activity and ideas of citizens. Good services for tourists e.g. cruise vessels.
- 2025: awakening! Sustainable local tourism in different shorelines of Estonia and Finland. In 2025-2030, nature tourism grows due to urbanization. Ranking-price system based on the impact and pressure to the environment will be introduced in 2030; tourists pay for externalities that their actions cost.
- Ranking-price system based on the impact and pressure to the environment will be introduced in 2030; tourists pay for externalities that their actions cost.
- Local or global? Areas of mass tourism and restricted areas will be determined and specific sectors for travellers will be established by 2035. Certain areas are sacrificed for mass tourism so that many other areas could be saved.
- Sustainable energy for travelling 2030-2035.
- Sustainability is developed by co-operation of sectors, holistical view.

Improved security and strong environmental leadership is needed for sustainability. One Delphi-respondent stated that tourism is not yet a problem in Baltic Sea Region (BSR), except some really vulnerable region (Kurland). In main tourism areas, restaurants and hotels create increased pressure. More effective ways for waste handling (in natural areas), garbage management and new sea-cleaning technologies in the mass-tourism areas in 2050 would help in reducing littering. Better opportunities should be created for people themselves to be more involved in environmental adventures.

To reach clean environment in the Baltic Sea region natural and cultural values must be exhibited to the greatest extent possible, but at the same time safely, so that valuable natural areas cannot be damaged. Strong BSR-wide cooperation is needed towards sustainable solutions for tourists. Political will and decisions at regional level are needed for sustainability. Technologies and behavior should be targeted to sustainability in all the sectors to achieve that also in tourism. Responsibility of the tourists themselves was pointed out: visitors should understand to develop the natural values we have in a sustainable way, and to understand the unique environmental values, their importance, and the importance of protecting them. People can help to create, restore, and protect ecosystems and protection areas; tourists may be engaged to rebuild ecosystems as nature workshop events. Tourists can be active in creating the nature that they want to see in future.

"Tourism has become a strong backbone of Finland's national economy. Joint understanding has been reached on that it is beneficial for Finland to ride on sustainable choices and take care of the environment. The know-how linked to this (water resources engineering, recycling, waste management, nature conservation, forestry etc.) gains much interest. Aside nature tourism, it is advertised and marketed as Finland's strong area of expertise, which has developed onto well-known product of service-export / concept. " (Delphi-panelist, 2018)

Joint marketing is needed to actively promote sustainable tourism. More information in different languages should be available locally. Open and participatory way to development the destination was called for: intention to listen to the needs of local people and to create them channels of influence, how to define their own living environment vs. traveling. Responsible marketing and building a brand should be based to reality and not to e.g. on an image of the past (ref. Sami; image of old reindeer management and current management with motor sledges) – vs. contradictory expectations of the tourists.

Restricting certain areas from tourism was discussed by Delphi-panelists and in Tallinn scenario workshop. There is a dilemma: to avoid sensitive areas and use more intensely other areas or plan maritime spaces with mixed uses (including buffer zones?), to sacrifice some areas for mass-tourism to protect other areas. Some opinions were for regulation and control for tourism activities in vulnerable natural areas, and application of systems to stay in such areas only with the competent sender or more environmental inspectors. Virtual reality instead of the real tourism might protect nature.

A Delphi-panelist figured the reasons for restrictions and their impact, development of certain tourist hubs:

"There would be so many incoming travelers willing to come to BSR, that it has been needed to restrict the amount of tourists, in particular in the most sensitive areas of Archipelago Sea. In spite of that tourist flows reach even the smallest towns and villages, they benefit of that, and operate as hubs, which endure the larger amounts of tourists. "

Five out of seven business interviewees replied to the question whether certain areas should be restricted. One of them could not think of an area that should be closed off. The other ones agreed on restricting. Heritage sites and protected areas were mentioned as ones to be regulated; Suomenlinna was mentioned as an example. Reasons mentioned for restrictions were pressure for nature, nature attractions and vulnerability, endangered species and encounters with the locals.

An Estonian interviewee noted that "Moving in protected areas, national parks should be regulated/controlled more in some cases, not all of our islands should be open for mass tourism. Otherwise peculiarity of some places can disappear". One interviewee found another way than restrictions; investments may directed e.g. to keep a destination for nature/eco-tourism.

Different new technologies enable much more extensive information on the destinations, e.g. via augmented reality. As much as possible information and promotion should be available digitally and through IT solutions. Services and infrastructure should be developed in cooperation between regional areas and between different instances in the same region to

create smart packages that attract tourists. For example, organized hiking in natural areas with organized activities (sights, adventure parks, nature reserves, etc.), mixed activities could be arranged.

4.5.4. "Unlimited growth" scenario in tourism, culture and services for leisure activities

Main drivers for the sector	Future image	Pathway
State of the environment Safety and security in BSR region Attitudes of travelers / tourists Conditions and trends of global economy Leisure interests	Strong growth has led to increasing mass tourism and environmental damage. All the different planned transport options have been realized. Attitudes towards the environment and sustainability are careless, as is towards local residents. Unsustainable ways of travelling prevail. Clear water is important and rare.	All the different planned transport options will be realized; Helsinki-Tallinn tunnel will be built, artificial islands etc. At the beginning, tourism will increase. There will be a lot of different cruise ships and routes, and for example fishing tourism. Further on, the amount of tourism will start to decline because of the bad state of the environment.
"All resources are used maximally, and the maximum is also taken from nature"		

Arguments of Delphi-panel, scenario workshops and interviewees

Scenario "Unlimited growth" in this sector was also accepted. It was characterised by no limitations or laws, many different actions and pressures. There are no conservation areas any more, or they fail in achieving conservation goal. Tourism is very intensive everywhere and causes pressure to nature. Finland's archipelago area will be used very intensely. There are many private cottages. In Estonia there are no free shoreline laws any more, people can close shoreline and build as close to the sea as they want, as in Finland. Short-term profit, people do not think about the future or sustainability. Rich and wealthy "can do anything". New restaurants and hotels, services. There are more guest harbors: the ecologically sensitive areas and areas valuable for ecotourism are not taken into account any more. Increased eutrophication. Attitudes that do not value nature. Vulnerable areas would suffer, and littering gets worse. Cultural heritage sites have been lost.

Pathway "Unlimited growth" in tourism from Tallinn workshop working group

- All the different planned transport options will be realized. In 2025, Rail Baltic has been built. At the beginning, tourism will increase. There will be a lot of different cruise ships and routes, and for example fishing tourism. Further, amount of tourism will start to decline because of the poor state of the environment.
- Helsinki-Tallinn tunnel will be built by 2030. Mass tourism or depopulation by 2035. Tourists do not care about the environment.
- Private submarines operate between Helsinki-Tallinn. Artificial islands (linked with tunnel) near Tallinn, casino island etc.
- Unlimited growth leads to building of a new nuclear power plants in 2035.
- Space tourism routes in 2035-2040 with lower cost.
- In 2040, underwater transport is available for everybody. Many private boats and submarines and no limitations will cause frequent boat accidents and oil spills.

- Limitations due to pollution and environmental damage will be accepted; tourists accept that sea and the entire environment is not clean.
- In 2050, white nights and dark days. Drinking water is imported. People use protective suits to go into water. Extreme weather, climate tourism (refugees).
- Many conflicts between people.

A reason mentioned for "Unlimited growth" was that it has not been prepared to these issues in advance and environmental legislation drags behind. There is no environmental leadership. Maximizing the profits will fast exhaust the popular destinations. Nature, which was the selling point will suffer so much that tourists are not interested to come and witness the damages. Too much power has been given to market forces – fast increase in the number of tourists has been considered a good means to survive for the desolated localities; however, the joint rules and regulations have been forgotten en route. Another reason mentioned was bad communication about what we can offer in our regions.

There is lack of sustainable tourism policies and regulations. Growth of mass tourism is fast in the region, including ecologic sensitive areas, such as the Finland's archipelago area. Massive privatization of shorelines in Finland and Estonia. Increasing environmental damages caused by intensive tourism and climate change. Self-absorbed society with no interest in nature and cultural values. "Low prices; lack of regulations; lack of knowledge".

The social aspects of tourism and impact on the life of the residents were described by one Delphi-panelist:

"It is not only about negative environmental impacts of mass tourism, but how strongly tourism affects the local life daily, living and the way of life. For travelers encountering (the locals) is once-and-only, however, for the locals it is continuous. Thus traveling shapes local culture and impacts on the views of local inhabitants on themselves. Unlimited growth areas may also mean destinations on islands or towns, in which cultural sustainability or endurance is threatened. For example, Venice (mass cruise tourism drives local residents off the city, and the result is cultural outdoor theme park); or Barcelona, Iceland. Airbnb and masses cause increasing rents in the centers and locals cannot afford to live there. " (Delphi-panelist, 2018)

4.5.5. "Sustainability dilemma" in tourism, culture and services for leisure activities

Main drivers for the sector	Future image	Pathway
State of the environment Safety and security in BSR region Attitudes of travelers / tourists Conditions and trends of global economy Leisure interests	Global tourism has increased. Tourists have different likes; various means of travelling are used and different destinations visited. Concern about the impact of tourism on the environment, but lack of environmental leadership and preparedness for the rise of tourist flows. Different smart technologies are available but they are not user-friendly.	Weak environmental leadership, lack of knowledge and information and too cheap travelling. Weak digital skills and preparedness in companies. Poor preparedness and restricted possibilities of companies to react fast to constantly changing global user needs. Tourism industry develops, but without cooperation between different instances. No common goal.
"Weak environmental leadership"		

Arguments of Delphi-panel, scenario workshops and interviewees

One Delphi-panelist considered "Sustainability dilemma" the most likely scenario, as tourism increases while its environmental footprint will not decrease fast enough to enable the improved sustainability of tourism as a whole. In addition,

weak environmental leadership, lack of knowledge and information and too cheap travelling were mentioned as reasons for this scenario. Another statement was that tourism is not considered our problem. When there will be flat energy/resources tax on every person, company, service and product, price will adjust the flow of tourism to sustainable level.

Digital skills and preparedness is weak in companies– traveling experiences is already now digital and this trend intensifies further. One panelist considered that it is not possible not to constantly develop the technologies and contents to be more user-friendly, because traveling is an extremely big business opportunity already now. The problem is now and probably also in the future, that traveling is a kind of business in which global change will instantly reflect in each local encounter, but the preparedness and possibilities of the companies to react to fast and constantly changing user needs are restricted.

Joint "tourist efforts" and acts to promote tourism are lacking. Unique tour organizers and entrepreneurs compete fiercely with each other without co-operation. Many applications are offered but they are "arty-crafty" styled. The tourism industry develops but without cooperation between different instances. There is no common goal.

4.5.6. "Virtual reality" scenario in tourism, culture and services for leisure activities

Main drivers for the sector	Future image	Pathway
State of the environment Safety and security in BSR region Attitudes of travelers / tourists Conditions and trends of global economy Leisure interests	People travel less, and prefer to experience destinations at home with augmented reality. New types of tourism have been developed, with facilities offering blue care and health services from the sea, and 5D digital simulations on ocean swimming and sunbathing.	Extensive digitalization will lead to development of virtual 3D models of sites, augmented reality. Internet of Things (IoT) - objects will be more extensively connected. Avatars. Expended memory and emotions. 2050; plenty of cultural heritage sites in 5D? Virtual tour of the Baltic Sea. Change in family models – robots, cyborgs. Slaves?
"Swim around as a fish" "If you do not wish pay full price for your consumption, stay at home and enjoy the show from the screen."		

Arguments of Delphi-panel, scenario workshops and interviewees

This scenario was considered unpredictable, and it had some doubts from the respondents of Delphi. "A clearly undesired future is that travelers would not travel any more but explore the destinations virtually." This was considered fairly unlikely, even it is possible, because human encounter is the most important experience of traveling. One panelist believed that this kind of "future vision of traveling" is farther away in the future, when intensive actions to restrict emissions are necessary. This would be a result of "Unlimited growth" scenario. Before that, in the coming decades we would see a huge tourist wave around the world, also in Finland, when the travelers from Far East rush to west: in the near future vast masses in China and India reach such a standard of living, that people will travel around the world. Encouragement and support for projects that develop virtual service of various kinds. Old cultural values will be forgotten, they are shadowed by all the new.

Knowledge, resource-efficiency, concerns on sustainability will take place in 20 years, according to a Delphi-panelist.

Pathway towards Virtual reality, Tallinn tourism working group

- 2018-2020: we are already working on 3D models of sites. There is augmented reality in heritage sites. Big data for use in tourism sector will be available. Citizen science?
- Black swan: Baltic region will become less available for tourists (2025-2030), some unexpected event like military action - Military conflict with Russia.
- 2025: Internet of Things (IoT) - objects will be more extensively connected.
- 2030 importance and usage of virtual reality in tourism increases. Avatars. Expended memory and emotions.
- 2035: there is too much information online > conspiracy theories > checking up facts will lead to increase in physical tourism. Artificial intelligence may become a threat.
- 2040: superhumans
- 2045 nature will get better because there are no humans there. People are afraid of the real world.
- 2050; plenty of cultural heritage sites in 5D? Virtual 3D models. Virtual tour of the Baltic Sea. Change in family models – robots, cyborgs. Slaves? Children are sick.

Assessment of the alternative scenarios in tourism sector

According to the experts, virtual tourism was estimated to increase by 2050 (results of 2017). Extensive digitalisation would not be the only reason for "Virtual reality" scenario. "Unlimited growth" was assessed to lead to "Virtual reality" scenario: if most of the nature is gone, tourists accept that sea and the entire environment is not clean. In a scenario in which state of the environment has worsened, the traditional touristic experience in nature would be replaced with digital and virtual means.

On tourism sector, EU has emphasized crosscutting policies to include coastal and maritime tourism in other EU-policies, such as connectivity, sustainable transport, safety issues and freedom of movement for workers. Aim is to develop BSR in co-operation as a coherent travel destination. Sustainability concerning nature and cultural heritage is promoted also by Baltic Cruise Dialogue (2016). Tourism and maritime sector interact, and link with IMO's MARPOL regulations to reduce environmental impact of maritime transport. Sustainability of tourism is also noticed, including the transport modes used in tourism. EU Commission Blue Growth Strategy, Vision for 2030 aims to respecting capacity limits of destinations, discussed in the context of "Sustainability above all!" scenario. Sectoral policies' impact to tourism was generally considered important and positive in Delphi 2017. However, tourism is a fragmented sector, and there is no clear indication on common sustainability targets in the sector nor particular, quantified targets.

