MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUKSEN JULKAISUJA
TURUN YLIOPISTON BRAHEA-KESKUS

PUBLICATIONS OF THE CENTRE FOR MARITIME STUDIES
BRAHEA CENTRE AT THE UNIVERSITY OF TURKU

A 75
2018

BLUE GROWTH – DRIVERS AND ALTERNATIVE SCENARIOS FOR THE GULF OF FINLAND AND THE ARCHIPELAGO SEA

Qualitative analysis based on expert opinions

Riitta Pöntynen & Anne Erkkilä-Välimäki

PLAN4BLUE
Interreg Central Baltic
EUROPEAN UNION
European Regional Development Fund
KIK ENVIRONMENTAL INVESTMENT CENTRE

MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUKSEN JULKAISUJA
TURUN YLIOPISTON BRAHEA-KESKUS

PUBLIKATIONER AV SJÖFARTSBRANSCHENS UTBILDNINGS- OCH FORSKNINGSCENTRAL
BRAHEA CENTRUM VID ÅBO UNIVERSITET

PUBLICATIONS OF THE CENTRE FOR MARITIME STUDIES
BRAHEA CENTRE AT THE UNIVERSITY OF TURKU

A 75
2018

BLUE GROWTH – DRIVERS AND ALTERNATIVE SCENARIOS FOR THE GULF OF FINLAND AND THE ARCHIPELAGO SEA

Qualitative analysis based on expert opinions

Riitta Pöntynen
Anne Erkkilä-Välimäki

Turku 2018

JULKAISIJA / PUBLISHER:
Turun yliopiston Brahea-keskus / Brahea Centre at the University of Turku
MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUS
CENTRE FOR MARITIME STUDIES

Käyntiosoite / Visiting address:
ICT-City, Joukahaisenkatu 3-5 B, 5.krs, Turku

Postiosoite / Postal address:
FI-20014 TURUN YLIOPISTO

Puh. / Tel. +358 (0)2 333 51
http://utu.fi/mkk

Turku 2018

ISBN 978-951-29-7530-3 (Verkkojulkaisu)
ISSN 2342–1437 (Verkkojulkaisu)

SUMMARY

The scenario-building process was part of the Plan4Blue project, in a work package called “Potential for Sustainable Blue Economies”. The approach consists of multiple alternative future visions. The Plan4Blue scenario process produced both qualitative and quantitative data. Expert views were included in the process from the Delphi studies, the Helsinki and Tallinn scenario workshops, as well as from expert interviews. This report describes the methods and results of the expert involvement in the scenario process, main drivers and the alternative Blue Growth scenarios for the Gulf of Finland and the Archipelago Sea. Economic and socioeconomic analyses as well as the mapping process have been reported in other publications of the Plan4Blue project.

Acknowledgements

The authors are thankful for INTERREG Central Baltic programme for co-funding the Plan4Blue project.

The authors are thankful for Tua Nylén, Riku Varjopuro, Hanna Nieminen, Anu Lähteenmäki-Uutela, Tuomas Pohjola, Hanna Uusitalo, Merle Kuris, Anneliis Peterson, Harri Tolvanen, Leena Laamanen and Janne Törrönen for their contribution to the workshop arrangements and working group moderation.

The authors are thankful for Lenita Nieminen, Annika Jaansoo and Merle Kuris for conducting the interviews, and Olena de Andres Gonzalez for her contribution to this publication.

The authors are thankful for Merle Kuris and Annika Jaansoo for the Estonian translations of the on-line questionnaire and English translations of the open answers as well as the communication with the Estonian experts.

The authors wish to thank Dimenteq Oy for the use and guidance of the HARAVA system and on-line questionnaire (eharava.fi).

CONTENTS

1 INTRODUCTION 9

2 SCENARIO BUILDING PROCESS 12
2.1 Methods applied in the scenario building process 12
2.2 Identification of the blue economy sectors for the scenario process 12
2.3 The selection of expert panel 14
2.4 First online questionnaire of the Delphi study 15
2.5 First scenario workshop in Helsinki in June 2017 17
2.6 Second online questionnaire of Delphi in 2018 18
2.7 Second scenario workshop in Tallinn 19
2.8 Business interviews related to specific issues discussed in workshops 22
2.9 Analysis and synthesis of the results of the scenario building process 23
2.10 Experts' background 26
2.10.1 The first phase of the scenario process in 2017 26
2.10.2 The second phase of the scenario process in 2018 28
2.10.3 Evaluation of the experts' background in the scenario process 29

3 GENERAL DRIVERS OF BLUE ECONOMY IN THE GULF OF FINLAND AND THE ARCHIPELAGO 31
3.1 Political drivers 31
3.2 Economic drivers 33
3.3 Social drivers 34
3.4 Technological drivers 35
3.5 Environmental drivers 36
3.6 Legal drivers 37

4 THE DRIVERS AND ESTIMATED CHANGES OF the blue economy sectors 40
4.1 Energy sector 40
4.1.1 Estimated changes by 2050 and impacts on sea use 40
4.1.2 Main drivers 43
4.2 Maritime cluster 49
4.2.1 Estimated changes and impact on sea use 49
4.2.2 Main drivers 52
4.3 Blue bioeconomy and subsea resources 59
4.3.1 Changes and impact on sea use 59
4.3.2 Main drivers 60
4.4 Tourism, culture, and services for leisure activities 66
4.4.1 Changes and impact on the sea use 66
4.4.2 Main drivers 70

5 ASSESSMENT OF THE IMPACTS AND RELATIONS OF THE DRIVERS 76

6 ALTERNATIVE FUTURE SCENARIOS FOR BLUE ECONOMY SECTORS 79
6.1 General remarks regarding the building and contents of the scenarios 79
6.2 Energy sector 81
6.2.1 “Sustainability above all!” scenario on energy sector 81
6.2.2 “Unlimited growth” scenario on energy sector 83
6.2.3 “Sustainability dilemma” on energy sector 84
6.2.4 “Virtual reality” scenario on energy sector 84
6.2.5 Assessment of the alternative scenarios on energy sector 85
6.3 Maritime cluster 89
6.3.1 "Sustainability above all" scenario 89
6.3.2 “Unlimited growth” scenario on maritime sector 89
6.3.3 “Sustainability dilemma” scenario on maritime sector 90
6.3.4 “Virtual reality” scenario on maritime sector 91
6.3.5 Assessment of the alternative scenarios on maritime sector 92
6.4 Blue bioeconomy and subsea resources 94
6.4.1 “Sustainability above all" scenario in blue bioeconomy and subsea sector 94
6.4.2 “Unlimited growth” scenario on blue bioeconomy & subsea sector 95
6.4.3 “Sustainability dilemma” on blue bioeconomy & subsea sector 96
6.4.4 “Virtual reality” scenario 96
6.4.5 Assessment the alternative scenarios on blue bioeconomy & subsea sector 97
6.5 Tourism, culture, and services for leisure activities 100
6.5.1 "Sustainability above all" scenario in tourism, culture, and services for leisure activities 100
6.5.2 “Unlimited growth” scenario in tourism, culture, and services for leisure activities 101
6.5.3 “Sustainability dilemma” in tourism, culture and services for leisure activities 102
6.5.4 “Virtual reality” scenario in tourism, culture, and services for leisure activities 103
6.5.5 Assessment of the alternative scenarios in tourism sector 104

7 SUMMARY OF THE BLUE GROWTH SCENARIOS 107
7.1 Summary of the future images 107
7.2 Main pathways to futures images 109

8 REFERENCES 112

ANNEXES 117

1 INTRODUCTION

Good scenarios affect the future while indicating existing options (Linturi & Rubin 2011). Future scenarios are often used as tools to develop views on preferred futures and how the preferred option may be promoted. Scenarios may also reveal other future types, such as probable and possible (e.g. Tuominen et al. 2014). The scenario-building process was part of the Plan4Blue project (Figure 1.1), in a work package called "Potential for Sustainable Blue Economies". Our approach consists of multiple alternative future visions, instead of one single end point (cf. Tuominen et al. 2014, Robinson 1988).