The future of the different subsectors of tourism were assessed in Tallinn tourism working group. "Nature tourism" and "Cultural heritage" were considered more stable sub-sectors, which could probably grow in future, because they do not need so much money; economical situations could change. "Nature tourism" includes recreation and camping. "Cultural heritage" includes e.g. old factories. A clear majority, 93 % of the respondents of Delphi 2018 considered that cultural destinations will attract increasing number of tourists to the BSR (Table 26).

The future options for various kind of leisure interests and new connections were discussed at Tallinn tourism working group:

- Ecotourism or mass tourism? Many indications were noted towards mass tourism.

- Health-tourism as trend would lead to new health services on the market, such as SPAs, mud procedures, ice-hotels etc.

- Boating and sailing, and tourism related to that could be connected with food sector. Fishing and cooking on the boat experience as a tourism attraction. There is a possibility that new species are coming with climate change, maybe eatable. Guest harbours.

- Extreme-tourism is growing. Things that are not extreme to us can be extreme for other cultural background tourists. Part of "Off-shore water sports"? - Diving, fishing, canoeing.

- Local tourism: different coast types of Estonia and Finland could attract tourists. Tourists will probably concentrate in some areas on the natural shoreline.

In Finland, theme-based tourism (linked with "individualism") and food tourism are supported in specific tourism programmes. (D.T. 1.8.1). Current tourism product development relies on diversification and global trends such as well-being and demand for nature stimulate markets. (Strategies 1.1.2. p. 16). Different industries might move to other parts of the world, but tourism is inherently regional. It can be combined with regional needs, e.g. ageing, often also elderly people stay at the area and thus e.g. floating nursing homes were suggested in scenario workshop 2017.

There are aims and targets on increasing the number of tourists, e.g. in Estonia, the aim has been set to increase the tourism sector by approximately a third even by 2020.

The strategies and action plans identified indicate development towards scenarios "Sustainability dilemma", or "Unlimited growth", which the experts considered to lead towards unwanted, unsustainable future, and possibly even towards "Virtual reality". One reason mentioned was that the area is responding to global needs of tourism, and does not take the action in own hands. On the other hand, maritime targets and regulations on sustainability and reduction of emissions affect e.g. cruise tourism.

4.6. Synergies and conflicts of blue businesses in the project area

Synergies and conflicts for Blue Growth were surveyed both in Delphi and in the workshop 2017 for each sector respectively. In Delphi questionnaires 2017, the synergies and conflicts from the perspective of each main business sector as a whole were mapped in relation to subsectors. The idea was to point out the clear synergies or conflicts between business sectors in the project area. The spread of answers between the options indicate that the relations between business activities need to be examined case-by-case and with considerations of the conditions affecting the case in the table (Figure 10).

In Helsinki scenario workshop in 2017, in-depth discussions enlightened more detailed views of the participants. The working groups discussed on the main blue economy sectors (Table 2): energy sector, maritime cluster, blue bio-economy and subsea resources, as well as tourism and culture, and services for leisure activities. The contents of each theme were defined briefly, and key points from Delphi questionnaire were reported to inspire and provoke discussion in the groups. The main results of the Delphi are presented in Table 5. In Annex VI, a table contains specifications about synergies and conflicts based to scenario workshops in Helsinki and Tallinn, as well as notions of from responses of Delphi 2018 and interviews for business sector.

4.6.1 Synergies and conflicts of different business sectors

The energy sector is estimated to have more conflicts than synergies with blue bioeconomy and the exploitation of subsea resources as well as with tourism, culture and leisure activities. Views considering the subsectors of maritime cluster were more variable indicating the interdependencies of energy production and marine transportation and businesses related to shipbuilding (Figure 10). The businesses that are mostly located in coastal industrial or urban areas are estimated to have more synergies than conflicts with energy production, e.g. shipbuilding, cleantech for marine transport, building and warehousing of leisure boats, production and distribution of biofuels and LNG. "Multiuse platform" –thinking was mentioned, e.g. possibility to use energy sector's physical constructions or areas nearby e.g. for aquaculture. The conflicts between tourism, culture and leisure activities with the energy sector and maritime cluster where thought to be avoided best by early interaction, good planning and collaboration with cultural heritage authorities.

In coastal and marine areas, possible synergies are due to the energy constructions and with remote and recreational housing (Roose et al. 2017: combined maps). The more detailed results indicated that energy infrastructures are long-term or permanent that makes the sector conflict-prone with other uses and infrastructures requiring space. The production of energy and energy constructions are also estimated to cause environmental harms (Table 5). For instance, dredging and seabed mining, commercial fishery, offshore construction and marine transportation are considered to have more conflicts than synergies with energy sector. Altogether, energy sector has both conflicts and synergies with sectors of blue economy, with slightly more synergies than conflicts. (Figure 10).

Maritime cluster and the subsectors of energy are estimated to have mostly both synergies and conflicts with somewhat more conflicts with nuclear power, submarine geothermal energy and energy transfer and conditioning. Little more synergies is thought to be with production and distribution of biofuels, storage and distribution of LNG, solar power, wave energy and alternative energy modes. Altogether, maritime cluster is thought to have rather evenly both synergies and conflicts with the subsectors of the blue economy. The subsectors of maritime cluster are estimated to have more synergies with tourism, culture and leisure activities than conflicts. Tourism sector is dependent on transport of people, ports as touristic hubs. (Figure 10).

Blue bioeconomy and subsea resources is estimated to have more conflicts than synergies with the subsectors of the energy, except regarding solar power and rather evenly with biofuels and alternative energy modes. Other way around, the blue bioeconomy is estimated to have mostly conflicts with the offshore construction, marine transportation and dredging while clean tech and building and warehousing of leisure boats is estimated to have more synergies than conflicts. Blue bioeconomy and subsea resources are estimated to have quite evenly both synergies and conflicts, with slight emphasis on conflicts (Figure 10). Traditionally all the water areas are potential fishing areas from the fishery point of view. In two groups the contradictions between professional fishing and leisure boating, recreational and sport fishing were noted as the share of the leisure activities is rising in the coastal and open sea areas (Annex VI). In Finland these contradictions were estimated to be increased. Negotiations and separate spaces for both groups were notices as a solution. Also fishing restrictions were suggested as for example hobby and sport fishing has become a problem in Northern coast of Estonia because it causes significant damage for protected salmonides. On the other hand, it was noted that the fishermen traditionally think that they can fish everywhere. In Estonia, there have been conflicts between fishermen and leisure boating/fishing for example because fishing nets have stacked in outboard motors and jet skis. In Pärnu area the problem is solved by the foundation of a sailing area (different areas for fishermen).

Tourism, culture and services for leisure activities is considered to have mostly conflicts with the subsectors of energy, apart from solar power and alternative energy modes. The storage and distribution of LNG and the construction and maintenance of the grids is thought to have no synergies or no interaction and only a little synergies wind and nuclear power, refinement of fossil fuels and energy transfer and conditioning. Panelists have estimated that tourism, culture and services for leisure activities have mostly conflicts with offshore construction, shipbuilding, marine transportation, demolition of ships and dredging. Cleantech as well as building and warehousing of leisure and sporting boats have synergies with tourism, culture and leisure activities. Altogether, tourism, culture and services for leisure activities are thought to have both synergies and conflicts with the subsectors of blue bioeconomy with slight emphasis on conflicts. Especially panelists have tough that seabed mining has mostly conflicts. (Figure 10).

Figure 10. Distribution of opinions regarding the synergies and conflicts between from the perspective of main business sectors. Red bar = conflicts, yellow bar = both synergies and conflicts, green bar = synergies. The results are from the on-line Delphi rounds I and II in 2017 (Annex I).

Table 28. The main results of Delphi considering the synergies identified for each main business sector. Figures of Delphi are based to following calculations: significant or some/possible conflicts as %, significant or some/possible synergies as %, no interaction as % (see Figure 10 for absolute numbers).

Main synergies	Energy	Maritime	Tourism	Blue bioeconomy & subsea
Energy		Cleantech (60%) Shipbuilding (46%) Building of leisure and sporting boats (39%)	Cultural services and attractions in the coastal and archipelago areas (25%) Guest harbors and other services for leisure boating (22%)	Aquaculture 29%
Maritime	Production and distribution of biofuels (47%) Solar power (39%) Wave energy (33%)		Guest harbors and other services for leisure boating (59%) Coastal cruises & taxiboats (45%) Submarine tourism (41%) Accommodation in coastal and archipelago areas, renting vacation homes (38%)	Commercial fishery (36%)
Tourism	Solar power (37%) Wave energy (27%)	Warehousing and storage of leisure boats (68%) Building of leisure and sporting boats (56%) Clean tech (46%)		Commercial fishery (31%)
Blue bioeconomy & subsea	Solar power (41%)	Clean tech and equipment for marine transportation (54%) Coastal cruises, taxiboats (34%) Accommodation in coastal and archipelago areas, renting vacation homes (34%)	Services for land-based adventure tourism (48%)	

Table 29. The main results of Delphi considering the conflicts identified for each main business sector. Figures of Delphi are based to following calculations: significant or some/possible conflicts as %, significant or some/possible synergies as %, no interaction as % (see Figure 10 for absolute numbers).

Conflicts	Energy	Maritime	Tourism	Blue bioeconomy & subsea
Energy		Dredging, maintenance of waterways (29%)	Sport fishing (41 %) Services for maritime adventure tourism (25%)	Commercial fishery (43%) Fish-farming (24%) Seabed mining (38%)
Maritime	Submarine geothermal energy (30%) Energy transfer and conditioning (27%) Wind power (24%) Nuclear power (24%) Construction and maintenance of the grids, energy lines, gas pipes (24%)		Sport fishing (19%)	Seabed mining (sand, gravel, minerals) (27%)
Tourism	Construction and maintenance of the grids, energy lines, gas pipes (63%) Energy transfer and conditioning (62%) Nuclear power (58%) Wind power (44%) Refinement and distribution of fossil fuels (44%) Offshore construction (fixed or floating platforms) (42%) Storage and distribution of LNG (41%)	Demolition of ships (46%)		Seabed mining (81%)
Blue bioeconomy & subsea	Construction and maintenance of the grids, energy lines, gas pipes (55%) Energy transfer and conditioning (52%) Refinement and distribution of fossil fuels (41%) Nuclear power (41%) Offshore construction (41%) Submarine geothermal energy (38%) Storage and distribution of liquefied natural gas (LNG) (38%) Wind power (34%)	Dredging & maintenance of waterways (38%) Demolition of ships (34%)	Submarine tourism (diving) (31%) Sport fishing (28%)	

4.2.2. Environmental vulnerability

In Delphi and workshop, issues related to the environment were raised. The environmental vulnerability of the area (see Roose et al. 2017: background maps) was causing problems for one working group in Helsinki workshop, as the participants had problems with conquering whole areas for business activities as they thought they might be endangering natural values that they do not know enough about. The role of the nature was pondered and it was mentioned that the profound element of the study area is the nature, because it forms the basis for ecosystem services blue businesses exploit. Thus there is unavoidable conflict with nature conservation and a challenge to build sustainability in the project area, because it is a small area with many different and to some extent conflicting interests. The influence of environmental legislation changes and restrictions was questioned. On the other hand, it was asked whether strict environmental regulations and recommendations are reducing investments in the project area (Annex III).

Information about ecosystem functioning and ecosystem services was mentioned as the basis for the successful planning of sustainable uses (Annex III). Knowledge-based planning is required in order to know the consequences of the human activities. It should be assessed what is happening if something is e.g. removed from the ecosystem: “you can’t sacrifice anything if you don’t know which the consequences are”. The importance of identifying the causes and effects as well as connections identified in planning process were emphasized, e.g. building of infrastructure changes in environment and affect (key) species causing biodiversity loss and affecting e.g. tourism and leisure activities. Also right timing of operations might help avoiding some pressure risks (such as those related to the nesting of birds and seals). Research and education are crucial for blue business success purely businesswise. The panelists of the online questionnaire estimated that the production and other activities of main business sectors and most of the subsectors will increase slightly or moderately (Figure 3). The workshop maps are drawn full of markings showing many different uses and interests in the area. The question remains: Do the environment sustain all the uses? Will the use of sea area be a greater mess in the year 2050 than currently? Effective land use planning of the water and land areas is needed in order to decrease conflicts between different stakeholders.

In addition, a statistical problem problem was mentioned at Helsinki workshop conserving energy: where energy is produced and where it is consumed cannot be easily identified from the official statistical data. This makes it difficult to study where the economic benefits and where the environmental harms are experienced.

5. CONCLUSIONS

5.1. Main drivers analysed in the scenarios

In this chapter, we will conclude which drivers were discussed most in the context of the alternative scenarios, as well as how the drivers on specific blue economy sectors reflect the first level analysis of the general drivers identified for blue economy with PESTEL classification.

Compared with PESTEL, political drivers had most mentions on energy sector, followed by technological and economic drivers. On blue bioeconomy and subsea sector, the political drivers were also considered most important, followed by the environmental ones. On maritime sector, economic drivers dominated, followed by technological drivers. Social drivers were considered the most important ones for tourism sector.

Among the unique drivers, attitudes gained altogether 19 mentions in Delphi. Also at Tallinn workshop, all the working groups selected attitudes to belong to the most important drivers. Regarding energy sector, "Attitudes" were discussed from the point of view of opinions towards renewables, in particular wind energy, the main issue being the location of the offshore windmills, which has a concrete spatial link with MSP. In maritime sector, public pressure was considered to affect ship owners' investments in cleantech and fuels. There is link with development of cleantech as a blue economy sector but no direct spatial link with MSP.