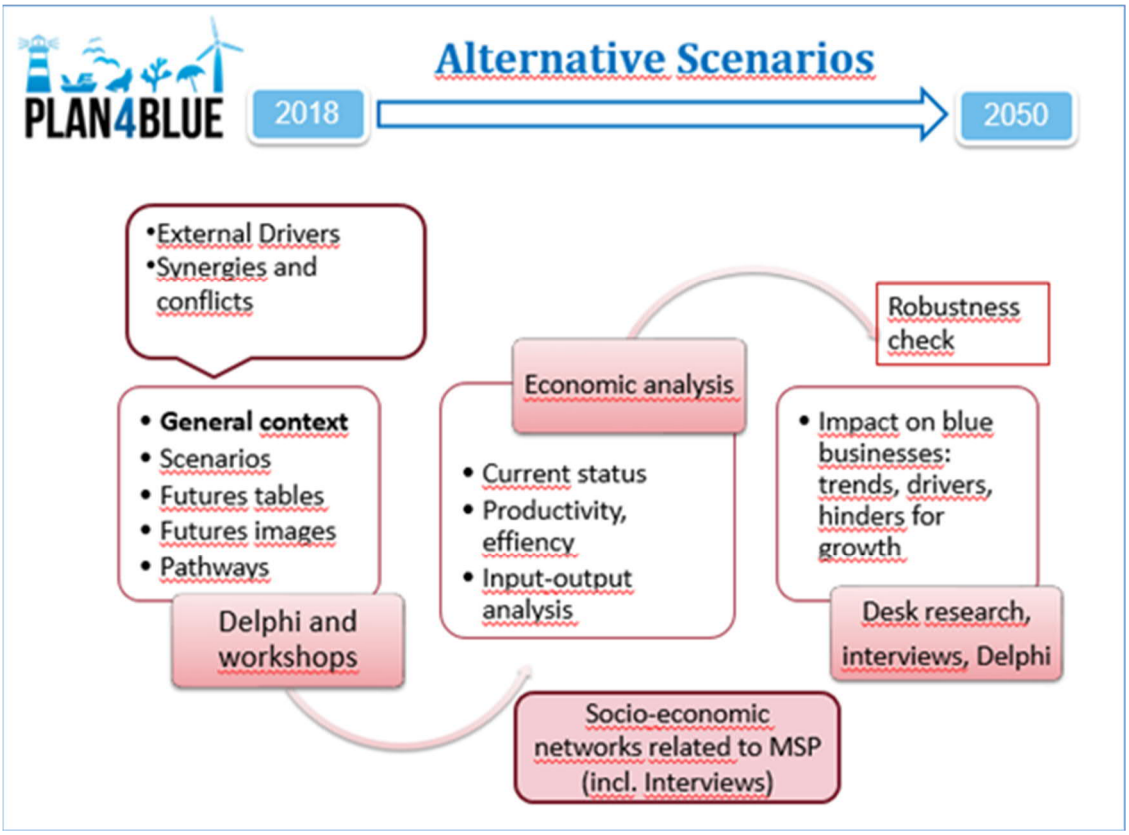


Figure 1.1. Plan4Blue scenario process.

The Plan4Blue scenario process produced both qualitative and quantitative data (Figure 1.1). Expert views were included in the process from the four rounds of Delphi studies, the Helsinki and Tallinn workshops, as well as from expert interviews. The report describes the methods and results of the expert involvement in the scenario process, and the alternative Blue Growth scenarios for the Gulf of Finland and the Archipelago Sea (the project area described in Figure 1.2). Other parts of the scenario process such as economic and socioeconomic analyses as well as the mapping process have been reported in other publications (e.g. Paas & Tverdostup 2018, Roose et al. 2017).

The scenario process was divided into two phases. 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 second phase was realised as participative backcasting, in which the involvement of stakeholders in the process was a key feature (e.g. Carlsson-Kanyama et al. 2013).

At a general level, the main questions of the first phase mapped the experts' views on future developments. The first phase included online questionnaires for the Delphi panel (Annex I) and the Helsinki workshop in 2017 (Annex II). The questions were as follows:

- Which blue economy sectors have potential for 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?
- What would the "Sea-use plan for the year 2050" look like?

The second phase of the scenario process focused more deeply on the potential blue economy sectors in the project area. First drafts of alternative scenarios of blue economy sectors' development by the year 2050 were discussed. The second phase consisted of the Tallinn scenario workshop (Annex III) and Delphi rounds in 2018 (Annex IV), along with complementary interviews with representatives of the business sector (Annex V). The 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 report describes the scenario building process, the drivers of the blue economy in the project area, and as a result, the final future scenarios created in the process.

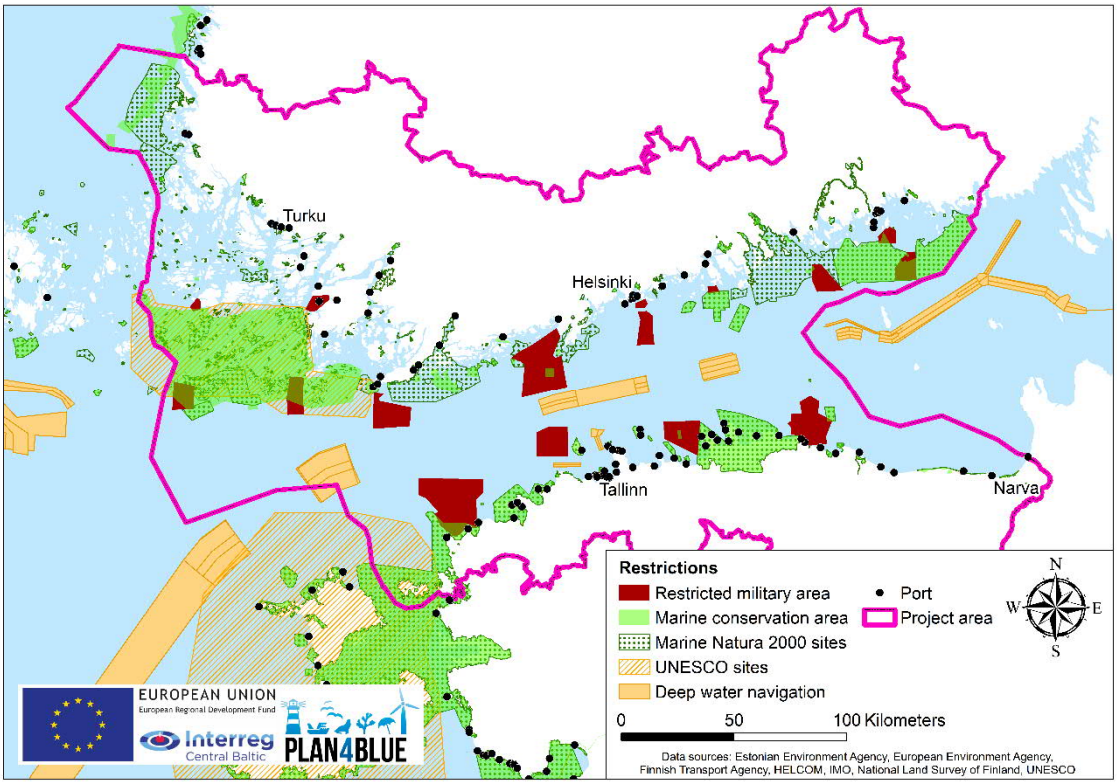


Figure 1.2. Base map of the project area from Nylén & Tolvanen 2017. The restrictions of the sea use are marked on the map: military areas, deep water navigation areas, national nature conservation areas, Natura 2000 sites, and UNESCO world heritage sites (Data: Estonian Environment Agency, European Environment Agency, Finnish Transport Agency, HELCOM, IMO, National Land Survey of Finland, UNESCO).

2 SCENARIO BUILDING PROCESS

2.1 Methods applied in the scenario building process

We applied and modified methods used in futures studies, as the scenario building for the regional blue economy sectors required taking into account complex, multilevel, and long-term aspects of socioeconomic development in the study area. The Delphi method was selected as it is capable of providing different alternative futures and argumentation of scenarios, and allows experts to freely express and change their opinions during the process (e.g. Rikkonen 2009, Maness 2012). The expertise matrix was used in compilation of the Delphi panel, as it shows the relevant categories of expertise of the participants (Kuusi et al. 2004, Varho & Tapio 2013).

We used both forecasting and backcasting methods to grasp alternative pathways of future development (e.g. Milestad et al. 2014). The futures table was chosen as the basis for scenario construction (e.g. Linturi & Rubin 2011, Varho & Tapio 2013). With the futures table method, we identified the key variables for each blue economy sector and the possible future states of these variables according to the experts' opinions. The futures table helped define the issues regarding the future changes of blue economy sectors, as well as future paths leading to alternative scenarios.

In creating the futures table, we applied PESTEL analysis in order to define drivers of change and blue economy in the study area in the first phase. PESTEL analyses the impact of political, economic, social, technological, ecological/environmental, and legal changes (the concept was introduced by Aguilar in 1967 as PEST analysis for Business Environment Scanning Task). As in Vuorinen (2013), we interpreted drivers as external forces on which the individual actors cannot possibly have impact with their own means. They are contextual scenario elements, which frame conditions beyond the control of the relevant actors (Milestad et al. 2014). Although the timespan for PESTEL analysis is usually considered 3-10 years, it is possible to create structured descriptions of alternative futures by carrying analyses of central drivers further when combined with the scenario process (Vuorinen 2013). Drivers were identified first for the blue economy as a whole and then for unique blue economy business sectors.

In the second phase, we also used the backcasting method to elaborate on the draft scenarios and to define pathways to the alternative futures. The backcasting method starts from the future images and looks back in order to determine the preferable and avoidable choices which may lead to the future (e.g. Milestad et al. 2014).

2.2 Identification of the blue economy sectors for the scenario process

In the first phase of the scenario process, the analysis included all blue economy sectors applicable to the project area, in order to select those that were considered the most important 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 regarding the socioeconomic and environmental characteristics of the project area. Each sector was divided to subsectors (Table 2.1).

In the second phase, the analysis focused on subsectors according to the results of first rounds of Delphi, and to the results of economic analysis (see Table 2.2). In Tallinn scenario workshop, the working groups selected their focus of discussion among these subsectors. Delphi panelists assessed the scenarios both from the level of the blue economy sector concerned, and regarding consequences for certain subsectors.

Table 2.1. The blue business sectors and subsectors used in the Delphi and Helsinki workshop in spring and summer 2017.

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

Table 2.2 Subsectors focused on in the second phase of the scenario process in 2018.

Energy	Maritime cluster	Blue bioeconomy and subsea resources	Tourism and culture, services for leisure activities
• Solar energy • Wave energy • Wind energy	• Building of ships & cleantech • Maritime - transport of passengers • Maritime cargo transportation	• Algae & mussel farming • Aquaculture, fish farming • Fishing	• "Nature tourism" – recreation, camping, outdoor activities etc. ; cottages and camping • Boating, sailing (guest harbors) • Cultural heritage, history • Offshore water sports: diving, fishing, canoeing etc.

2.3 The selection of expert panel

The aim of the selection process was to guarantee representation of each blue economy sector and well-balanced participation from Estonia and Finland, from public and private sectors, and from non-governmental organisations (NGOs). Panelists' fields of expertise were intended to represent the study area. However, the focus was on those stakeholder organisations that have concrete interests or activities in the coastal and sea areas regarding either spatial planning, blue economy, or environmental issues. Thus, academics were largely not invited to participate in the panel or the workshops despite their considerable expertise. In addition, representatives of business sectors were mostly affiliated with business-support organisations, associations, or groups, thus representing the general views of a certain industry rather than a single company. In the last phase of the scenario process, interviews provided a possibility to gather more opinions from business sectors.

The compilation of the expert matrix was carried out by internet searches as well as by utilizing the knowledge of the Plan4Blue 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 approximately 40-60 persons (cf. Loë et al. 2016). The prospective panelists were asked to be engaged in the entire scenario process of the project. Given the challenges in obtaining long-term engagements, 132 invitations were sent. A total of 55 invitees accepted the invitation to the Delphi panel, and in 2018, two new members were recruited to the panel. The anonymity of the panelists was preserved throughout the Delphi studies, as well as in the Helsinki and Tallinn scenario workshops, and in analysing and reporting the results of the business interviews.

2.4 First online questionnaire of the Delphi study

The aim of the Delphi study in the first phase of the scenario building process in 2017 was to define such blue business sectors and drivers that were considered relevant to the future regional development of the Gulf of Finland and the Archipelago Sea, both in Estonian and Finnish territorial waters (see Figure 1.2). The questionnaire included survey questions regarding the blue economy sectors shown in Table 2.1.

HARAVA, a map-based survey tool able to integrate responses with spatial data, was selected as the query tool for the 2017 online questionnaires. HARAVA was produced by Dimenteq Oy and has been listed among the Good Practices by the UN Human Rights Council in March 2015. The first online questionnaire for the Delphi panel included traditional survey questions, map questions, and some Delphi-type questions, as the aim was to comprehensively map panelists' views on blue economy sectors in the study area. There were two similar versions of questionnaires in Finnish and in Estonian, and an identical English version with both language versions. The questions were formulated and tested by the Plan4Blue project partners.

The questionnaire included the following sets of questions (see Annex I for details):

- 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 in the blue business sectors.
- Map questions considering the desirable or unwanted locations of blue economy subsectors and whether they should be increased or decreased, claim new areas, or 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 the 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 (See Figure 1.2), preliminary results of the economic analysis of the selected business sectors, and information on the environmental vulnerability analysis. The economic analysis and environmental vulnerability analysis have been reported in other Plan4Blue publications (e.g. Herkül et al. 2017, Paas & Tverdostup 2018, Pohjola & De Andres Gonzalez 2018).

Because of the detailed questions, the questionnaire was quite long, which was reflected in a couple of the comments by respondents. This issue was considered when testing the questionnaire and weighted against the need to explore widely expert opinions on blue business sectors and different aspects affecting the future development of these sectors. However, there

were no obligatory questions except identification of the panelist. The panelists were asked to select those items or answer at least those questions they thought were relevant to future development. The open links to the HARAVA questionnaire were sent to the panelists by email.

In the map questions, the point symbols were used to make it easy to fill in the map and the dialogue boxes for each point. Respondents were asked to place symbols at the approximate centre of the area they meant. When a respondent placed a symbol on a map, a separate dialogue box appeared and the respondent could select the following choices: increase, decrease, claim new areas, total ban. Multiple areas could be marked in the same category. As background data for each map page, the business locations of the sector in question were placed as a layer on the base map; the respondent could open the legend of the map layers in each map view to hide or change the transparency of the layers. ESRI's ArcGIS software was used for the creation and analysing of all the maps in this study (Roose et al. 2017).

The first round of the online questionnaire was open for four weeks in April-May 2017. The HARAVA system always creates a separate ID number, timestamp, and empty row for the answers when the questionnaire is opened from the link. There were a number of empty rows as well as zero values in the original results, which meant that some respondents had opened the link and possibly clicked through the questionnaire. These empty or zero value rows were excluded from further analysis. Most of the panelists gave their names for identification as requested. A few respondents opened the questionnaire link several times and gave different answers to some Likert scale selections. In these cases, the answers with the later timestamp were chosen for further analysis. Rows with no identification or background information and only some answers to selections were excluded from further analysis. There were two cases included in further analysis with no proper name but which had the full panelist's background information and responses for most questions. On the other hand, four rows with the name of the panelist but no answers were excluded from further analysis.

The answers of 42 panelists were included in further analysis of the April-May 2017 online questionnaire. Some of the respondents did not answer all questions, and thus the number of responses changed in different questions (See Table 2.6). Seven respondents answered map questions. The panelists filled out either Finnish or Estonian versions of the questionnaire and also answered the open-ended questions in Finnish and Estonian. These answers were translated into English for further analysis.

The main results of the April-May 2017 questionnaire were composed for the second four-week round in June-July 2017 as PowerPoint presentations. The results were in English, but they consisted mostly of charts and maps, with little text. The questionnaire was otherwise similar to the one used in the spring, but the previous results were attached at the beginning of each question page. All 55 panelists were again given an opportunity to reflect on the results of the first round as well as to add new answers or change their previous opinions. The panelists were asked to add their comments regarding the results to an open-ended question. The answers from the first round were replaced by these new responses for the final analysis of the questionnaires.

Seven Finnish and seven Estonian panelists viewed the second round of the Delphi questionnaire. Some had clicked through the questionnaire and had produced only zero value 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 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 from the second round, and the new panelist's answers were added as a new row. There were only a few answers from one panelist to map questions in the June-July 2018 round. These were joined with the results of the first-round map questions using ArcGIS software. Thus, the total number of panelists who responded to the online questionnaire was 43 in the 2017 Delphi rounds.

2.5 First scenario workshop in Helsinki in June 2017

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

The aim of the Helsinki workshop was to complement and assess the results of the first online questionnaire. In the beginning of the workshop, the background information and the main results of the online questionnaire 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 economic sectors in each working group.

There were two moderators in each group on both days. One led the group through the exercises and the other made notes. The moderators wrote memorandums of each session based on the notes, photographs, and recordings. The drawings of the map exercise were later digitised to ArcGIS shape files based on the photos taken right after the group work (see Roose et al. 2017).

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 (moderators Tuomas Pohjola and Anu Lähteenmäki-Uutela). The theme explored the potential of the blue economy by applying Lego Serious Play methodology (e.g. Peabody & Noyes 2017). The participants in the working group were asked to put on the map such activities as they believe will be there in 2050. This session was video recorded.

- Group 2. Synergies and conflicts of blue economy sectors (moderators Riku Varjopuro and Hanna Nieminen). This theme explored synergies and conflicts of the blue economy

sectors in the project area, with participants using Post-it notes; later the number of mentions of each synergy or conflict were counted.

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

On the second day, all the groups carried out a map exercise: "Sea-use plan for the year 2050". Large canvas maps with the borders of restricted areas of the project area were supplied to each group (see e.g. Figure 1.2). The idea of the exercise was to generate ideas and discuss future developments of the blue business sectors. The groups were asked to project, by drawing, the most important areas of different activities in 30–40 years' time. All the groups worked for about one hour, and afterwards they had 15 minutes to examine and comment on the maps created by the other two groups.

After the exercise, all the drawings were photographed and later digitised by WP 3. WP 3 worked with all collected map materials to form combination maps for each of the four blue economy sectors. The combination maps present the results from the Delphi panel, the HARAVA questionnaire, and the workshop. As a final product, WP 3 produced intensity maps to see growth trends in blue economy sector-related activities. These heat maps present the future intensity centres of sector-related activities in the year 2050 for each sector separately. All digitised map results and visualisations 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).

2.6 Second online questionnaire of Delphi in 2018

The aim of the Delphi rounds 3-4 in 2018 was to evaluate the draft futures tables and images of the future, which were created based on the results of the first Delphi rounds in 2017 and complemented by the results of the scenario workshop in Helsinki in June 2017. The questionnaire was composed with the Webropol tool. Webropol was chosen as the tool to compile the questionnaire, as no further map-based questions were planned to be presented in the online questionnaire. Instead, map-based questions were included in the Tallinn scenario workshop.

Draft versions of futures tables and futures images were created separately for each main blue economy sector. In the futures table, each row represented a different future state of a variable. These variables were formed based on the drivers identified in the first phase of the process. The panelists were asked to assess possible effects of the three drivers they had selected. The respondents identified both effects that link clearly with certain drivers and those that link jointly to several drivers. The Delphi panelists also received a summary of strategies on blue economy sectors as a background file. Answering in English, Finnish, or Estonian to the open-ended questions was possible.