Table 30. Drivers discussed in Delphi 2018, Tallinn scenario workshop and by the interviewees

Variable / sector	Energy			Maritime			Tourism			Blue bioeconomy		
	DELPHI	WS	INTER-VIEWS	DELPHI	WS	INTER-VIEWS	DELPHI	WS	INTER-VIEWS	DELPHI	WS	INTER-VIEWS
Attitudes	7	1	1	2	1	1	7	1	1	3	1	0
Conditions and trends of global economy, globalization	3	1	1	6	1	9	4	1	1	1	1	
(Level of) cooperation in the BSR – (safety situation and stability in the Baltic Sea area)	3		0	4	1	0	8	1	3			
Environmental regulations, legal practises	6	1	2	8		3				8		
Main energy options supported by energy and environmental policies	7	1	7									
Fuels used in shipping (environmental policy)				5		1						
Policies concerning the use of natural resources										10	1	2
Industrial policy	2		0									
Clean tech innovations (for energy / maritime / blue businesses)	8	1	3	6		0				9	1	
ICT, digitalization	2		2	3	1	6	2		2			
Regional economic situation	3		0	4		0						
State of the environment							9	1	2	7	5	1
Climate conditions				1		0						
Transport routes				1		4						
Leisure interests							4		4			
Tourist destinations in aerial development							3		0			
Globalisation							1		0			
Ethical issues - interest on nutrition..										1		
Attitudes towards blue economy as a profession										2		
Urbanisation	0											

In tourism sector, "attitudes" links with the destinations and types of tourism that tourists and travelers are interested in - their leisure interests, and on the other hand, on the attitudes of tourists towards the environment; when selecting the destination and during their stay in the destination. Another aspect discussed was attitudes towards the local residents, interaction with them – "responsibility and sustainability of cultures". State of the environment is connected strongly with attitudes of tourists on the destination; a poor state of the sea does not attract tourists. In the scenarios, responsibility of tourists towards the environment and their actions were also raised into discussion. Attitudes on tourism sector link with spatial requirements and different attitudes towards the environment. In blue bioeconomy sector, attitudes constitute a basis to position and development of this business sector.

"Conditions and trends of global economy, globalization" had 14 mentions in Delphi. It was considered to have most impact on the maritime sector, which was reflected in the results of the interviews. Globalisation affects maritime exports and imports, and maritime sector is the most fluctuating of the blue economy sectors. Also maritime regulation is more global compared to the other sectors. On energy sector, the viewpoint was the impact of regional and overall economic development, and the role of subsidies in development of wind energy. In the field of tourism, globalization affects where tourists come from into the area. Number of the Chinese tourists was discussed most, however, if the area is globally known, it would attract tourists from a variety of regions. In blue bioeconomy sector, "global" was discussed in the context of global markets for the locally developed circular aquaculture systems and products. In Delphi 2017, the most important Economic driver was considered to be conditions and trends of global economy, and it was noted that global economy will affect all sectors e.g. price development of energy.

"Clean tech innovations" had most mentions of all drivers among the sectors of energy, maritime and blue bioeconomy, altogether 23, which was the highest figure in spite of that was not on the list of drivers of tourism sector. Innovations for cleantech was expected to have impact on expansion of wind energy. Statement "Innovations in clean tech will lead to sustainability in all energy options" was agreed or strongly agreed by 54 % (statements).

"ICT and digitalization" was the most often mentioned factor in the interviews. In maritime sector, it is seen to lead to cleantech and to more automatisation. "ICT and digitalization" as such had seven mentions in Delphi, quite evenly from energy, maritime and tourism sectors. These drivers have mostly an indirect link with MSP, however, automatisation would require attention on its impacts on fairways and ports. In addition, dedicated pilot areas such as Jaakonmeri were proposed on the project area, too. Advanced digitalization may link maritime more intensively with inland transport.

In the field of tourism, ICT and digitalization enable searching information on prospective destinations globally, as well as booking and paying online. In the field of blue bioeconomy, cleantech was considered as a backbone of sector's development: that would enable utilization of sea-based biomasses, as well as new kind of circular aquaculture, a sustainable development. Land-based aquaculture is a weak signal; the production might take place on land, too (in what extent?). Reflected with the results of Delphi and workshop 2017 on drivers for blue economy, the results strengthen the position of clean tech innovations as the most important technological driver. Among the drivers classified according to PESTEL, the Technological drivers gained most mentions in sector-specific assessment of the drivers (2018). This is based to the position of clean tech and the unique ICT and digitalization related drivers in the expert opinions. In the analysis of drivers for Blue Economy, digitalization as a whole and environmental technology were considered as a positive possibility.

"Environmental regulations, legal practices" had second most of mentions, 22, from three sectors: energy, maritime and blue bioeconomy. In Tallinn workshop, it was proposed to be combined with "Main energy options supported by energy and environmental policies" which had seven mentions in Delphi concerning drivers for energy sector. Legislation in the field of renewable energy might be enforced. In maritime sector, legislation was noted to affect directly the fuel chosen, and to routes and ports. Legislation may provide possibilities for clean tech –related production. In addition, e.g. the Blue Growth Strategy (2017) vision includes "shipyards have completed the retro-fitting of existing vessels" which indicates that during 2020's there is work to be done.

Environmental legislation and stricter demands were considered to force to think about new solutions. In tourism sector, "Environmental regulations, legal practices" was not listed as a driver, but there is an indirect effect from the regulations of other sector. In the field of Blue bioeconomy and subsea resources, "Environmental regulations, legal practices – industrial policy" had second most mentions in Delphi. They were discussed from the point of view of possible favouring of the development of the blue bioeconomy. The regulations need to be on the level of the BSR, not national ones.

Policies concerning the use of natural resources – concerning the blue bioeconomy & subsea sector had the highest number of mentions, 10, in Delphi. Fuels used in shipping (environmental policy) had 5 mentions in Delphi. Already in Delphi

2017 and Helsinki workshop, different policies affecting the blue economy sectors were considered important Political drivers. Certain policy is creating a framework and rules for operation for different blue economy sectors. On the other hand, a policy may restrict development of a certain blue economy. At Helsinki workshop it was noted that national parliaments decide on the policies but their operation period is only maximum four years, both in Finland and Estonia. Another comment was that co-operation between the authors representing different sectors has strong effect. "Tight orders of environmental permits" was considered the most important Legal drivers in Delphi 2017. In Helsinki workshop, "environmental regulations and permitting processes on the whole – changes and restrictions" was considered the main legal driver.

"State of the environment" was considered an important driver in particular for tourism and blue bioeconomy, with 16 mentions in Delphi. As said before in the context of attitudes, good state of the environment was considered a key issue for maritime tourism. In the field of blue bioeconomy, state of the environment has a strong impact on the possibilities of the blue growth. On the other hand, with "new kind" of aquaculture it is possible to reduce the amount of the nutrients in the sea. Aquaculture should be managed in closed circular systems. Another new driver mentioned was "environmental restrictions" which refer to worsened state of the environment, causing that there are not enough suitable resources for blue bioeconomy. Environmental drivers were discussed from many aspects in Delphi and workshop 2017.

"Co-operation in the BSR" had in Delphi 15 mentions, although the driver was not presented for Blue bioeconomy & subsea sector at all. In energy sector, co-operation was considered important in advancing different kind of EU policies to national level. For example, co-operation between countries with functioning renewable energy systems. Cooperation with other sectors and between other countries was considered to lead to "Sustainable" scenario, which would be reachable only through global agreements. "Co-operation in the BSR promotes use of renewable energy options" and "digitalization supports the use of smart energy systems" was agreed by 71 % respondents (agreed or strongly agreed).

Co-operation may be linked with EU, depending on the status of EU in 2050. In the maritime sector, it was noted that safety and stability would increase co-operation in the Baltic Sea area. In the context of tourism, high level of safety and security in the BSR region was considered to attract tourist in the BSR area.

"Urbanisation" had no mentions; it was presented only at the energy sector. This may reflect the fact that the Plan4Blue project area already is the most urbanized both in Finland and in Estonia. In Finland almost 64% and in Estonia 74 % of people live in the coastal regions (COM, 2013).

Black swans may have impact for all the sectors altogether. For example, military conflict in the Baltic Sea region or nuclear disaster.

5.2. Summary of the futures images

The short narratives of each business sector and future images are presented in Table 31 below.

Table 31. Summary of the future images

Blue economy sector	Sustainability above all!	Unlimited growth	Sustainability dilemma	Virtual reality
Energy	Strong environmental policies and legislation have led to decarbonisation. Smart, distributed energy production; renewable energy sources are used. Saving of energy; optimization of energy use. Innovative cleantech –based energy production.	Economic growth is based on the use of traditional fossil and nuclear energy. Heavy industrial production maintains centralized energy production, current and old technologies are used. Weak environmental legislation.	New and old energy production exist side by side, decarbonisation has not succeeded. Aim to self-sufficiency in energy production. Slightly modernized technologies used.	Extensively digitalised society: need to use natural resources changes because of changing human behaviour. Enormously increasing need for energy. Major breakthrough in smart grids has been reached.
Maritime	Zero emission policies - low emission renewables used in shipping. Strong environmental leadership. Modern shipbuilding and innovations: the environmental impact of ships is designed to be as small as possible. Ports and ships use their waste at the maximum level. Advanced intelligent maritime systems used, autonomous vessels operate in the Baltic Sea.	Increasing global consumption and heavy maritime traffic. Minimum environmental requirements are fulfilled in shipping. Current technologies used in the maritime cluster. Mainly fossil fuels and other unsustainable fuels used in shipping.	Mix of renewable and fossil fuels used. Attitudes impact on choices: some shipping companies use renewables, others use traditional fossil fuels. Economic revenues are considered more important than sustainable values.	Extensive digitalization, local production such as 3D printing, and optimization of logistics have drastically reduced the need for maritime transport, except raw materials. Unmanned vessels operate on the Gulf of Finland and Archipelago Sea. Internet of Things in cargo handling.
Tourism, culture and services for leisure activities	The safe and secure Baltic Sea Region has enabled the development of sustainable tourism. Restrictions for tourists to enter certain conservation areas. Well working, unified ICT systems; digitalisation allows easy use of travel related data for planning, reservations, and information on the destination.	Strong growth has led to increasing mass tourism and environmental damage. All the different planned transport options have been realized. Attitudes towards the environment and sustainability are careless, as is towards local residents. Unsustainable ways of travelling prevail. Clear water is important and rare.	Global tourism has increased. Tourists have different likes; various means of travelling are used and different destinations visited. Concern about the impact of tourism on the environment, but lack of environmental leadership and preparedness for the rise of tourist flows. Different smart technologies are available but they are not user-friendly.	People travel less, and prefer to experience destinations at home with augmented reality. New types of tourism have been developed, with facilities offering blue care and health services from the sea, and 5D digital simulations on ocean swimming and sunbathing.
Blue bioeconomy and subsea resources	Sustainable, circular economy based blue bioeconomy. New bio-based products are cultivated in the sea. Systems are sold to global markets. People are interested in locally produced food. Environmental policy and legislation restrict the emissions caused by blue bioeconomy and the subsea, and the over-	Subsea resources and fish stocks are overexploited. Aquatic flora and fauna suffer from deteriorating of the environment and the consequences of climate change. The production and availability of blue bioeconomy has decreased. Attitudes towards the environment and sustainability are careless.	Awareness of the environmental problems and their impacts on blue bioeconomy, but old technologies are used instead of innovative systems. Old customs and consumer habits prevail. Conflicts of different sea use continue. Small measures addressing environmental impacts despite concerns and sea pollution.	Resource wisdom: digital-based production and circular economy. New, digital offshore aquaculture technologies are used, for example independent, floating aquaculture units. Automation used in blue bio-economies and the subsea.

	exploitation of subsea resources.			

5.3. Main pathways to futures images

The main pathways to futures images are presented in the tables 32-35 below.

Table 32. Main pathways to futures images on energy sector

Energy sector	
Sustainability above all! "Environmental awakening"	The attitudes of all, citizens and political decision makers, will change remarkably. Decisions will be based on scientific knowledge. Strong environmental policy and legislation will be introduced: new stricter targets and environmental taxes. New innovations for saving energy.
Unlimited growth "Nothing will be done, no decisions will be made, and thus the current state will continue"	No commitment to promote sustainability via international agreements or EU regulations. Because of fast economic growth existing energy infrastructure will be used. In Finland, current investments into nuclear power plants will bind for decades and hinder the development of renewable energy production
Sustainability dilemma "Balancing between different interests"	Political budget-support and financial systems are too interlinked, corrupted, and there is no interest in change. Weak development of global economy will affect development. The political situation in neighboring area leads to highlighting energy self-sufficiency, slowing down development of alternate production and its promotion.
Virtual reality "Extensively digitalized society"	Strong governmental support for digitalization and virtual solutions leads to further digitalization and greater need for energy. Internet of Things monitors energy consumption in every device and spot. Later a fully digitalized future means a decrease in energy consumption, due to decrease in mobility. Smart, decentralized systems, grids and pipelines will be developed. Support for rural areas and expanded opportunities for distant working will increase. People consume much less.

Table 33. Main pathways to futures images on maritime sector

Maritime sector	
Sustainability above all! "Zero emissions"	Policy will towards sustainability will lead to global climate agreement and strong legislation proposing zero emissions will be introduced. Strong environmental leadership. Environmental thinking will be strengthened in maritime education: it will create more favorable attitudes among the people in the industry. Technological solutions, ICT and digitalization will support sustainability. Most vessels are autonomous and cargo handling will be automatized to optimize cargo transport, and to minimize the environmental impact of shipping.
Unlimited growth "Do nothing and continue in an old-fashioned way"	Today's support and fiscal policy will continue, with small reforms on taxation, EU-support and local political systems. Low awareness of environmental problems, more consumption and production, bigger vessels, people buy more. Fossil fuel from Arctic: oil and LNG. Multifunctional ships will carry new cargo types, such as waste. There will be more offshore services, port congestion and new waiting areas.
Sustainability dilemma "Profit drives business"	Lack of regulation, or no common regulation. Inconsistency in energy, environmental policies and legislation. No strategy with a vision of sustainable economy in the long-term. Political systems and businesses are too closely interlinked. Profit drives business, both politicians and businesses are beneficiaries of the current system and there is no motivation to change the system. No price on carbon in climate policy.

Virtual reality "Autonomous will be enabled by regulations"	Autonomous transport will be enabled by regulations, and by providing the best conditions for testing and trial runs of new technologies and solutions. Development and innovations at universities in close cooperation with the industry. A greater need for new technology creates the conditions for new companies to develop and create the required equipment. 3D printing develops with an unexpected space and with no problems. Renewal of business models.