The questionnaire was sent in February to 33 Delphi panelists in Finland and for 24 in Estonia (Annex IV). Answering via a personalised email link made assessing one's own reply easier, and also easier to consider the replies given by the respondents in the first round. The third round was closed in first week of April, and the fourth round was open later in April, with the report of the responses. Altogether 16 replies were received: 15 on the third and one on the fourth round. The panelists had the possibility to change their view during the fourth round, however, none of them used this opportunity. The questionnaire included questions related to future scenarios for blue economy sectors and/or their subsectors: energy, maritime cluster, tourism, culture, and services for leisure activities, blue bioeconomy, and subsea resources (see Table 2.1 and Table 2.2). Some replies were received in Finnish and translated into English. 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.

2.7 Second scenario workshop in Tallinn

The second workshop of Plan4Blue was arranged in Tallinn on 23-24 January 2018 (Annex III). The aim of the workshop was to assess first drafts of scenarios for blue growth, including sector-specific futures tables, future images, and their impact on selected blue economy sectors (see Table 2.2). Furthermore, in the backcasting exercise, participants identified pathways to the draft alternative scenarios. In the mapping exercise, participants assessed what kind of spatial impacts different scenarios would have.

The workshop was based on the first two rounds of Delphi and the 2017 scenario workshop in Helsinki. Their results were combined to create draft future images for blue economy sectors in the Gulf of Finland and the Archipelago Sea areas: energy, maritime cluster, tourism, culture, and services for leisure activities, as well as blue bioeconomy and subsea resources. A mapping exercise was based on the combination maps on sea use for the year 2050 with indications of initial hotspot areas for the blue economy (final programme of the workshop in Annex III).

In the Tallinn workshop, there were 41 participants altogether, including moderators and organisers. Of the 28 experts, 19 were from Estonia and nine from Finland. The number of Delphi panelists in the Tallinn workshop was six, two from Finland and four from Estonia.

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

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

Background material for the participants of the workshop consisted of the draft futures tables and future images, as well as the summary table of the main strategies and their visions, targets, and timespan. These were sent by email to participants before the event.

The participants in the working groups discussed the consequences of drivers for selected blue economy subsectors. Base maps of the results of the previous Delphi round and workshop in Helsinki were available at the workshop to support the work group discussions. In addition, participants in the previous workshop and Delphi panelists had received the resume of draft alternative scenarios in 2017. The groups discussed the development of the blue economy sectors by 2050 based on the draft alternative scenarios.

The main questions discussed in the working groups were the following:

- Were the variables relevant for the future development of the specific blue economy sectors in 2050? These variables were based on the drivers identified in the first two Delphi rounds and Helsinki workshop and presented in the rows of the futures tables.
- Which types of alternative future states may exist in the alternative scenarios in 2050? These were described in the columns for each variable in different alternative futures.
- What were the consequences of the alternative scenarios for different blue economy sectors?
- Which steps would lead to the alternative futures was discussed in the backcasting exercise.

Each working group selected subsectors of the blue economy that discussions in the working group focused on. The impacts and consequences of various alternative scenarios for the sector were considered. The aim was to bring the discussions to a more practical and tangible level. The sector was selected among the subsectors focused on in phase two of the scenario process (Table 2.2).

The backcasting exercise was carried out using a timeline on the wall, with timelines for each sector and scenario. Post-it notes were used to mark and date which events, actions, decisions, or other things would lead to alternative scenarios and when. Participants were also asked to

consider which actors would be involved in future development. The aim was to create paths towards 1-3 scenarios.

The participants were guided as follows:

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

In addition, all participants were asked to add unexpected events on the timeline during the backcasting exercise. These "black swans" or "wildcards" are sudden and high-impact events, which are difficult to predict and may change the socioeconomic development or environmental conditions completely. In the end, the participants also discussed 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 the map working groups, the aim was to discuss alternative scenarios on the map. The 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 most represented. It was possible to make some changes to the map, if the map did not represent any of the scenarios or would have needed 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 within blue economy sectors in different scenarios, including:

- intensity of different energy sources in different scenarios: renewables, wind energy, fossil fuels
- intensity of cargo, passengers, cleantech, and routes regarding maritime cluster
- changes in intensity of different kinds of tourism
- changes in intensity of different subsectors of blue bioeconomy

In addition, the participants assessed and identified locations for the following questions: ”Which are expected to be the hot spots and main conflict areas with other sectors?” and “Where would be the possibility for multi-use with other sectors?”.

2.8 Business interviews related to specific issues discussed in workshops

In the final phase of the scenario process, the business interviews provided the opportunity to gather opinions directly from companies and to make a robustness check related to the results of Delphi and the scenario workshops (Annex V). The interview plans and the complete analysis of the interviews are presented in Pohjola et al. 2018b. The interviewees were not asked about consequences; however, their responses are reported in cases where they mentioned issues connected to drivers and their consequences. The factors mentioned by the interviewees were combined with a driver presented during the scenario process, either by Delphi panelists or in the scenario workshops. New factors and drivers mentioned by the interviewees are included in tables presenting the drivers per each sector. In addition, the interview results have been used in the analysis of changes to blue economy sectors, as well as in creating the pathways for the alternative scenarios. The results of Delphi and workshops are reflected with the interview results.

Selection of the interviewees was performed based on the four main blue economy sectors in Plan4Blue project and the subsectors focused on in phase two of the scenario process. In total, 33 interviewees were contacted. Twenty-two gave an interview, 15 from Finland and 7 from Estonia.

In Delphi rounds 3-4 in 2018, the focus was on development of wind energy and other renewable energy sources. In the Tallinn workshop, the working group focused on future development of wind energy in alternative scenarios for blue growth. The interviewees from the energy sector represented renewable energy modes, and one of them represented the energy sector as a whole.

The panelists focused on development of the entire maritime cluster in the Delphi rounds of 2018. In the Tallinn workshop, the maritime working group chose to focus on the future of maritime transport when discussing the alternative scenarios for blue growth. The interviewees from the maritime sector were selected from among port authorities and ship owners, as well as their associations and support organisations.

In the Tallinn workshop, the working group chose to focus on fish farming—in particular, multitrophic aquaculture. In Delphi rounds 3-4 in 2018, the focus was more extensive, on the development of fishing, aquaculture, fish farming, and mussel and algae farming. Thus, the interviewees of the blue bioeconomy sector were selected among aquaculture and subsea producers. In the maritime tourism sector, the interviewees selected represented support and promotion organisations.

In Delphi rounds of 2018, tourism, culture, and services for leisure activities were considered as an entity as was also decided at the Tallinn scenario working group on tourism. Organisations for tourism, tourism companies, and specific leisure associations, as well as services for cruise tourism, were selected to be interviewed.

2.9 Analysis and synthesis of the results of the scenario building process

The results of the Delphi rounds in 2017 and 2018, Helsinki and Tallinn scenario workshops, and interviews were analysed and synthesised in order to produce the final scenarios. In the first phase of the 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 the blue economy sectors, describing possible alternative developments by the year 2050.

Variables for futures tables for each blue economy sector were defined according to drivers classified with PESTEL. We considered different future states for each variable and built the futures images based on the contents of futures tables. As in earlier literature (cf. Linturi & Rubin 2011, Varho & Tapio 2013, Seppälä 2013), we applied four different states for each key variable, which build the following future images:

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

For each main blue economy sector, four future states and four future images were defined. In total, we produced sixteen short narratives for Blue Growth. The draft narratives were mostly based on qualitative data gathered from experts, but to some extent, also literature and other studies carried out as part of the Plan4Blue project during 2017.

In the second phase, after the Delphi rounds 3-4 and workshop 2018, the feedback on the chosen drivers and variables was analysed to affirm that they influence the specific sectors most. The main drivers were identified and missing drivers were surveyed. The most important subsectors of blue businesses were selected for further analysis (Table 2.2). Selection was done as part of the collaboration with project partners, based on discussions of the results of the 2017 Delphi and workshop 2017 and supported by the results of economic analysis (Pohjola & De Andres Gonzalez 2018; Paas et al. 2017). The selected subsectors were in the focus of the analysis in the Delphi rounds 3-4 and Tallinn workshop in 2018, as well as in the interviews in spring 2018.

In the second phase, pathways were created towards the alternative futures. Finalizing the scenarios was performed with a robustness check: analysis of the interviews with business representatives from the point of view of scenarios. Specific questions were designed to complement the results of the previous phases of the analysis. Assessment of the scenarios consisted of examining the impact of existing strategies on the alternative scenarios. Probabilities and possibilities were assessed from the point of view of selected subsectors.

In this publication, first the general drivers for the development of the blue economy are presented and discussed. Then the alternative future scenarios of blue economy sectors are discussed, starting with the general remarks regarding, for example, the societal development of each scenario. Each blue economy sector is treated in the following order:

- Estimated future changes of the blue economy sector by the year 2050;
- Main drivers of the sector and their anticipated consequences regarding the future development of that sector;
- Description and discussion of each alternative scenario; weak signals and black swans, futures images and pathways presented; and
- Assessment of the alternative scenarios.

The final versions of futures tables are presented in this report, as results of the entire scenario process. The descriptions of drivers and scenarios for each blue economy sector, as well as the futures tables and pathways to the future, are based on the combined results of the expert views from the Delphi rounds, workshops, and interviews. Topics that have been considered more important regarding future development of the blue economy have been discussed more deeply during the scenario process and are thus emphasised in scenario descriptions (Table 2.3). See also Annex I and IV for the questions of Delphi rounds. The 2017 questionnaire and workshop focused on experts' estimations of future changes. Based on these estimations, drafts of alternative scenarios were formulated. Alternative scenarios were finalised in the 2018 Delphi and workshop and further elaborated on in interviews. In addition, estimations of future changes were still discussed and revisited in 2018, and they have been taken into account in chapters presenting estimated future changes (chapters 4.1.1, 4.2.1, 4.3.1 and 4.3.1).