Table 34. Main pathways to futures images on Tourism, culture and services for leisure activities

Tourism, culture and services for leisure activities	
Sustainability above all! "Tourists participate in activities for sustainable tourism: rebuilding ecosystems, reducing nutrients"	The attitudes of the travelers themselves towards sustainability will change. A ranking-price system based on the impact and pressure to the environment will be introduced; tourists pay for the externalities that their actions cost. Areas of mass tourism and restricted areas will be determined and specific sectors for travelers will be established. Sustainability will be developed by co-operation of sectors. Sustainable energy for travelling will be used.
Unlimited growth "All resources are used maximally, and the maximum is also taken from nature"	All the different planned transport options will be realized; Helsinki-Tallinn tunnel will be built, artificial islands etc. At the beginning, tourism will increase. There will be a lot of different cruise ships and routes, and for example fishing tourism. Further on, the amount of tourism will start to decline because of the bad state of the environment.
Sustainability dilemma "Weak environmental leadership"	Weak environmental leadership, lack of knowledge and information and too cheap travelling. Weak digital skills and preparedness in companies. Poor preparedness and restricted possibilities of companies to react fast to constantly changing global user needs. Tourism industry develops, but without cooperation between different instances. No common goal.
Virtual reality "Swim around as a fish"	Extensive digitalization will lead to development of virtual 3D models of sites, augmented reality. Internet of Things (IoT) - objects will be more extensively connected. Avatars. Expended memory and emotions. 2050; plenty of cultural heritage sites in 5D? Virtual tour of the Baltic Sea. Change in family models – robots, cyborgs. Slaves?

Table 35. Main pathways to futures images on Blue bioeconomy and subsea

Blue bioeconomy and subsea	
Sustainability above all! "We don't pollute"	Countries will start immediately and efficiently to implement the UN Sustainable Development Goals. Cleantech and innovations in bioeconomy technologies, e.g. multi-trophic aquaculture. Circular fish farming and subsea mineral extraction. Efficient interaction of different smart, ubiquitous technologies.
Unlimited growth "Do nothing, pretend everything is under control with some more regulations and reforms"	No environmental leadership. No focus on environmental thinking in schools. No control of the overall picture, poor cooperation. Decision makers are not educated on issues related to blue bioeconomy. Accelerating of economic development and continuing economic boom will increase the flow of tourists in the BSR, and will also have an impact on the unsustainable over-exploitation of the sea space. The building of the Helsinki-Tallinn tunnel will increase sand and gravel extraction, more fish farms will be established on the coasts.
Sustainability dilemma "Weak environmental leadership"	Weak environmental leadership and no innovation. No common focus on circular economy. The Baltic Sea Region states will proceed in different timing in their operations. The price of new technologies continues to be high.

Virtual reality “New product and service models are being built”	EU funding is provided for experimental projects and for risk investments. New product and service models are being built. Environmental legislation will be changed so that permits to moving platforms can be granted.

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ANNEXES

Annex I. English version of Delphi questionnaire of round I.

Map questions of the Delphi round I are captured separately and placed between the printed HARAVA pages. The base map was closed after the questionnaire was closed, thus it is empty. lat map question is capture twice to show the layers of blue business locations upon the base map.

harava

Plan4Blue, Delphi round I (FIN - ENG)

1/18 WELCOME TO THE DELPHI PANEL ROUND I!

THANK YOU FOR PARTICIPATING IN THE DELPHI PANEL!

Thank you for participating in the Delphi panel!

The aim of the first round is to define such blue business sectors and drivers that are considered relevant to the future regional development of the Gulf of Finland and the Archipelago Sea. Please read the short guidance on page 3. There you also find the background data and the maps of the business locations and land and sea uses, which may be helpful when considering your answers. The questionnaire should be filled in and submitted by the 17th of May 2017.

Please identify yourself in the next page, especially if you want to suspend and continue to fill later.

The study is implemented as part of the project Plan4Blue (*Maritime Spatial Planning for Sustainable Blue Economies*). Plan4Blue brings together the key blue growth and maritime spatial planning (MSP) actors from Estonia and Finland to define future pathways to sustainable use of the sea areas and resources. These results are inputs to the identification of alternative maritime spatial planning options to support a sustainable growth of blue economy. Please see more on the projects webpages

2/18 GUIDANCE, BACKGROUND DATA AND MAPS

HOW TO FILL IN THE QUESTIONNAIRE

We have listed many types of businesses and drivers in this questionnaire. Please select at least those you think are relevant considering the future development. If you think something is missing or needs to be clarified, you may add your views in the text boxes at the end of the pages.

The questionnaire has three parts: the definition of the changes, synergies and conflicts of the blue businesses (pages 5-12), selecting the PESTEL drivers that influence the development of the blue businesses (pages 13-16) and considering the weak signals and black swans (page 17). Please see the definitions of the key concepts at the end of this page.

HOW TO FILL IN THE MAPS

We ask you to place your views on the desired changes in the blue economy and on the possible locally affecting drivers on the map. At this first phase, the point symbols are used. Please mark the symbol at the approximate center of the area. At the later rounds, the areas will be specified more closely if needed. You can mark multiple areas of the same category.

In each map page, you can see current business activities of the sector in question on the base map. In the upper right corner of the map view you may open the legend of the map layers. You may hide or change the transparency of the layers. Please note that the locations of the businesses have been mapped to their official addresses, thus they may also have production and activities elsewhere, but those locations are not marked. The businesses do not have any other attributes except location. Please find other background data and maps below.

You can zoom in and out with your mouse's scroll wheel and move on the map by dragging it. Select a symbol from the list by clicking the point symbol (turns gray). Then click on the map to place the symbol of the selected business sector or driver (no dragging is needed). A dialogue box opens where you can select the direction of change you desire and save your answer.

BACKGROUND MAPS

https://query.eharava.fi/data/questionparameter/2396/Background_maps.pdf

Project area, the restrictions of the sea area uses, marine traffic, population density and human impact, blue businesses and nature values.

BACKGROUND DATA

https://query.eharava.fi/data/questionparameter/2396/Environmental_vulnerability.pdf

Environmental vulnerability in the project area

BACKGROUND DATA

https://query.eharava.fi/data/questionparameter/2396/Industry_development.pdf

Industry development in the Plan4Blue project area

DEFINITIONS OF KEY CONCEPTS

Blue growth/blue economy (EU definition) -

Blue businesses: in this questionnaire "blue businesses" refer to the business sectors that are listed here as well as businesses that are somehow connected to or located in sea areas.

Maritime spatial planning (MSP) -

PESTEL drivers: Political, Economic, Social, Technological, Environmental and Legal drivers -

MAP OF THE PROJECT AREA

The Gulf of Finland and the Archipelago Sea in Estonia and Finland.

The project area includes three counties (regions) in Finland and three counties in Estonia. In addition, three coastal municipalities of the Lääne county are included. Plan4Blue focuses on processes on the sea and in 53 coastal municipalities (with less than a 10-kilometer distance to coast).

3/18 IDENTIFICATION

THE IDENTIFICATION OF THE PANELIST

The answers of the Delphi study are processed anonymously.

The answers are not automatically saved to the HARAVA-system. Instead, if you suspend filling in the form, you should send your answers by pressing the SUBMIT-button (in the lower right corner on every page). The answers you have given will then be submitted to the system. You may continue later using the same link in the email. The questionnaire asks you every time to fill in your name. The answers you gave in the previous session will not be visible for you. However, using your name we will be able to join the answers when processing the results.

Your name*

Marks left: 200

4/18 PANELIST'S BACKGROUND

Gender
- Female
- Male

I consider my main expertise to be
- Spatial planning
- Environmental issues, conservation
- Energy
- Marine transportation
- Fishing
- Aquaculture
- Tourism
- Culture and cultural heritage
- Societal issues
- Politics
- Sub-sea construction
- Sub-sea resources
- Offshore construction, shipbuilding
- Other, please specify

Years of work experience in the field of my main expertise
- < 10 years
- 10-19 years
- 20-30 years
- > 30 years

My primary employment is in
- Municipality
- Regional/county administration
- Government institution
- Non-governmental organisation (NGO)
- Research and education
- International corporation
- National enteprise
- Business support organization
- Association
- Other, please specify:

Regions I mostly operate within
- National level in Estonia
- National level in Finland
- Harju
- Lääne-Viru
- Ida-Viru
- Lääne
- Kymenlaakso
- Uusimaa
- Southwest Finland
- Other, please specify

I need to consider issues connected to spatial planning in my work

(Spatial planning in its widest sense: business locations, environmental and regional planning)
- Daily
- Weekly
- Monthly or bimonthly
- A few times every year
- Less than every year
- Never
- I cannot say

5/18 ENERGY: CHANGES, SYNERGIES AND CONFLICTS

THE CHANGES OF THE ENERGY SECTOR BY THE YEAR 2050

In your opinion, how will the production and other activities of the energy sector change in the project area, both on land and on sea (onshore and offshore), by the year 2050?

	significant decrease			no change			significant increase	can't say
	---	--	-	0	+	++	+++	
Energy sector on the whole	○	○	○	○	○	○	○	○
Wind power	○	○	○	○	○	○	○	○
Nuclear power	○	○	○	○	○	○	○	○
Submarine geothermal energy	○	○	○	○	○	○	○	○
Production and distribution of biofuels	○	○	○	○	○	○	○	○
Refinement and distribution of fossil fuels	○	○	○	○	○	○	○	○
Construction and maintenance of the grids, energy lines, gas pipes	○	○	○	○	○	○	○	○
Energy transfer and conditioning (e.g. gas pipes)	○	○	○	○	○	○	○	○
Storage and distribution of liquefied natural gas (LNG)	○	○	○	○	○	○	○	○
Solar power	○	○	○	○	○	○	○	○
Wave energy	○	○	○	○	○	○	○	○
Alternative, experimental energy modes	○	○	○	○	○	○	○	○
please specify alternative energy mode:		Marks left: 100						
Other	○	○	○	○	○	○	○	○
please specify:		Marks left: 100						

THE SYNERGIES AND CONFLICTS OF THE ENERGY SECTOR WITH OTHER BUSINESSES

Which business activities may have positive synergies, conflicts or both with the activities of the energy sector in the project area?

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Maritime cluster							
Offshore construction (fixed or floating platforms)	○	○	○	○	○	○	○
Shipbuilding	○	○	○	○	○	○	○
Marine transportation (commercial shipping and ports, pilotage and towage of ships)	○	○	○	○	○	○	○
Demolition of ships	○	○	○	○	○	○	○
Clean tech and equipment for marine transportation	○	○	○	○	○	○	○
Dredging, maintenance of waterways	○	○	○	○	○	○	○
Building of leisure and sporting boats	○	○	○	○	○	○	○
Warehousing and storage of leisure boats	○	○	○	○	○	○	○

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Blue bio-economy and subsea resources							
Commercial fishery	○	○	○	○	○	○	○
Fish-farming	○	○	○	○	○	○	○
Aquaculture	○	○	○	○	○	○	○
Seabed mining (sand, gravel, minerals)	○	○	○	○	○	○	○

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Tourism and culture, leisure activities							
Guest harbors and other services for leisure boating	○	○	○	○	○	○	○
Submarine tourism (diving)	○	○	○	○	○	○	○
Sport fishing	○	○	○	○	○	○	○
Services for land-based adventure tourism (e.g. camping, hunting, visiting nature parks)	○	○	○	○	○	○	○
Services for maritime adventure tourism (e.g. canoeing, surfing, water-skiing, jet-skiing)	○	○	○	○	○	○	○
Coastal cruises, taxiboats	○	○	○	○	○	○	○
Cultural services and attractions in the coastal and archipelago areas	○	○	○	○	○	○	○
Accommodation in coastal and archipelago areas, renting vacation homes	○	○	○	○	○	○	○

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Other	○	○	○	○	○	○	○
please specify:							
	Marks left: 100						
Other	○	○	○	○	○	○	○
please specify:							
	Marks left: 100						

If you want to specify the changes of the energy sector or the synergies and conflicts with other businesses in the project area in the future, please add your views here:

Marks left: 250

	significant decrease			no change			significant increase	can't say
	---	--	-	0	+	++	+++	
Maritime cluster on the whole								
Offshore construction (fixed or floating platforms)								
Shipbuilding								
Marine transportation (commercial shipping and ports, pilotage and towage of ships)								
Demolition of ships								
Clean tech and equipment for marine transportation								
Dredging, maintenance of waterways								
Building of leisure and sporting boats								
Warehousing and storage of leisure boats								
Other								

please, specify:

Marks left: 100

THE SYNERGIES AND CONFLICTS OF THE MARITIME CLUSTER WITH OTHER BUSINESSES

Which business activities may have positive synergies, conflicts or both with the activities of the maritime cluster in the project area?

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Energy sector							
Wind power							
Nuclear power							
Submarine geothermal energy							
Production and distribution of biofuels							
Refinement and distribution of fossil fuels							
Construction and maintenance of the grids, energy lines, gas pipes							
Energy transfer and conditioning (e.g. gas pipes)							
Storage and distribution of liquefied natural gas (LNG)							
Solar power							
Wave energy							
Alternative, experimental energy modes							

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Blue bio-economy and subsea resources							
Commercial fishery							
Fish-farming							
Aquaculture							
Seabed mining (sand, gravel, minerals)							

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Tourism and culture, leisure activities							
Guest harbors and other services for leisure boating							
Submarine tourism (diving)							
Sport fishing							
Services for land-based adventure tourism (e.g. camping, hunting, visiting nature parks)							
Services for maritime adventure tourism (e.g. canoeing, surfing, water-skiing, "jet skiing")							

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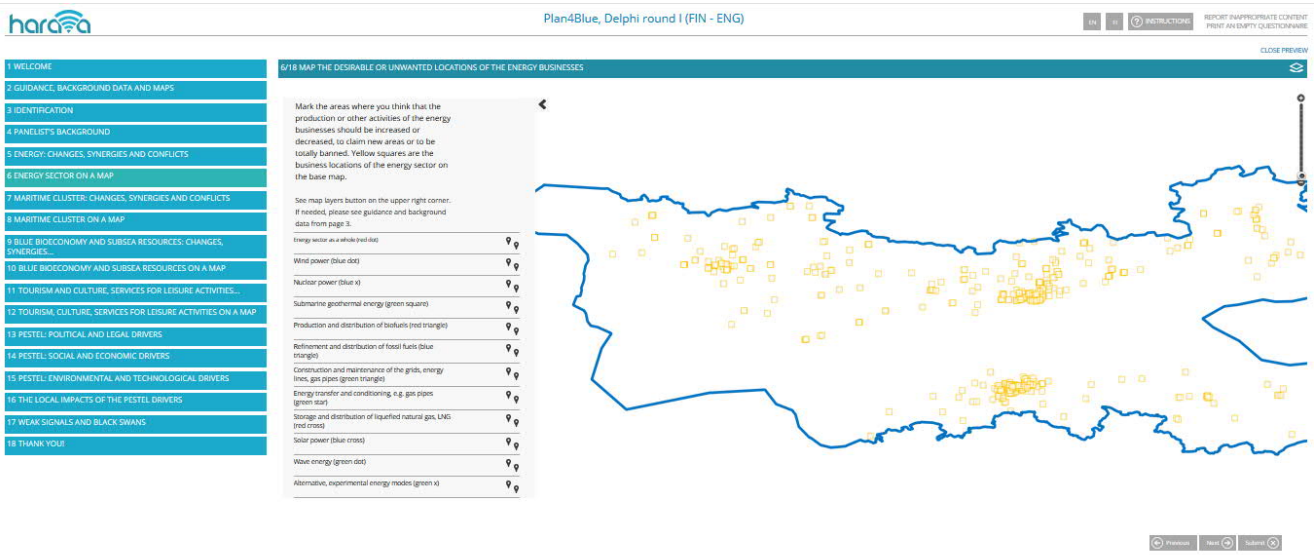

7/18 MARITIME CLUSTER: CHANGES, SYNERGIES AND CONFLICTS

THE CHANGES OF THE MARITIME CLUSTER BY THE YEAR 2050

In your opinion, how will the production and other activities of the maritime cluster will change in the project area, both on land and on sea (onshore and offshore), by the year 2050?