Table 2.3. Blue economy sectors in the phases of the scenario process

	1st phase: Estimations on future changes		2nd phase: Alternative scenarios		Estimations of future changes and factors affecting their development
Blue economy sector	Delphi rounds 1-2 in April-July 2017	Helsinki workshop in June 2017	Delphi rounds 3-4 in February-May 2018	Tallinn workshop in January 2018	Interviews in summer 2018
Energy sector	Sector as a whole, including all the subsectors	Sector as a whole, including all the subsectors	Development of wind energy and other renewable energy sources.	Working group on energy focused on future of wind energy.	Interviewees represented mostly the renewable energy modes; one represented the energy sector as a whole.
Maritime cluster	Sector as a whole, including all the subsectors	Sector as a whole, including all the subsectors	Development of maritime cluster in general.	Focus on future of maritime transport; consequences of selected drivers for maritime transport; environmentally friendly shipping, and attitudes towards sustainable shipping.	Interviewees represented port and ship owners and their associations.
Blue bioeconomy and subsea resources	Sector as a whole, including all the subsectors	Sector as a whole, including all the subsectors	Focus on the development of fishing, aquaculture, fish farming, mussel and algae farming.	Focus on fish farming; in particular, multitrophic aquaculture.	Interviewees selected among aquaculture and subsea producers.
Tourism, culture, and services for leisure activities	Sector as a whole, including all the subsectors	Sector as a whole, including all the subsectors	Sector as a whole, including all the subsectors	Focus on tourism: drivers for tourism sectors, “Nature tourism”, i.e. recreation, camping, outdoor activities etc.; cottages and camping; diving, fishing, canoeing; cultural heritage and history; boating and sailing; offshore water sports; as services for cruise tourism, guest harbours.	Interviewees represented 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 same subsectors as in Tallinn workshop.

2.10 Experts' background

2.10.1 The first phase of the scenario process in 2017

In 2017, 67 experts participated either in the Delphi rounds 1-2, the Helsinki workshop, or both (Table 2.4). Almost half the respondents were representatives of the public authorities in the Delphi rounds 1-2, 26% of the respondents were from the private sector, and 16% were academics and representatives of NGOs. The workshop participants were not asked their opinion of their expertise. However, 10 workshop participants were from organisations that represented spatial planning, as well as regional or environmental governance. Four were academics from project partner organisations. The rest were from organisations dealing with environmental issues and nature conservation, energy, marine transportation, and fishing. Few participants represented more than one field of expertise. The Helsinki workshop participants represented different types of organisations (Table 2.4), but among all the panelists and participants, still over half were from the public sector and about one-third from the private sector. The number of private sector representatives increased due to the interviews in the last phase of the scenario process, as the interviewees from business sector, business interest, and business support organisations contributed in the scenario building.

Table 2.4. The primary employment organization of the Delphi panelists and the organizations of workshop participants in 2017. 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 enterprise	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 %

Among the respondents in the Delphi query in 2017, both nationalities were relatively evenly represented. There were 24 Finnish (including one group answer from a single organisation) and 19 Estonian respondents. Gender division was also rather equal: 22 males and 20 females (the group not included). Two-thirds of respondents reported having over 10 years of working experience in their fields of expertise (Table 2.5). The majority of the panelists announced that they worked on the national level: 33% in Finland and 33% in Estonia. The rest of the panelists worked mainly in the coastal provinces of the project area, 1-3 in each province and one on the EU level.

Table 2.5 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 %

Over half of the panelists selected 2-5 fields of expertise for themselves (Table 2.6). The number of fields of expertise was not clearly related to work experience. Spatial planning (defined very loosely, see Annex I) and environmental issues were the fields of expertise most often marked. All the other fields of expertise were represented by 5-7 panelists, apart from subsea construction which was represented by only two panelists. Table 2.6 shows the fields of expertise the respondents reported 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 organisation of the questions from Annex I).

Table 2.6. The response rate to the Delphi rounds 1 - 2 in 2017 by the panelists and the distribution of their expertise regarding the questions answered.

		Fields of expertise respondents selected (several selections possible for one respondent)													
	Highest number of respondents	Spatial planning	Environmental issues,	Energy	Marine transportation	Fishing	Aquaculture	Tourism	Culture and cultural heritage	Societal issues	Politics	Sub-sea construction	Sub-sea resources	Offshore construction,	Other
Changes 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	43	13	16	5	7	7	4	4	4	6	6	2	4	4	4
Legal drivers	30	6	12	3	5	5	2	3	4	2	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

2.10.2 The second phase of the scenario process in 2018

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

The Delphi rounds in 2018 were responded to 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. The interviewees' fields of expertise are presented in Table 2.7. One of them represented two fields of expertise: tourism and blue bioeconomy. Most of the interviewees represented the maritime sector and tourism. In Finland, two Delphi panelists were also interviewed, and in Estonia, one. The total number of experts interviewed was 15 in Finland and 7 in Estonia.

Table 2.7. The interviewees' field of expertise.

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

In total, 65 experts participated in the scenario process in 2018. As in the Helsinki scenario workshop, participants in the Tallinn workshop were not asked about their own assessment of their fields of expertise. However, 13 workshop participants were from organisations that represented spatial planning or regional or environmental governance. Six of them were academics from project partner organisations. The participants represented similar types of organisations to the first scenario workshop in Helsinki: environmental issues and nature conservation, energy, marine transportation, and fishing.

2.10.3 Evaluation of the experts' background in the scenario process

Altogether, 105 experts participated in the scenario process during the two phases in 2017 and 2018 (Table 2.8). The degree of their contribution varied. Few experts participated intensively in more than one part of the scenario building process. On the other hand, some participated in only one part of the scenario process. However, the number of experts allowed the collection of a large body of views, notes, and remarks, which were necessary to develop alternative scenarios for each main blue economy sector.

A variety of fields of expertise and affiliations were represented, thus giving a range of expert opinions for the scenario building process. The representatives of public organisations were emphasised among the participants in the scenario process, and approximately one-third of the participants represented the private sector. However, most of the representatives of the private sector were personally interviewed, which also increased their relative contribution to the scenario process.

Table 2.8. 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

3 GENERAL DRIVERS OF BLUE ECONOMY IN THE GULF OF FINLAND AND THE ARCHIPELAGO

3.1 Political drivers

Altogether 18 political drivers were presented for discussion in the Helsinki scenario workshop. Fifteen drivers were from Delphi, and three were added before the workshop by the project team. Working groups added four more drivers. In the workshop, there were mentions of 16 drivers (total of 18 mentions). On the other hand, there were no mentions of six political drivers (Table 3.1).

Based on Delphi and the Helsinki workshop, environmental policies were considered the most important political driver and as a positive one with strong impact. Other sectoral policies were considered important as well, and the share of respondents was almost the same. Traffic and industrial policies were both considered strong positive drivers. Energy policy is almost at the same level and considered a positive driver. Housing policy and land use planning was considered a positive driver among those who considered that this driver had an effect on the blue economy sectors. There were some strong opposite views, in particular concerning fisheries policies. In Delphi it was noted that EU fisheries policy (part of industrial policy) has had a negative impact on coastal fisheries.

Altogether, co-operation was perceived to be an important driver both in Delphi and in the Helsinki workshop. The driver “degree of EU integration” was divided into two parts for the workshop discussions: 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 was seen possible only if there is dialogue and co-operation between the member states of the EU.

In the Helsinki workshop, co-operation was combined as one driver and thus for the futures tables, co-operation in the Baltic Sea Region was formed as a single variable. In the project area, the 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 noted. Global security issues were also raised in discussion. Co-operation as a driver was linked with different conflicts and synergies.

Table 3.1 Political drivers. Drivers of the Delphi which were marked to have a moderate or significant effect, i.e. 4 or 5 on a Likert scale of 1-5, have been presented in the order of descending impact. The distribution of the Delphi panelists' views regarding the positiveness or negativeness of policy drivers' impacts on the blue economy sectors have also been presented. Views of the Helsinki workshop have been marked with + in case of positive and – in case of negative impact. The share of positive or negative impacts have been counted as percentage from the responses which considered that the driver has effect (ref. no effect at all).

Political drivers	
Delphi 2017	Helsinki scenario workshop
1. Environmental policies as a whole 72%. Total N=29, of which negative impact 19% and positive 81%. 2. Traffic policies on the whole 69%. %. Total N=29, of which negative impact 10% and positive 90%. 3. Industrial policies (incl. fishing) 69%. Total N=29, of which negative impact 5%, positive 95%) 4. Energy policies on the whole 66% %. Total N=29, of which negative impact 16%, positive 84%) 5. Housing policy and land use planning 59%. Total N=29, of which negative impact 12%, positive 88%) 6. The degree of EU integration 58%. Total N=24. 7. The conflicts of the sectoral policies in Finland 48%. Total N=25. 8. Increased political tensions in the Baltic Sea 46%. Total N=26. 9. Co-operation between Finland and Estonia 41%. Total N=27. 10. The conflicts of the sectoral policies in the EU 38%. Total N=26. 11. Co-operation with international bodies of the BSR 37%. Total N=27. 12. The conflicts of the sectoral policies in Estonia 35%. Total N=26. 13. Co-operation with Russia 23%. Total N=26.	• Environmental policies (3) • Traffic policies (2) • Strengthening EU integration (1) + • Increased political tensions in the Baltic Sea (1) – • Co-operation between Finland and Estonia (1) • Co-operation with international bodies of the BSR (1) • Co-operation 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) New drivers presented in the workshop: • Co-operation: 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

3.2 Economic drivers

Eight economic drivers were presented for discussion in the workshop. Six of them were from the Delphi, and two were added before the workshop by the project team. The working groups of the Helsinki workshop added two more drivers. Altogether, there were mentions for eight drivers (total of 14 mentions, and no mentions for 2 drivers) (Table 3.2).