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Coastal cruises, taxiboats	○	○	○	○	○	○	○
Cultural services and attractions in the coastal and archipelago areas	○	○	○	○	○	○	○
Accommodation in coastal and archipelago areas, renting vacation homes	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○

please, specify:

Marks left: 100

Other	○	○	○	○	○	○	○

please, specify:

Marks left: 100

If you want to specify the changes of the maritime cluster or the synergies and conflicts with other businesses in the project area in the future, please add your views here:

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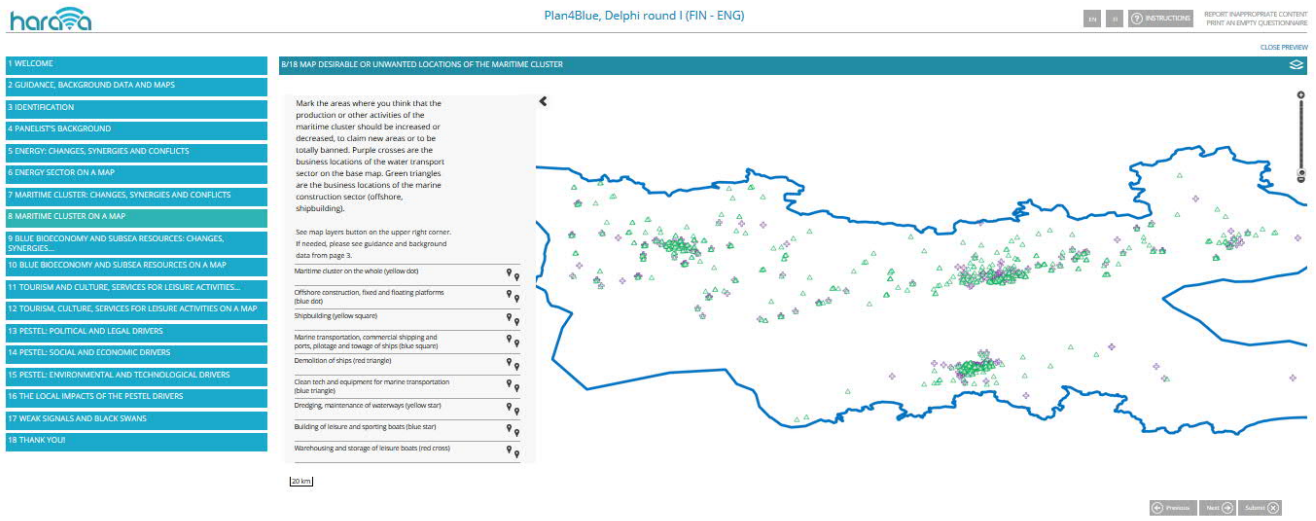

9/18 BLUE BIOECONOMY AND SUBSEA RESOURCES: CHANGES, SYNERGIES AND CONFLICTS

THE CHANGES OF THE BLUE BIOECONOMY AND THE UTILIZATION OF THE SUBSEA RESOURCES BY THE YEAR 2050

In your opinion, how will the activities of the blue bioeconomy and the utilization of the subsea resources change in the project area, both on land and on sea (onshore and offshore), by the year 2050?

	significant decrease			no change			significant increase	can't say
	---	--	-	0	+	++	+++	
Blue bio-economy and subsea resources on the whole	○	○	○	○	○	○	○	○
Commercial fishery	○	○	○	○	○	○	○	○
Fish-farming	○	○	○	○	○	○	○	○
Aquaculture	○	○	○	○	○	○	○	○
Seabed mining (sand, gravel, minerals)	○	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○	○

please specify:

Marks left: 100

THE SYNERGIES AND CONFLICTS OF THE BLUE BIOECONOMY AND THE UTILIZATION OF THE SUBSEA RESOURCES WITH OTHER BUSINESSES

Which business activities may have positive synergies or conflicts or both with the activities of the blue bioeconomy and the utilization of the subsea resources in the project area?

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Energy sector							
Wind power	○	○	○	○	○	○	○
Nuclear power	○	○	○	○	○	○	○
Submarine geothermal energy	○	○	○	○	○	○	○
Production and distribution of biofuels	○	○	○	○	○	○	○
Refinement and distribution of fossil fuels	○	○	○	○	○	○	○
Construction and maintenance of the grids, energy lines, gas pipes	○	○	○	○	○	○	○
Energy transfer and conditioning (e.g. gas pipes)	○	○	○	○	○	○	○
Storage and distribution of liquefied natural gas (LNG)	○	○	○	○	○	○	○
Solar power	○	○	○	○	○	○	○
Wave energy	○	○	○	○	○	○	○

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Alternative, experimental energy modes	○	○	○	○	○	○	○

Maritime cluster

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Offshore construction (fixed or floating platforms)	○	○	○	○	○	○	○
Shipbuilding	○	○	○	○	○	○	○
Marine transportation (commercial shipping and ports, pilotage and towage of ships)	○	○	○	○	○	○	○
Demolition of ships	○	○	○	○	○	○	○
Clean tech and equipment for marine transportation	○	○	○	○	○	○	○
Dredging, maintenance of waterways	○	○	○	○	○	○	○
Building of leisure and sporting boats	○	○	○	○	○	○	○
Warehousing and storage of leisure boats	○	○	○	○	○	○	○

Tourism and culture, leisure activities

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Guest harbors and other services for leisure boating	○	○	○	○	○	○	○
Submarine tourism (diving)	○	○	○	○	○	○	○
Sport fishing	○	○	○	○	○	○	○
Services for land-based adventure tourism (e.g. camping, hunting, visiting nature parks)	○	○	○	○	○	○	○
Services for maritime adventure tourism (e.g. canoeing, surfing, water-skiing, "jet skiing")	○	○	○	○	○	○	○
Coastal cruises, taxiboats	○	○	○	○	○	○	○
Cultural services and attractions in the coastal and archipelago areas	○	○	○	○	○	○	○
Accommodation in coastal and archipelago areas, renting vacation homes	○	○	○	○	○	○	○

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Other	○	○	○	○	○	○	○

please specify:

Marks left: 100

Other	○	○	○	○	○	○	○

please specify:

Marks left: 100

If you want to specify the changes of the blue bioeconomy and the utilization of the subsea resources or the synergies and conflicts with other businesses in the project area in the future, please add your views here:

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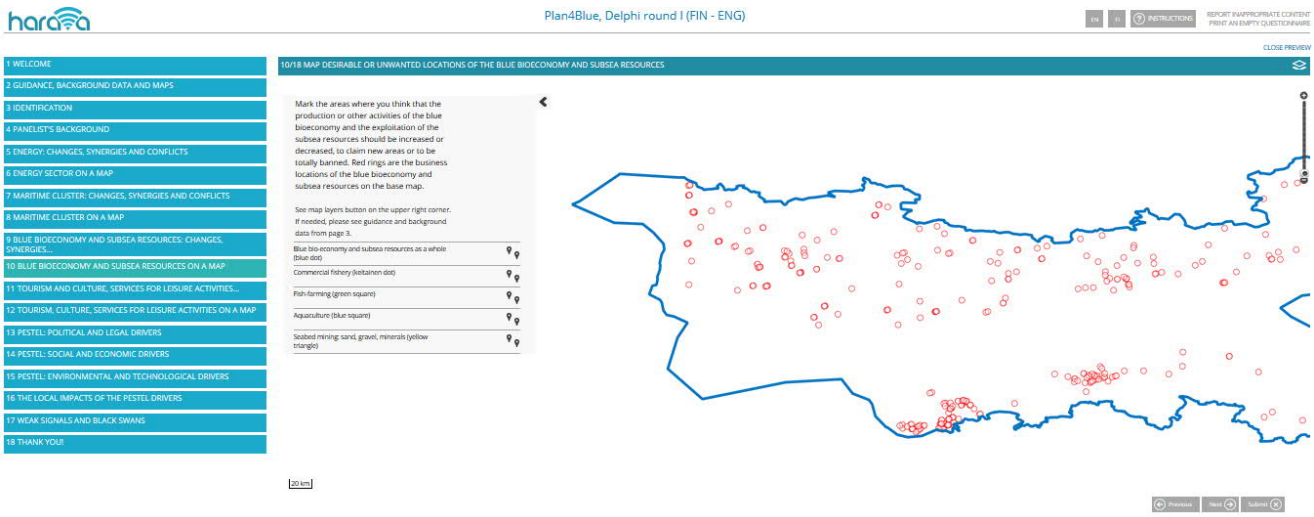


11/18 TOURISM AND CULTURE, SERVICES FOR LEISURE ACTIVITIES: CHANGES, SYNERGIES AND CONFLICTS

THE CHANGES OF THE TOURISM, CULTURE AND SERVICES FOR LEISURE ACTIVITIES BY THE YEAR 2050

In your opinion, how will the activities of the tourism and culture as well as services for leisure activities change in the project area, both in the land and sea (onshore and offshore), by the year 2050?

	significant decrease			no change			significant increase	can't say
	---	--	-	0	+	++	+++	
Tourism and culture, services for leisure activities on the whole	○	○	○	○	○	○	○	○
Guest harbors and other services for leisure boating	○	○	○	○	○	○	○	○
Submarine tourism (diving)	○	○	○	○	○	○	○	○

Sport fishing								
Services for land-based adventure tourism (e.g. camping, hunting, visiting nature parks)								
Services for maritime adventure tourism (e.g. canoeing, surfing, water-skiing, "jet skiing")								
Coastal cruises, taxiboats								
Cultural services and attractions in the coastal and archipelago areas								
Accommodation in coastal and archipelago areas, renting vacation homes								
Other								

please specify:

Marks left: 100

THE SYNERGIES AND CONFLICTS OF THE TOURISM AND CULTURE AND SERVICES FOR LEISURE ACTIVITIES WITH OTHER BUSINESSES

Which business activities may have positive synergies or conflicts or both with the activities of the tourism and culture or with the services for leisure activities in the project area?

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Energy sector							
Wind power							
Nuclear power							
Submarine geothermal energy							
Production and distribution of biofuels							
Refinement and distribution of fossil fuels							
Construction and maintenance of the grids, energy lines, gas pipes							
Energy transfer and conditioning (e.g. gas pipes)							
Storage and distribution of liquefied natural gas (LNG)							
Solar power							
Wave energy							
Alternative, experimental energy modes							

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Maritime cluster							
Offshore construction (fixed or floating platforms)							
Shipbuilding							
Marine transportation (commercial shipping and ports, pilotage and towage of ships)							
Demolition of ships							
Clean tech and equipment for marine transportation							
Dredging, maintenance of waterways							
Building of leisure and sporting boats							
Warehousing and storage of leisure boats							

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Blue bio-economy and subsea resources							
Commercial fishery							
Fish-farming							
Aquaculture							
Seabed mining (sand, gravel, minerals)							

	significant conflicts	some / possible conflicts	both conflicts and synergies	some / possible synergies	significant synergies	no interaction	can't say
Other	○	○	○	○	○	○	○

please specify:

Marks left: 100

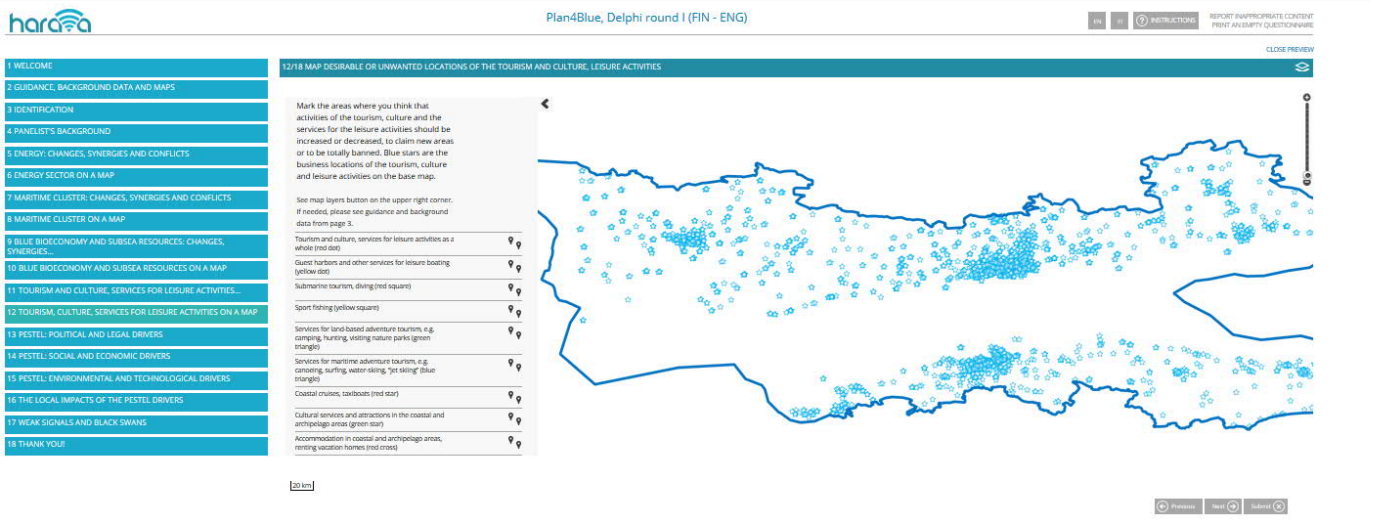
Other	○	○	○	○	○	○	○

please specify:

Marks left: 100

If you want to specify the changes of the tourism and culture or services for leisure activities or the synergies and conflicts with other businesses in the project area in the future, please add your views here:

Marks left: 250



13/18 PESTEL-ANALYSIS: POLITICAL AND LEGAL DRIVERS

In your opinion, which political and legal drivers will probably have effects of the blue businesses of the project area? Please mark those drivers or add them the text boxes below.