Table 3.2 Economic drivers

Economic drivers	
Delphi 2017	Helsinki scenario workshop
1. The conditions and trends of global economy, 78 %. Total N=23. 2. The conditions and trends of regional economy in the Baltic Sea 71%. Total N=21. 3. The Government's support to the business ability to compete 50%. Total N=18. 4. Aim to low carbon society (decarbonisation) 48%. Total N=23. 5. Aim to increase circular economy 45%. Total N=20.	• 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 the Delphi study and in the workshop, the conditions and trends of the global economy were considered the most important driver. In Delphi, it was followed closely by the conditions and trends of regional economy as one combined driver; in the Helsinki workshop, regional economy was considered as part of the global economy.

The aim to a circular economy was supported in the workshop as the second most important political driver. The government's support of a business's 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 such activities as removing nitrogen and phosphorus from the sea should be supported. The ways different sectors are supported (e.g. in Estonia and Finland), as well as the level of governmental support, should be taken into account when defining the importance of the economic drivers. The aim to a low-carbon society was seen as linked to environmental policies and might be considered both a political and an economic driver. One new driver mentioned in the workshop

was increasing traffic, which affects the disintegration of natural habitats. However, it can also be considered a consequence of economic growth more than a driver itself.

3.3 Social drivers

Twelve social drivers were presented for discussion in the workshop (eight from Delphi, and four added before the workshop by the project team). The working groups did not add any others. There were mentions for nine drivers (total of 14 mentions), and no mentions of three 3 drivers (Table 3.3).

Table 3.3. Social drivers. Drivers of the Delphi which were marked to have a moderate or significant effect, i.e. 4 or 5 on a Likert scale of 1-5, have been presented in the order of descending impact. The distribution of the Delphi panelists' views regarding the positiveness or negativeness of policy drivers' impacts on the blue economy sectors have also been presented. The share of positive or negative impacts have been counted as percentage from the responses which considered that the driver has effect (ref. no effect at all).

Social drivers	
Delphi 2017	Helsinki scenario workshop
1. Ageing 79% (positive 9%, negative 91%), Total N=29. 2. The depopulation of the remote districts 76% (positive 23%, negative 77%). Total N=29. 3. Positive attitudes towards blue businesses 73%. Total N=26. 4. Urbanization 66% (positive 58%, negative 42%). Total N=29. 5. Increasing degree of education 56%. Total N=25. 6. Negative attitudes towards blue businesses 54%. Total N=26. 7. Immigration 38% (positive 64%, negative 36%). Total N=29. 8. Increasing polarization of population groups and classes 13%. Total N=23.	• 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 aging an important social driver with negative effect. In the workshop, positive effects were also identified, for example, related to tourism. People live longer and they have more money to spend; however, the effects depend on the living standard of the retired people. On the other hand, it was mentioned that the

number of taxpayers is decreasing due to declining birth rates. Aside from aging, depopulation of the remote districts was considered as an important social driver in Delphi. Urbanisation and depopulation interact as drivers; in the workshop, urbanisation was considered the most important social driver.

Attitudes towards blue businesses were discussed in both Delphi and the workshop. In Delphi, most of the respondents expressed positive attitudes towards blue businesses, but negative attitudes gained more mentions in the workshop. Leisure interests, ethical issues, and interest in nutrition and healthy eating were seen as factors that link together and reflect positive attitudes towards tourism and bioeconomy in the coastal and marine areas. An increasing level of education was not mentioned in any of the working groups, although it had support in Delphi.

3.4 Technological drivers

Six technological drivers were presented for discussion in the workshop (five of them were from Delphi and one driver was added by project team before the workshop). Three drivers were added by working groups. There were mentions for eight drivers (total of 13 mentions) and no mentions for one driver (Table 3.4)

Table 3.4. Technological drivers

Technological drivers	
Delphi 2017	Helsinki scenario workshop
1. Clean tech innovations for blue businesses 60%. Total N=25. 2. Increasing automatization 58%. Total N=24. 3. The development of the ICT technology 56%. Total N=25. 4. Increasing robotization 54%. Total N=24. 5. Expanding internet of things (IoT) 40%. Total N=25. New drivers added in Delphi • artificial intelligence, virtual reality, augmented reality, material technology	• 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 from the workshop • 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, cleantech innovations for blue businesses were considered the most important driver. Innovations in energy technologies were also mentioned, and that they may have a link to cleantech. In the workshop, unknown new technologies were mentioned as a new driver. In Delphi, material technology was mentioned in open comments, and expected to have an effect, for example, on energy storage and the durability of the floating structures.

Information technology-related drivers gained the most mentions in Delphi and in the workshop. Specific concepts such as augmented reality were added before the workshop by the project team and were mentioned in the workshop. These types of drivers are interlinked, and the pace of introduction of technologies has impact on their development.

3.5 Environmental drivers

Sixteen environmental drivers were presented for discussion in the workshop (all of them were from Delphi). One driver was added by working groups. There were mentions for 15 drivers (total 22 mentions), and no mentions for three drivers (Table 3.5).

Table 3.5. Environmental drivers. Views of the Helsinki workshop have been marked with + in case of positive and – in case of negative impact.

Environmental drivers	
Delphi 2017	Helsinki scenario workshop
1. Eutrophication of the sea waters 100%. Total N=24. 2. Microplastic litter 71%. Total N=24. 3. Reduction of water emissions: nutrients, oil, hazardous substances 63%. Total N=24. 4. The proliferation of extreme weather phenomenons 63%. Total N=24. 5. Increasing amount of litter 58%. Total N=24. 6. Reduction of atmospheric emissions: CO2, SOx, NOx, black carbon 50%. Total N=24. 7. Invasive species 50%. Total N=24. 8. Expansion of environmental protectorates 43%. Total N=23. 9. Increasing temperatures 43%. Total N=23. 10. Chemicalization of the environment 42%. Total N=24.	• 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: CO2, SOx, NOx; black carbon, methane (1) New drivers identified in workshop • Climate change as a whole (1)

11. Lesser and shorter winter ice coverage 42%. Total N=24. 12. Decreasing salinity 38%. Total N=24. 13. Disintegration of habitats 38%. Total N=24. 14. Increasing precipitation 38%. Total N=24. 15. Sea level rise 35%. Total N=23.	

A multitude of environmental drivers were mentioned and discussed in Delphi and the workshop. In Delphi, eutrophication of the seawater was unanimously considered the most important driver. Reducing 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 discussed in the workshop. 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—for example, the following individual drivers from Delphi: proliferation of extreme weather phenomena, decreasing salinity, increasing temperatures, less winter ice coverage and shorter duration, increasing precipitation and Sea level rise.

3.6 Legal drivers

Sixteen legal drivers were presented for discussion in the workshop (15 were from the Delphi questionnaire and one was added before the workshop by the project team). One driver was added by working groups. There were mentions for 7 drivers (total 14 mentions), and no mentions for two drivers (Table 3.6).

Table 3.6. Legal drivers. Drivers of the Delphi which were marked to have a moderate or significant effect, i.e. 4 or 5 on a Likert scale of 1-5, have been presented in the order of descending impact. The distribution of the Delphi panelists' views regarding the positiveness or negativeness of policy drivers' impacts on the blue economy sectors have also been presented. The share of positive or negative impacts have been counted as percentage from the responses which considered that the driver has effect (ref. no effect at all).

Legal drivers	
Delphi 2017	Helsinki scenario workshop
1. Tight orders of environmental permits 76% (neg.effect 36%, positive 64%). Total N=29.	• Environmental regulations and permitting processes on the whole (incl. ISO-standards) (3); changes and restrictions

2. Environmental laws in Finland 66% (neg.effect 26%, positive 74%). Total N=29. 3. Weak expertize and differing interpretations of regulations of the permitting officials 62%. Total N=26. 4. Finland: Environmental regulations and permitting processes on the whole (incl. ISO-standards) 55% (neg.effect 31%, positive 69%). Total N=29. 5. Estonia: Environmental regulations and permitting processes on the whole (incl. ISO-standards) 55% (neg.effect 25%, positive 75%). Total N=29. 6. Environmental laws in Estonia 55% (neg.effect 31%, positive 69%). Total N=29. 7. The weak preparation of the laws and regulations 54%. Total N=26. 8. Tax laws in Finland 45% (neg.effect 46%, positive 54%). Total N=29. 9. Employment laws in Finland 41% (neg.effect 33%, positive 67%). Total N=29. 10. Employment laws in Estonia 41% (neg.effect 33%, positive 67%). Total N=29. 11. Tax laws in Estonia 28% (neg.effect 37%, positive 63%). Total N=29. 12. Intellectual property (e.g. patents) 22%. Total N=23.	• 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 identified in the 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)

Strict rules of environmental permits was the most important legal driver according to Delphi; however, it was not mentioned in the workshop at all. In Delphi, it was said that the knowledge of decision-making officials and politicians about what is going on in the sea area is more important than the content of laws and regulations. This view was reflected in the discussions in the workshop. There were also a number of mentions of weak preparation of laws and regulations, as well as weak expertise and differing interpretations of regulations by the permitting officials. These views are supported by Kemiläinen and Keinänen (2016); they found out that in Finland, environmental impacts are poorly taken into account in preparing the legislation. For example, in 2014, 77% of government proposals did not include any kind of environmental assessment. Only 4% included a quantified assessment of environmental impacts.