Political drivers affecting the blue businesses

Political drivers concerns all types of policies, e.g. international, EU level, Baltic Sea Regional or Estonian and Finnish national policies, business sector strategies or regional strategies.

The degree of the EU integration	insignificant effect		significant effect
Cooperation between Finland and Estonia	insignificant effect		significant effect
Cooperation with Russia	insignificant effect		significant effect
Cooperation with international bodies of the Baltic Sea Region	insignificant effect		significant effect
The conflicts of the sectoral policies in EU	insignificant effect		significant effect
The conflicts of the sectoral policies in Finland	insignificant effect		significant effect
The conflicts of the sectoral policies in Estonia	insignificant effect		significant effect
Increased political tensions in the Baltic Sea	insignificant effect		significant effect
Environmental policies as a whole	negative effect		positive effect
Energy policies on the whole	negative effect		positive effect
Industrial policies (incl. fishing)	negative effect		positive effect
Housing policy and land use planning	negative effect		positive effect
Traffic policies on the whole	negative effect		positive effect

Please describe, if in your view there are some special policies that have exceptionally strong, positive or negative effect on some business sectors by the year 2050:

Marks left: 250

Legal drivers affecting the blue businesses

Employment laws in Finland	negative effect		positive effect
Employment laws in Estonia	negative effect		positive effect
Tax laws in Finland	negative effect		positive effect
Tax laws in Estonia	negative effect		positive effect
Environmental laws in Finland	negative effect		positive effect
Environmental laws in Estonia	negative effect		positive effect
Finland: Environmental regulations and permitting processes on the whole (incl. ISO-standards)	negative effect		positive effect
Estonia: Environmental regulations and permitting processes on the whole (incl. ISO-standards)	negative effect		positive effect
Tight orders of environmental permits	negative effect		positive effect
The weak preparation of the laws and regulations	insignificant effect		significant effect

Weak expertize and differing interpretations of regulations of the permitting officials	insignificant effect		significant effect
Intellectual property (e.g. patents)	insignificant effect		significant effect

Please describe, if in your view there are some regulations that may have exceptionally strong positive or negative effect on some business sectors by the year 2050:

Marks left: 250

14/18 PESTEL-ANALYSIS: SOCIAL AND ECONOMIC DRIVERS

In your opinion, which social and economic drivers will probably have effects of the blue businesses of the project area? Please mark those drivers or add them the text boxes below.

Social drivers affecting blue businesses

Urbanization	negative effect	positive effect
The depopulation of the remote districts	negative effect	positive effect
Ageing	negative effect	positive effect
Immigration	negative effect	positive effect
The increasing degree of education	insignificant effect	significant effect
The increasing polarization of population groups	insignificant effect	significant effect
Positive attitudes towards blue businesses	insignificant effect	significant effect
Negative attitudes towards blue businesses	insignificant effect	significant effect

In your opinion, are there any other social drivers that may affect the blue businesses by the year 2050? Please mention those drivers:

Marks left: 250

Economic drivers affecting blue businesses

Aim to increase circular economy	insignificant effect	significant effect
Aim to low carbon society	insignificant effect	significant effect
The conditions and trends of global economy	insignificant effect	significant effect

In your opinion, which businesses are affected most by the global economies, and in which way: negative or positive?

Marks left: 250

The conditions and trends of the regional economy in the Baltic Sea	insignificant effect	significant effect

In your opinion, which businesses are affected most by the regional economies, and in which way: negative or positive?

Marks left: 250

Government support to the businesses ability to compete on the whole	insignificant effect	significant effect

Please comment the negative or positive effects of the government support to the businesses in Finland:

Marks left: 250

Please comment the negative or positive effects of the government support to the businesses in Estonia:

Marks left: 250

In your opinion, are there any other economic drivers that may affect the blue businesses by the year 2050? Please mention those drivers:

Marks left: 250

15/18 PESTEL-ANALYSIS: ENVIRONMENTAL AND TECHNOLOGICAL DRIVERS

In your opinion, which environmental and technological drivers will probably have effects of the blue businesses of the project area? Please mark those drivers or add them the text boxes below.

Environmental drivers affecting the blue businesses

Eutrophication of the sea waters	insignificant effect	significant effect
Increasing precipitation	insignificant effect	significant effect
Decreasing salinity	insignificant effect	significant effect
Increasing temperatures	insignificant effect	significant effect
Sea level rise	insignificant effect	significant effect
The proliferation of extreme weather phenomenon	insignificant effect	significant effect
Invasive species	insignificant effect	significant effect
Disintegration of habitats	insignificant effect	significant effect
Chemicalization of the environment	insignificant effect	significant effect
Increasing amount of litter	insignificant effect	significant effect
Microplastic litter	insignificant effect	significant effect
Lesser and shorter winter ice coverage	insignificant effect	significant effect
Reduction of atmospheric emissions: CO2, SOx, NOx, black carbon	insignificant effect	significant effect
Reduction of water emissions: nutrients, oil, hazardous substances	insignificant effect	significant effect
Expansion of environmental protectorates	insignificant effect	significant effect

In your opinion, are there any other environmental drivers that may affect the blue businesses by the year 2050? Please mention those drivers:

Marks left: 250

Technological drivers affecting the blue businesses

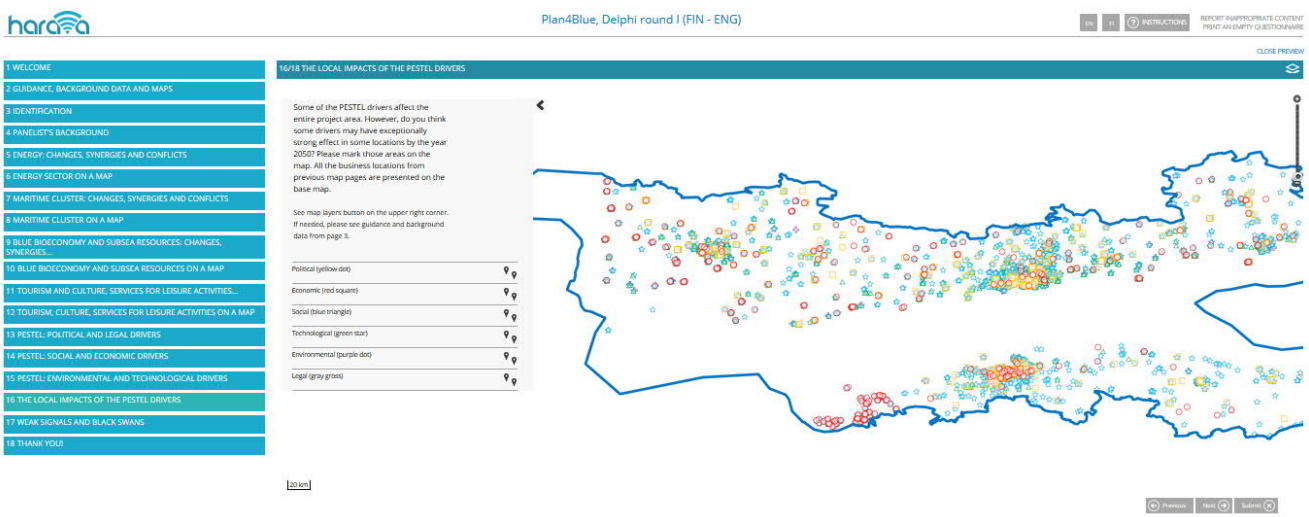
The development of the information and communications technology (ICT)	insignificant effect	significant effect
Expanding internet of things (IOT)	insignificant effect	significant effect
Increasing automatization	insignificant effect	significant effect
Increasing robotization	insignificant effect	significant effect
Clean tech innovations for blue businesses	insignificant effect	significant effect

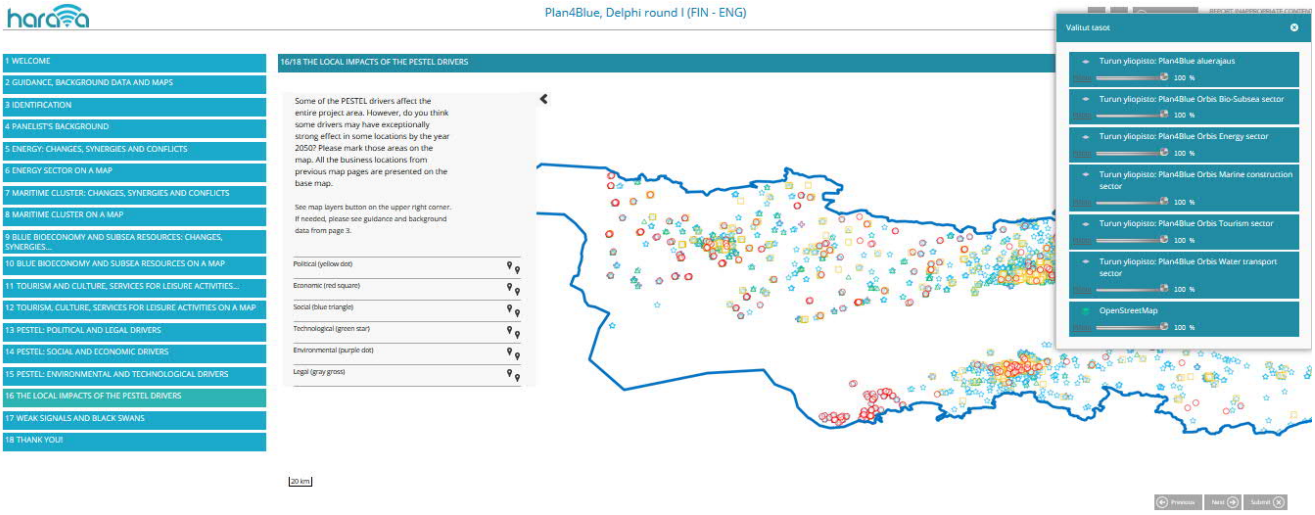
In your opinion, are there any other technological drivers that may affect the blue businesses by the year 2050? Please mention those drivers:

Marks left: 250

In your view, do the technological drivers have especially positive or negative effects on some businesses? Which businesses?

Marks left: 250





17/18 WEAK SIGNALS AND BLACK SWANS

WEAK SIGNALS

A weak signal is an event or a phenomenon which does not appear to be significant at the time it occurs. However, it may be important or even crucial regarding the emergence of the future. Currently, there may exist seemingly weak signals, which may have considerable effect on the blue businesses in the Baltic Sea region in the future. What could they be in your view?

Marks left: 250

BLACK SWANS

In the future may occur events, which deviate beyond what is normally expected and which are extremely difficult to predict, called black swans. In your opinion, could there be some black swans that would have effect on the blue businesses in the Baltic Sea region until the year 2050? What could they be?

Marks left: 250

Annex II. Programme of the first Plan4Blue scenario workshop

Scenarios for Blue Economy

Helsinki 15th -16th June, 2017

at Restaurant Botta, room 'Juhlasali'

Museokatu 10, 00100 Helsinki (see map on page 3)

PROGRAMME

The event is chaired Riku Varjopuro, Plan4Blue Project Coordinator, the Finnish Environment Institute SYKE

Thursday 15th June

11.00 – 12.00	Registration & lunch (provided)
12.00 – 12.15	Plan4Blue - developing MSP methods and capacity Riku Varjopuro, Plan4Blue Project Coordinator, Finnish Environment Institute SYKE
12.15 – 12.45	Blue Economy and Blue Growth on the agenda of the EU Riku Varjopuro, Plan4Blue Project Coordinator, Finnish Environment Institute SYKE
12.45 – 13.45	Preliminary results as introduction for the working groups Scenarios for Blue Economy Riitta Pöntynen, University of Turku, Centre for Maritime Studies Current status of sustainable blue economies in the Gulf of Finland and the Archipelago Sea Tuomas Pohjola, University of Turku, Turku School for Economics. Environmental vulnerability and environmental risk in the project area Robert Aps, University of Tartu, Estonian Marine Institute. Main Results of the views of first Delphi-round. Anne Erkkilä-Välimäki, University of Turku, Centre for Maritime Studies
13.45 – 14.00	Coffee break – organization to the working groups
14.00 – 15.45	Working groups

Group 1. Potential Blue Economy sector developments by 2050 (chaired by Tuomas Pohjola)

Group 2. Synergies and conflicts of blue economy sectors (chaired by Riku Varjopuro)

Group 3. Main drivers for sustainable Blue Economy sectors: political, legal, social, economic, environmental, technological (chaired by Riitta Pöntynen)

Learning café as a method for all the groups. The opinion of the first group will be presented for the second, and respectively the previous opinions for the third group.

15.30 – 15.45 Conclusion of the working groups and day one

18.30 – 21.30 Dinner cruise & visit to Vallisaari (provided)

The cruise starts from the market square at 18:30, see location on page 3

Friday 16th June

9.00 – 9.30 Coffee and registration

9.30 – 10.00 Potential for Blue Economy on the Baltic Sea Region
Tuomas Pohjola, University of Turku, Turku School for Economics.

10.00 – 10.10 Guidance for the working groups, how to work with maps
Anne Erkkilä-Välimäki, University of Turku, Centre for Maritime Studies

10.15 – 11.15 Working groups: map-based exercise

11.15 – 11.30 Visit to see the results of the other groups

11.45 – 12.00 Closing of the workshop, next steps

Riku Varjopuro, Plan4Blue Project Coordinator, Finnish Environment Institute SYKE

The workshop - Scenarios for Blue Economy - is the first of four workshops that are organized by the project Maritime Spatial Planning for Sustainable Blue Economies (Plan4Blue).

Annex III. Programme of the second Plan4Blue scenario workshop

Blue Economy Scenarios for Maritime Spatial Planning

Tallinn, 23-24 January, 2018

Tallink Spa & Conference Hotel (Sadama 11a, Tallinn)

Tuesday 23rd January

18:00 – 18:30 Registration and welcome coffee

18:30 – 18:45 Introduction to Plan4Blue scenario work and sustainability of blue futures (Riku Varjopuro, SYKE)

18:45 – 19:00 UN Sustainable Development Goals of the 2030 Agenda for Sustainable Development (Liisi Lees, University of Tartu)

19:00 – 19:15 Environmental cumulative risk analysis and assessment background for the Gulf of Finland Blue growth scenario development (Robert Aps, University of Tartu)

19:15 – 20:45 Discussion and networking

20:45 – 21:00 Conclusions (Riku Varjopuro, SYKE)

You won't be left hungry or thirsty – refreshments and snacks will be served!