Environmental regulations and permitting processes on the whole (including ISO-standards) were considered the main legal driver in the workshop. These combine many of the unique drivers presented in Delphi and in the workshop. Employment- and tax law-related drivers were not discussed in the workshop. In Delphi, they also received less support, but those who considered them drivers saw their impact as positive.

4 THE DRIVERS AND ESTIMATED CHANGES OF THE BLUE ECONOMY SECTORS

4.1 Energy sector

4.1.1 Estimated changes by 2050 and impacts on sea use

The entire energy sector is growing, according to the results of Delphi in 2017 (Figure 4.1). A total of 81% of respondents expected an increase; most of them assessed that the increase would be moderate or significant. Solar power is expected to grow most, followed by wind energy, including planning, building, and maintenance. For construction and maintenance of grids, energy lines and gas pipes, 88% of respondents expect an increase. Storage and distribution of LNG, production and distribution of biofuels, energy transfer and conditioning, and submarine geothermal energy are also predicted to have strong growth by the year 2050. The only energy sector with negative expectations was the refinement and distribution of fossil fuels, according to 42% of the respondents. No change was expected for nuclear power by 51% of the respondents.

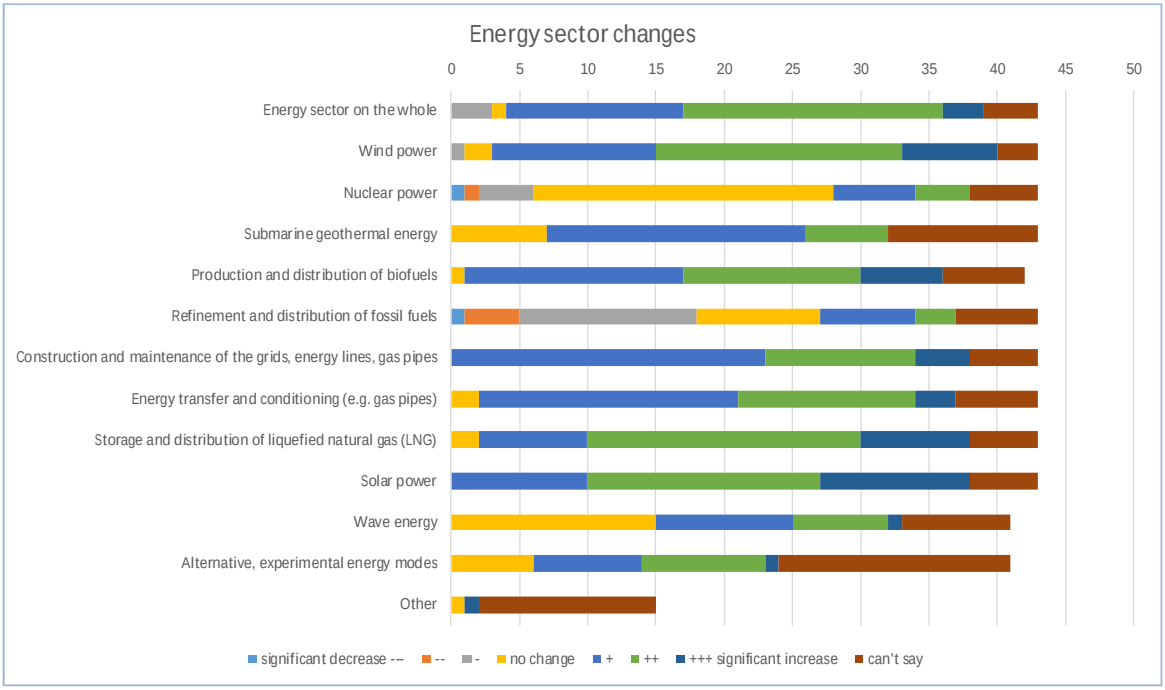


Figure 4.1 Distribution of opinions regarding the changes of production and other activities of the energy sector in the project area, both on land and on sea (onshore and offshore) by the year 2050. The results of on-line questionnaire from Delphi rounds 1 and 2 in 2017 (Annex I)

Fossil fuels and nuclear power

The refinement and distribution of fossil fuels is expected to decrease; however, keeping energy production stable has required fossil fuels: “We've invested a lot in renewable energy and gone back on fossil”. The production of nuclear power is mostly estimated to remain the same because, for example, the current investments on nuclear power plants will be binding for decades. In addition, energy production, for example, in dark and cold wintertime may still need nuclear power, if renewable or new forms of energy are not producing adequate supplies. In the future, nuclear fusion may maintain nuclear energy’s share.

The nuclear power plant currently under construction in Olkiluoto, near the project area, would still be running in 2050, according to the experts. No nuclear power is desired in the Tallinn area, but possible sites are near Kunda and Pakri Islands. Nuclear energy in Estonia in 2050 was considered questionable, due to its high price. 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) also influence the need to develop offshore wind energy. Many potential sites for coastal and offshore wind power were placed on the maps in both Delphi and the Helsinki workshop (Roose et al. 2017). However, wind power was also questioned; areas where wind power was suggested to be decreased or to be totally banned were located in the eastern part of Estonia especially. This was presumably for reasons of defence, as windmills interfere with radar.

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

Wind power was also undesired in the western archipelago areas of Finland, mostly because of nature conservation or recreational values. Possible future locations for offshore wind parks were close to ports in Finland (e.g. Hanko, Turku) or near Inkoo, which is already marked on Uusimaa regional plans. 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.

Energy transfer activities and infrastructure

Energy transfer activities and infrastructure building (construction and maintenance of grids, energy lines, and gas pipes) require a rather long planning period, and their lifetime is decades. Thus, subsea gas pipelines currently in operation or planning stages, were unanimously mentioned to be probably still in operation in 2050. They are located in the middle of the Gulf

of Finland (currently Nord Stream from Russia to Germany, and Balticconnector from Inkoo in Finland to Paldiski in Estonia). In addition, two submarine power cables between Finland and Estonia crossing the Gulf of Finland were mentioned.

New interconnections can change the anticipated future development entirely in the energy sector. Desynchronisation from Russia is planned through Poland and Lithuania, possibly also via marine cables. In addition to Estlink 1 and 2, there could also be a connection in the eastern part of the Gulf of Finland. There could be a mesh grid, with combinations of several projects to make it more economically viable, such as building artificial islands with wind farms in between. For another example, grid or cable connection development could take place between Hanko and the Estonian coast.

Other renewable and alternative modes of energy production

Hamina was mentioned as a potential site for liquefied natural gas (LNG) in the Helsinki working groups, but in Delphi, larger ports in Finland were also marked as LNG sites, whereas in the vicinity of Tallinn, LNG was wanted to be banned. LNG was seen as a provisional form of energy, in particular for shipping. The production sites of biofuels were marked mostly on shore areas near the big cities and industrial clusters. The entire coastal area both in Finland and Estonia was estimated to be covered with smart energy grids/systems by 2050. The storages for renewable energy was also mentioned.

The use of solar power was unanimously estimated to increase in the future (Figure 4.1). It was expected to be important both in Estonian and in Finnish coastal areas, for summer houses, for instance. Solar energy was anticipated to be produced all along the coast—for example, on rooftops. Energy production from waves and currents was also considered to increase if technology was further developed. Potential sites of wave energy in the Southern Archipelago Sea were mentioned. This area has relatively high waves relative to the conditions elsewhere in the project area, and it is located outside the most heavily trafficked navigation routes. Similar to wind energy, wave energy was considered a renewable energy option for a longer timeframe; however, it was noted that much development work needs to be done. According to one interviewee, there are few companies with market-ready technology. Recognition in national and international strategies would enable bigger projects and shares as part of the international electricity production industry.

Submarine geothermal energy was also projected to increase in the future. It was mentioned as an alternative energy mode a few times, but on the other hand, it was also suspected to be too costly for extensive use in the future. Other types of alternative energy forms mentioned were heat recovery, pumped hydro-accumulation power plants, energy from moving people, local solutions of circular energy, and solar-hydrogen solutions.

4.1.2 Main drivers

Political drivers were considered the most important for the development of the energy sector, with technological and economic drivers following. Drivers that gained the most mentions were cleantech innovations for energy, attitudes, main energy options supported by energy and environmental policies, environmental regulations and legal practices, and conditions and trends of global economy and globalisation (see Table 4.1).

Energy options supported by energy and environmental policies were considered to constitute a framework according to which energy production will be implemented in the future. Practices themselves will not change without changes in the framework. Low carbon or carbon neutral energy production was expected to be critical in the future, and renewable energy was regarded as the main energy option in 2050 (see Figure 4.2). However, regulation of the energy market will be needed to conduct changes towards environmental goals. Effects of climate change and aims to improve the state of the environment were mentioned as drivers for energy and environmental policies. Environmental policies and legislation were thought to affect the scale of fossil and renewable energies used.