PROGRAMME

The event is chaired Riku Varjopuro, Plan4Blue Project Coordinator, Finnish Environment Institute SYKE

Wednesday 24th January

9.30 – 10.00 Registration & coffee

10.00 – 10.15 Opening & aims of the workshop
Riku Varjopuro, Plan4Blue Project Coordinator, Finnish Environment Institute SYKE

10.15 – 10.40 Keynote speaker: Andrew Merrie, Stockholm Resilience Center
"Three decades ahead – How to come to grips with uncertain ocean futures?"

10.40 – 12.30 Elaboration of the future scenarios

Working in four groups:
Energy: focus on development of renewable energy options: wind energy, solar power, wave energy, other future energy options and energy transfer and conditioning.
Maritime cluster: focus on maritime transport of freight and passengers, shipbuilding and cleantech.
Maritime and coastal tourism, culture and services for leisure activities
Blue bioeconomy (fishing, fish farming, aquaculture) and subsea resources
The groups will discuss development of these sectors by 2050 under alternative scenarios:

Sustainability above all! - how a sustainable future may be reached?

Growth unlimited - what actions would lead to a worst case scenario?

Sustainability dilemma - what are the components of a business as usual scenario?

Virtual reality – how would a fully digitalised future play out?

We will discuss what kind of consequences alternative scenarios might cause within the sectors? Which unexpected events might change the development path into something else? The groups will also discuss the paths towards the alternative scenarios. Which actions support their realization, and in which circumstances these scenarios would realize?

12.30 – 13.30 Lunch (provided, restaurant "Nero" on the 1st floor)

13.30 – 14.00 Reports from working groups and introduction to next working group session

14.00 – 15.00 Working groups: future use of sea areas (map-based exercise)
Discussion on the preliminary results on maps. Which are the most intensive and potential areas of future development? Which kind of spatial impact the alternative scenarios would have? What are the possibilities and potential areas for multi-use platforms and synergies?

15.00 – 15.15 Main results from the working groups

15.15 Closing of the workshop
Riku Varjopuro, Plan4Blue Project Coordinator, Finnish Environment Institute SYKE

The workshop - Blue Economy Scenarios for Maritime Spatial Planning - is the second of four workshops that are organized by the project Maritime Spatial Planning for Sustainable Blue Economies (Plan4Blue).

Annex IV. The Questionnaire of Delphi round 3-4, 2018

Plan4Blue Delphi-questionnaire 2018 (1)

Future scenarios for Blue Economy in 2050

Dear Delphi-panelist! The aim of this questionnaire is to evaluate the draft futures scenarios for Blue Growth on different blue economy sectors on Gulf of Finland and Archipelago Sea area. They have been created based on the results of the previous Delphi-rounds, and complemented with the results of the scenario workshop arranged in Helsinki in June 2017. Results include views on changes on blue economy sectors and on main drivers for development. Based on the responses, draft futures tables and brief descriptions of the alternative scenarios have been compiled for blue economy sectors, describing possible alternative developments in 2050.

We are looking forward to receiving your feedback on the draft alternative futures. Your input to this questionnaire will be used in continuing the process of creating the scenarios for Blue Economy in 2050. As a result, we will update the futures tables and descriptions of the future images, and create draft descriptions on how the alternative futures may occur.

Please answer to the questionnaire and evaluate the results from the viewpoint of your field of expertise.

The structure of the questionnaire is as follows:

- background questions
- questions related to future scenarios of blue economy sectors and/or their sub-sectors: energy, marine cluster, tourism, culture, and services for leisure activities, blue bio-economy and sub-sea resources

In the files which were attached to the e-mail you will find background for the questions: futures tables, images of future and summary of strategies on blue economy sector.

You may answer in English, Finnish or Estonian in the open questions. To proceed in the questionnaire, click on the page numbers.

Please reply to the questionnaire **on Thursday, March 29th at the latest.**

If you have any questions, please contact

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e-mail: riitta.pontynen@utu.fi
Merle Kuris, tel. +372 6597 029, GSM +372 56 203 864
e-mail: merle.kuris@bef.ee

Background questions

The answers of the Delphi study are processed anonymously. Background information of the panelists is for technical reasons and will be kept confidential. It will be kept separate from the answers.

Your name and organisation

Name	_____
Name of the organisation	_____

My main expertise is in

Energy ☐

Marine cluster ☐

Maritime transport ☐

Shipbuilding, offshore ☐

Cleantech ☐

Tourism ☐

Culture and cultural heritage ☐

Societal issues ☐

Politics ☐

Subsea resources ☐

Fishing ☐

Aquaculture ☐

Other, please specify ☐

_____

Futures of the energy sector

The focus of the Plan4Blue Blue Growth scenarios regarding the energy sector is on renewable energy sources: wind energy, solar power, wave energy in which production takes place on sea and coastal areas.

1. Please choose the 3 most important variables which in your opinion would have a major impact on the future development of energy sector towards 2050.

These variables in the futures table of energy have been formed based on identified drivers in Delphi and workshop. Variables have different values in the alternative futures scenarios.

Attitudes ☐

Co-operation in the BSR ☐

Main energy options supported by energy and environmental policies ☐

Industrial policy ☐

Conditions and trends of global economy and globalization ☐

Regional economic situation ☐

Urbanization ☐

ICT – digitisation ☐

Clean tech innovations for energy ☐

Environmental regulations and legal practices ☐

Other variable not mentioned above, please specify ☐

_____

Other variable not mentioned above, please specify ☐

_____

2. What would be possible effects of these 3 drivers you have selected, in particular for development of wind energy and renewable energy sector?

Please describe briefly possible consequences of the 3 most important drivers you have chosen.

_____

_____

_____

3. Future scenarios for energy sector

Please assess the following statements. Time frame for all statements is year 2050.

Strongly Disagree	Disagree	Slighty disagree	Neutral	Slighty agree	Agree	Strongly agree
Currently mixed attitudes towards renewable energy will turn mainly positive in the next 10-20 years	○	○	○	○	○	○	○
Co-operation in the BSR promotes use of renewable energy options	○	○	○	○	○	○	○
In a fully digitalised society, consumption of energy increases	○	○	○	○	○	○	○
Renewable energy will be the main energy option used in 2050	○	○	○	○	○	○	○
Industrial policy which supports large industries will lead to the continuing use of fossil energy	○	○	○	○	○	○	○
Global growth leads to increasing consumption of fossil energy	○	○	○	○	○	○	○
Urbanisation will be sustainable in 2050	○	○	○	○	○	○	○
Digitalisation supports the use of smart energy systems	○	○	○	○	○	○	○
Innovations in clean tech will lead to sustainability in all energy options	○	○	○	○	○	○	○
Co-operation between Estonia and Finland promotes strict enforcement of environmental legislation	○	○	○	○	○	○	○
In the future, there will be smart floating platforms or artificial islands which will be utilised by different blue sectors: energy, maritime, tourism and bioeconomy.	○	○	○	○	○	○	○

4a) How the "Sustainability above all!" -scenario would be reached in energy sector? Please propose 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Decarbonisation is a success story. Strong environmental policies and legislation have led to decarbonisation. Smart, distributed energy production and renewable energy sources are being used. Campaigns to save energy; optimization of energy use. Innovative clean tech-based energy production"

_____

_____

_____

4b) What would lead to the "Growth unlimited" scenario on energy sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Economic growth is based on consumption of traditional fossil and nuclear energy. Favoring of centralized energy production, current and old technologies are used. Heavy industrial production with low degree of processing. Weak environmental legislation."

_____

_____

_____

4c) What would be the reasons for the "Sustainability dilemma" to realize on energy sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"New and old energy production exist side by side, decarbonisation has not succeeded. Aim to self-sufficiency in energy production. Slightly modernized technologies used."

_____

_____

_____

4d) How would the “Virtual reality” scenario - full digitalized future – be reached on energy sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Fully digitalised society: need to use natural resources changes because of changing human behaviour. Enormously increasing need for energy. Need for smart systems, grids and pipelines."

_____

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_____

Futures of the maritime sector

The focus of the Plan4Blue Blue Growth scenarios regarding the maritime sector is on maritime transport, both freight and passenger transport. Other sectors focused are marine cleantech and offshore construction, which are important sectors with potential for blue growth. Passenger transport is linked to development of maritime tourism.

1. Please choose the 3 most important variables which in your opinion would have a major impact on the development of maritime cluster in 2050.

These variables in the futures table of maritime sector have been formed based on identified drivers in Delphi and workshop. Variables have different values in the alternative futures scenarios.

Attitudes of customers and shippers

Level of co-operation in the BSR - safety situation and stability in the Baltic Sea area

Fuels used in shipping (environmental policy)

Conditions and trends of global economy /globalization

Regional economic situation

Transport routes

ICT/ digitalisation

Clean tech / emissions from maritime cluster (energy efficiency)

Climate conditions

Environmental regulations and legal practices

Other variable not mentioned above, please specify

_____

Other variable not mentioned above, please specify

_____

2. What would be possible effects of the 3 drivers you have selected, in particular for development of maritime transport?

Please describe briefly possible consequences of the 3 most important drivers you have chosen.

_____

_____

_____

3. Future scenarios for maritime cluster

Time frame for all statements is year 2050

	Strongly Disagree	Disagree	Slighty disagree	Neutral	Slighty agree	Agree	Strongly agree
Increasing nationalism would lead to decrease in international trade and less need for maritime transport in 2050	○	○	○	○	○	○	○
Fossil fuels will be replaced by renewables, leading to zero emission shipping in 2050	○	○	○	○	○	○	○
Global economic growth leads to bigger vessel sizes in the BSR	○	○	○	○	○	○	○
In the BSR, stricter environmental regulation for shipping will continue, supporting clean tech production	○	○	○	○	○	○	○
Freight transported on Gulf of Finland will decrease because of Helsinki-Tallinn tunnel	○	○	○	○	○	○	○
In 2050, there will be smaller ports and smaller vessels on Gulf of Finland and Archipelago Sea Area	○	○	○	○	○	○	○
Digitalisation decreases the need to transport	○	○	○	○	○	○	○
Weather conditions are difficult and unpredictable, which leads to decrease in maritime imports and exports from the Northern parts of the BSR	○	○	○	○	○	○	○
Freight volumes on Gulf of Finland and Archipelago Sea Area will increase by 2050	○	○	○	○	○	○	○
Passenger transport volumes on Gulf of Finland and Archipelago Sea Area will increase by 2050	○	○	○	○	○	○	○
New regular transport routes will be opened on Gulf of Finland and Archipelago Sea Area	○	○	○	○	○	○	○
Most vessels are autonomous in 2050	○	○	○	○	○	○	○

4a) How would the "Sustainability above all" -scenario would be reached on maritime sector? Please propose 3-5 activities, events or decisions. When would you think these activities, events or decisions will be happened/occured?

"Low emission renewables used in shipping - zero emission policies. Modern shipbuilding and innovations: environmental impact of ships is designed to be as small as possible. Advanced intelligent maritime systems are used, autonomous vessels operating on BSR. Internet of Things in cargo handling."

_____

_____

_____

4b) What would lead to the “Growth unlimited” scenario on maritime sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Increasing maritime traffic. Minimum environmental requirements are fulfilled in shipping. Current technologies used in maritime cluster. Mainly fossil fuels and other unsustainable fuels used in shipping."

_____

_____

_____

4c) What would be the reasons for the “Sustainability dilemma” scenario to realize on maritime sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Mix of renewable and fossil fuels used. Attitudes impact on choices: some shipping companies use renewables, others use traditional fossil fuels. Economic revenues are considered more important than sustainable values."

_____

_____

_____

4d) How would the “Virtual reality” scenario - a fully digitalized future – be reached on maritime sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Extensive digitalization, local production such as 3D printing has drastically reduced the need for maritime transport, except raw materials. Unmanned vessels operate on Gulf of Finland and Archipelago Sea."

_____

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_____

Futures of tourism, culture and services for leisure activities

The focus of Plan4Blue Blue Growth scenarios regarding tourism sector is on various kind of tourism activities in destinations situated on the coasts and islands, and on the sea areas (project area - Gulf of Finland and Archipelago Sea area) including

- “nature tourism” – recreation, camping, outdoor activities, cottages and camping
- off-shore water sports: diving, fishing, canoeing etc.
- cultural heritage, history
- boating, sailing (guest harbors)

1. Please choose the 3 most important variables which in your opinion would have major impact on the development of tourism, culture and services for leisure activities.

These variables in the futures table of tourism, culture and services for leisure activities have been formed based on identified drivers in Delphi and workshop. Variables have different values in the alternative futures scenarios.

Attitudes of travelers / tourists

Safety and security in BSR region

Conditions and trends of global economy /

Globalization

Leisure interests

ICT - digitalisation

State of the environment

Tourist destinations in areal development

Other variable not mentioned above, please specify

_____

Other variable not mentioned above, please specify

_____

2. What would be possible effects of the 3 drivers you have selected for the development of the sector?

Please describe briefly possible consequences of the 3 most important drivers you have chosen.

_____

_____

_____

3. Future scenarios for tourism, culture and services for leisure activities

Time frame for all statements is year 2050

Strongly Disagree		disagree	Slighty disagree	Neutral	Slighty agree	Agree	Strongly agree
BSR region is a safe and secure tourist destination	○	○	○	○	○	○	○
Global growth leads to increasing number of global tourists in BSR	○	○	○	○	○	○	○
Sharing economy has an important position in tourism business	○	○	○	○	○	○	○
Tourists prefer local and regional destinations	○	○	○	○	○	○	○
Travelling decreases because of virtual experiences at home	○	○	○	○	○	○	○
Digitalisation leads to individualisation of travelling and interest in unique travel destinations	○	○	○	○	○	○	○
BSR is clean and attracts more tourists to coastal and sea areas	○	○	○	○	○	○	○
International tourists visit mainly touristic hubs in the BSR	○	○	○	○	○	○	○
Cultural destinations will attract increasing number of tourists to the BSR	○	○	○	○	○	○	○
Access of tourists will be restricted on vulnerable areas.	○	○	○	○	○	○	○

4a) How would the "Sustainability above all" -scenario be reached in tourism, culture and services for leisure activities? Please propose 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Safe and secure BSR has enabled development of sustainable tourism. Restrictions for tourists have been established to enter certain conservation areas. Well working, unified ICT systems, digitization allows easy use of travel related data for e.g. planning, reservations, and information on the destination."

_____

_____

_____

4b) What would lead to the "Growth unlimited" scenario in tourism, culture and services for leisure activities? Please propose 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Strong growth has led to increasing mass tourism and environmental damages. Attitudes towards environment and sustainability are negative or careless, also towards local residents. Unsustainable ways of travelling prevail."

_____

_____

_____

4c) What would be the reasons for the "Sustainability dilemma" to realize in tourism, culture and services for leisure activities? Please propose 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Global tourism increases. Tourists have different likes; various means of travelling are used and different destinations visited. Different "smart" technologies are available but they are not user-friendly. Thus their advantages have not realised."

_____

_____

_____

4d) How would the "Virtual reality" scenario - a fully digitalized future – be reached in tourism, culture and services for leisure activities? Please propose 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Due to virtual reality, people do not travel much, but prefer to experience destinations at home. New types of tourism have been developed, for example new kind of blue care and health services from the sea."

_____

_____

_____

Futures of the blue bio-economy and sub-sea resources

The focus of the Plan4Blue Blue Growth scenarios on blue bioeconomy and subsea is on fishing, aquaculture, fish farming, mussel and algae farming.

1. Please select the 3 most important variables which in your opinion would have a major impact on the development of blue bioeconomy and subsea resources in 2050.

These variables in the futures table of blue bioeconomy and subsea resources are based on drivers identified in Delphi and workshop. Variables have different values in the alternative futures scenarios.

Attitudes ☐

Policies concerning the use of natural resources

Conditions and trends of global economy, globalization

Attitude towards blue bioeconomy as a profession

Ethical issues / interest on nutrition and healthy eating

Clean tech innovations for blue businesses

State of the environment

Environmental regulations and legal practices – industrial policy

Other variable not mentioned above, please specify

_____

Other variable not mentioned above, please specify

_____

2. What would be possible effects of the 3 drivers you have selected for development of the sector?

Please describe briefly possible consequences of the 3 most important drivers you have chosen.

_____

_____

_____

3. Future scenarios for blue bioeconomy and subsea sectors

Time frame for all statements is year 2050

	Strongly Disagree	Disagree	Slighty disagree	Neutral	Slighty agree	Agree	Strongly agree
Aquaculture, fishing and exploitation of subsea resources will be restricted to improve the state of the environment	○	○	○	○	○	○	○
Blue bioeconomy is based to circular systems	○	○	○	○	○	○	○
Global blue bioeconomy products are imported to BSR and only small-scale local production exists	○	○	○	○	○	○	○
Blue bioeconomy professions are popular	○	○	○	○	○	○	○
In 2050, people are interested in nutrition and healthy eating	○	○	○	○	○	○	○
Local bioeconomy systems have global markets	○	○	○	○	○	○	○
Clean tech innovations decrease impacts of blue bioeconomy on sea	○	○	○	○	○	○	○
State of Gulf of Finland and Archipelago Sea area has improved by 2050	○	○	○	○	○	○	○
Blue bioeconomy is supported in the national policies of Estonia and Finland	○	○	○	○	○	○	○

4a) How the "Sustainability above all" -scenario would be reached in blue bioeconomy and subsea sector? Please propose 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Sustainable circular economy based blue bioeconomy. New bio-based products are cultivated in the sea. People are interested in local, near produced food. Environmental policy and legislation restrict emissions to sea caused by blue bio-economy, and over-exploitation of subsea resources."

_____

_____

_____

4b) What would lead to the "Growth unlimited" scenario on blue bioeconomy & subsea sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Subsea resources and fish stocks are overexploited. Aquatic flora and fauna suffer from deteriorating
of the environment and the consequences of the climate change. Production and availability of blue bioeconomy decreases. Attitudes towards environment and sustainability are negative or careless."

_____

_____

_____

4c) What would be the reasons for "Sustainability dilemma" to realize on blue bioeconomy &
subsea sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Awareness of the environmental problems and their impacts on blue bioeconomy, but old technologies
are used. Old customs and consumer habits prevail. Conflicts of different sea use continue."

_____

_____

_____

4d) How would the "Virtual reality" scenario - a fully digitalized future – be reached? Name
3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?

"Resource wisdom: digital-based production and circular economy. New, digital offshore aquaculture technologies are being used e.g. independent aquacultural (floating) units. Automation used in blue bioeconomies and subsea."

_____

_____

_____

If you have any other comments regarding futures scenarios, or other feedback to the questionnaire, please add your views here.

_____

Annex V. Interview questionnaire

INTERVIEW GUIDE

Business questions

1. *How do you see the future of your business/your company …say in 2025-2030?*
2. *Which factors do you think will most affect the long-term economic development of your company…say in 10-20 years (turnover, number of employees)?*
3. *Do you see an increasing or perhaps a decreasing trend in your business/in the business of this field?*
4. *What kind of new opportunities and possibilities do you see in your business/in the business of this field …say by the year 2025 - 2030?*
5. *Is it anything you would like to say about the future of your business or the business of this field?*
6. *A sector specific question*

Networking questions

I Drivers

General drivers for networking:

In what kind of networks are you participating?

Why have you joined these networks?

Drivers for Maritime Spatial Planning (MSP) networking:

Do you do any networking in MSP?

Describe that networking

What has made you to do this kind of networking?

II. Trends

Trends in networking:

What do you see as a future in cross-border networking in Gulf of Finland and Archipelago sea area in your sector? Between sectors? Between Estonia and Finland? Is it increasing? Decreasing? Why?

What characteristics dominate the future networks in Gulf of Finland and Archipelago sea area? Why?

III. Suggestions

Improvement of networking in Gulf of Finland area:

What do you suggest should be done to make networking better / more intense in Gulf of Finland and Archipelago sea area?

Who should do that? Why?

Annex VI. Specifications of synergies and conflicts

Specifications of synergies and conflicts, based to results of scenario workshops in Helsinki 2017 and Tallinn 2018, as well as notions from responses of Delphi 2018 and interviews for business sector.

Synergies and conflicts specified in the on-line questionnaire, workshop groups and interviews. Figure in brakets = mention in Helsinki workshop group, and + -mark additional mentions of the following groups. D=Delphi-mention. Tallinn workshop = T, followed by the mention in brackets. Interview mentions, in brackets (INT).

Synergies and conflicts regarding	Energy sector synergies	Maritime cluster synergies	Blue bioeconomy and subsea resources synergies	Tourism, clture and leisure activities synergies	Energy sector conflicts	Maritime cluster conflicts	Blue bioeconomy and subsea resources conflicts	Tourism, clture and leisure activities conflicts
Energy sector	• more energy interconnections, grids, and links; big grid is the best battery. (T, 1) •	• wind turbines located in ports (industrial landscapes), transport sector can use renewable energy, possible technological innovations (2) • 1.6.1. lists renewable energy sources for ships!	• Possibility to co-locate with other activities (e.g. common infrastructure), co-location of blue bioeconomy activities, "Multi-use platform" idea (6) • By-products of energy production (e.g. warm water to be used in aquaculture) (2) • power demand, the combination of the power plants and establishments (D) • new biofuels (D)	• Co-operation with renewable energy (e.g. renewable energy producers + hotels; developing sustainable tourism) (1 mention) • Site visits to "alternative energy production" (1) • Sustainable energy for travelling (T, 1)	•	•	• Energy sector activities and constructions at sea can harm other human activities at sea (tourism, recreational use, fishing) (7)	• Energy sector activities and constructions at sea can harm other human activities at sea (tourism, recreational use, fishing) (7) • Energy sector activities and constructions at sea can destroy underwater cultural heritage (3)
Maritime cluster	• ports: serving offshore wind power plants (T, 1) • circulation, e.g. ports may produce energy from collected material; reuse of waste in ports; reused in ferries (T, 1) • cargo, passengers, energy (T, 1) • Floating ports get energy from waves (T, 1)	• Artificial islands built for the tunnel might be locations for new ports. (T, 1) • Cleantech in ports or in their vicinity; demolition of ships (T, 1)	•	• ports and harbours as gateways to tourism (D) • coastal cruises (T, 1) • Virtual glasses and cargo mixed with tourism – tourists working / cruising in cargo ships (T, 1) •	•	• collision risk between autonomous and regular vessels, (T, 1) •	• Fishing activities and traffic has a risk of collision (1)	
Blue bioeconomy and subsea resources	• Energy sectors physical constructions (power plants) as multiuse platforms, e.g. spawning sites (7+)	• Transportation operations and building of structures for the bioeconomy (D) • Passenger and cargo transport in tunnels or airborne, the front of	• local food (D), • opportunities for fishing (D) • salmon ponds (D)	• Local food (bioeconomy), also smart solutions in aquaculture (1+++) • fishermen add local colour to the port	• cabling works and their route loactions may harm coastal waters and commercial fihing (D)	•		• Underwater cultural heritage in conflict with underwater mining (can be planned) (1 mention ++) • Professional vs. (uncontrolled)

	• By-products of energy production, e.g. warm water (2)	Tallinn and Helsinki could be used as aquaculture sites. (T, 1) • Building the tunnel Hki-Tallinn will increase sand and gravel extraction . (T, 1) •	• Fishing and pelagic fishing can utilise same areas (1)	(guest harbour) (INT, 1) • .				recreational fishing (1 mention) • energy price (D) • Projects that affect underwater nature and cultural environ-ment harmfully reduce the attraction of the regions to tourism (D)
Tourism, culture and leisure activities	• site visits, e.g. to alternative energy production sites (2)	• Maritime tourism sector is dependent on transport of people (maritime heritage, coastal tourism). Ports as touristic hubs. Sea swimming pools for the tourists. (3, D) • Helsinki-Tallinn tunnel creates / encourages to new ways to travel. (T, 1) •	• Synergies (e.g. fishing / fisheries) with tourism: (local) food, cultural heritage (tradition), experiences to tourists, site visits (5) • Power demand (D), • destinations for visits (D), • traveller's environmental conciousness (D) • local food (D), • island hopping (D), • Fishing and cooking on the boat experience as a tourism attraction (T, 1)	• Synergies with transport (cruise business), ports (1 +++) • Synergies between different tourism activities, e.g. combination of onshore and offshore tourism: tourist make day trips to off-shore attractions (2). • co-operation with marine sports, sailors (INT, 1)	• energy sectors activities and constuctions may harm tourism, recreational use, fishing (7) • energy sector activities and constructions can destroy UCH. eg., shipwrecs, overlapping use of sea space (7) •	• Possible conflicts with underwater cultural heritage values (1)	• traveller's environmental conciousness (D	• Cultural heritage need to be protected from overuse by tourism • Conflicts are seen at the coast line between summer cottages and free shoreline. (T, 1)
Spatial-economic-societal-nature impacts & aspects	Energy sector synergies	Maritime cluster synergies	Blue bioeconomy and subsea resources synergies	Tourism, clture and leisure activities synergies	Energy sector conflicts	Maritime cluster conflicts	Blue bioeconomy and subsea resources conflicts	Tourism, clture and leisure activities conflicts
Sea space	• Disposition ???? (D) •	•	•	•	• Energy installations as permanent structures restricts of many other sea uses (1) • Potential conflicts with military areas (D) • Geopolitical conflicts between wind farms and radar surveillance (T, 1)	• Potential conflicts with military areas (D) • disposition?? (D), •	• Competing use of space, e.g. food production compete with other uses (1) • disposition??? (D), •	• disposition?? (D),
Economic aspects	• Possibilities to create energy supply, fosterin local economies / jobs in remote areas (2) • Energy demand (D) • New sources of energy (D) • Energy from recreational housing (D) • local production of components for wave	• Material recycling (1)	• New jobs to remote coastal areas (2) • Possibility to support other economies / different types of bio-economies in the area (2)	• co-operation with accomodation and catering business (INT, 1)	• differents interests in use and demand for renewable energy may jepardize economic feasibility of renewable energy projects at sea (1) • Difficulties to study where energy is produced and where used – the economic benefits and environmental harms may be experieced in different areas (1)	• limits for growth of ports because of urbanisation (T, 1)	•	•

	energy; employment (INT, 1)				• Wind: ruins businesses or tourism, military is also against it (T, 1)			
Societal aspects	• Resistance against energy projects create social networks and social capital, increassed environmental conscioussness (2) • New technologies and skills developed - exporting knowhow (2) • Synergies for local people would solve attitude problems (T, 1)	•	• R&D opportunities (e.g. in biotechnology) that benefit also other sectors + education (2) • the environmental consciousness of the consumers (D)	• Tourists participate in activities for sustainable tourism: rebuilding ecosystems, reducing nutrients, (T, 1) • tourism creates employment and adds value to the lives of locals; e.g. trips to islands (INT, 1)	• High public support and investments to renewable energy may reduce support to other business sectors (1) • High dependency on energy makes energy production and transmissions systems potetial targets to terrorists or criminals (1) • NIMBY problems (not-in-my-back-yard) (T, 1)	• the environmental consciousness of the consumers (D)	• Fish farming causes eutrophication that causes harms to many other human activities (1)	•
Effects on coastal and maritime environment (abiotic issues, flora and fauna)	• in Estonia there is a principle that no wind farms can be built in protected areas (T, 1) • Compromise between nature conservation and wind power (T, 1) • Wave energy installations work as a sort of artificial reef for fish and sea animals that stimulate the local greener. (INT, 1)	•	• Possible environmental benefits from bioeconomy (nutrient removal) and environmentally friendly activities (2+) • Mussels may be used in filtering out the seabed nutrients in shallow areas, rivers (T, 1) • Innovations make it possible for aquaculture to be on marine conservation areas (zero emissions). (T, 1) •	• Virtual reality instead of the real tourism might protect nature (T, 1) •	• Activities and constructions of energy production may harm bird species, habitats, benthos, cause noise, cause changes of spawning areas or behaviour etc. (7+, D) •	• Aimal species harmed by underwater noise (1, D) • Erosion of habitats by ships (1) • Marin elitter by caused transport (1) • Disturbance of seal pupping areas in winter (1) • Risk of accidents and oil spills (1+++) • effects on the catch (D) • hindrances to landscape (D)	• Conflicts with nature protection: overfish-ing, eutrophication from aquaculture, seabed mining (1) • the effects on nature and catches, landscape (D), • noise (D) • odour (D)	• Tourism can be harmful for protected areas. Visits to national parks (e.g. Eastern GoF, in Estonia) need to be controlled (2+++). • the effects on nature and species (D), • hindrances to landscape (D), • harmful effects of noise (D) • Many private boats and submarines and no limitations > will cause frequent boat accidents and oil spills. (T, 1) •

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