Regulation may either set obstacles or give freedom for development towards carbon neutrality. According to experts, the renewable energy sector could be supported by a progressive energy policy, and legislation regarding renewable energy production might be enforced. Energy options that are supported by policies, regulation, information technologies, and digitalisation could provide options for safe energy and side products as well as markets for new technology, including cleantech solutions. Socioeconomic impacts would include reducing pollution, saving energy, and smart energy production. Expansion of wind energy was suggested to be one possible consequence of policy and regulative drivers, combined with innovations in cleantech solutions. Various tariff scenarios and their effects, the growth pace of wind and renewable energy, and global competitiveness of energy-intensive industries were also discussed as consequences of policies and regulation. In addition, the price of carbon was proposed to be linked to promoting different alternatives. Subsidies link the economy with policies, and with economic and policy drivers. Linked to industrial policy, production costs and the development of electricity prices were seen to dictate the potential methods of energy production.

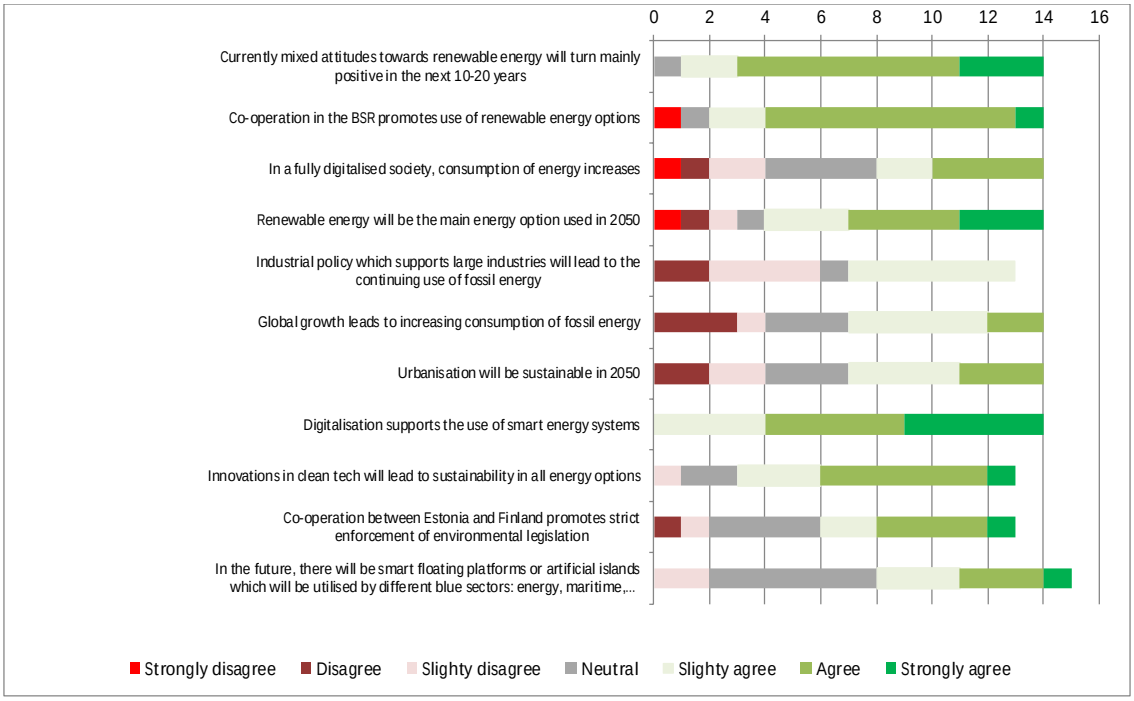


Figure 4.2. Result of Delphi rounds 3-4 (2018) statements on the future of energy sector.

Attitudes were considered to connect with policies. They were deemed the most problematic force against the development of wind energy in the sea and 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 (not in my backyard) problem. However, it was also estimated that attitudes towards renewable energy would turn mainly positive in the coming decades. The attitudes were considered to focus mostly towards locating windmills in Finnish coastal areas, and not, for example, related to nature conservation. There are some wind farms in conservation areas in Finland, and they are generally accepted, whereas in Estonia, there is a principle that no wind farms can be built in conservation areas. Synergies for local people were considered to help solve these attitude problems. Alternatively, there may be other solutions, such as increased connections to energy grids, expected to be important in the future. However, experts noted that finding appropriate locations for wind farms is also an issue in the future and thus part of maritime spatial planning.

The attitudes of different stakeholder groups were also mentioned (e.g. governments and officials in ministries, local communities and representatives of other sectors). Their attitudes were considered to affect the contents of the regulations and whether renewable energy would be accepted as a new use for marine areas. Positive attitudes towards renewable energy sources would increase demand on an individual level. Political will of states and municipalities affects, at least to some extent, investing and planning decisions.

The economy, and the regional economic situation in particular, were considered important factors. The prevailing global economy and global price development of energy affect the Baltic

Sea Region. The interviewees noted several factors related to economic drivers: development of and changes to the energy and electricity market, prices of energy on the market, and an unclear situation in the energy market. A poor economic situation could be a limiting factor, with fewer possibilities for development. Economic reality was considered to determine operations and support to energy production: "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. An interviewee noted that onshore wind has stabilised commercially, thus support should go to non-commercial, unstable technology to mature the offshore wind power to the same extent as onshore wind power.

Co-operation was considered difficult to grasp as a driver; it was linked to the discussion on energy policy. The level of co-operation and stability in the Baltic Sea region were the political drivers considered to have an effect on the energy sector, in particular on the production, transfer, and use of energy sources. An unstable security situation in the Baltic Sea region could change the big picture regarding energy production. Relationships with Russia also have an important role in energy policies in the future. The geopolitical situation was mentioned as mattering to development of wind energy in Estonia. On the maps, in certain parts of Eastern-Estonia, wind farms are banned for military reasons. The EU also has an impact on co-operation, depending on its existence in 2050. Currently, 70% of wind power built in Finland is under Finnish ownership according to interviewee.

Co-operation in the Baltic Sea Region was considered important, in particular, in transferring knowledge about new systems: "the more information the less anxiety". Co-operation will advance bringing EU politics to the national level—for example, between countries with functioning renewable energy systems. Co-operation in the Baltic Sea Region was agreed to promote the use of renewable energy options. Co-operation between Estonia and Finland was considered important, too, but it was also noted that energy production will take place wherever it is most efficient.

Table 4.1. Main drivers for energy sector identified in Delphi rounds 3-4 (2018). Main drivers identified and discussed in Tallinn energy working group are counted as one mention.

Driver	Delphi N=15	Tallinn workshop	Interviews N=3	Total
Clean tech innovations for energy	8	1	3	12
Attitudes	7	1	1	9
Main energy options supported by energy and environmental policies	7	1	7	15
Environmental regulations and legal practices	6	1	2	9
Conditions and trends of global economy and globalization	3	1	1	5
Regional economic situation	3			3
Co-operation in the BSR	3			3
Industrial policy	2			2
ICT – digitalization	2		2	4
Urbanization	0			0
Other drivers added in Delphi 2018				
Subsidies	1		1	2
Price of energy, costs of energy infrastructure	1		2	3
Fiscal policy instruments, incl. taxation and subsidy policies	1			1
Climate change, mitigation and adaptation	1			1
New drivers identified from the interviews				
Development of the energy and electricity market			4	4
Total	45	5	23	73

Weak signals for the energy sector:

- Enlargement of areas with nature conservation restrictions, stricter rules (including over-regulating of use of water and water areas)
- Energy consumption—different fuels and energy sources.

Black swans for the energy sector

- Dependency on energy; energy transmission systems are a possible target for terrorists or criminals—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

Futures table for energy sector is presented in Table 4.2.

Table 4.2. 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.	Polarisation of opinions: e.g. wealthy/educated 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 practices	Strict environmental legislation is in effect and enforced by the authorities.	Enforcement of environmental legislation is not in the focus, and its enforcement is weak. Weak preparation of laws and regulations.	Strict environmental legislation is in effect, but its 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 economy, globalisation	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.
Regional economic situation	Blue growth in BSR.	Negative growth in BSR.	Modest blue growth, struggling blue business.	Virtual economic flourish in BSR.
Urbanisation	Sustainable urbanisation and centralisation of population.	Rapid, unsustainable urbanisation and centralisation of population. Polarisation of populated areas to “good” and “bad”.	Balancing between urbanisation and living in countryside.	Slow urbanisation process, distant and flexible working from remote areas.
ICT – digitalisation	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.
Cleantech 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), centralised energy production.	Slightly modernised technologies used. Offshore wind energy.	New unknown technologies; smart energy grids.

4.2 Maritime cluster

4.2.1 Estimated changes and impact on sea use

The activities of the maritime cluster as a whole were estimated to increase until the year 2050 (Figure 4.3). Growth was expected for the maritime cluster by 97% of respondents and half of them considered maritime cluster activities would increase moderately or significantly. Strongest growth was expected in cleantech and marine transportation, followed by offshore construction and shipbuilding. Warehousing, storage, and building of boats as well as dredging were estimated to grow moderately by a majority of panelists. Demolition of ships was expected not to change or to grow moderately. The interviewees also considered the future of shipping positive, but dependent on economic factors.

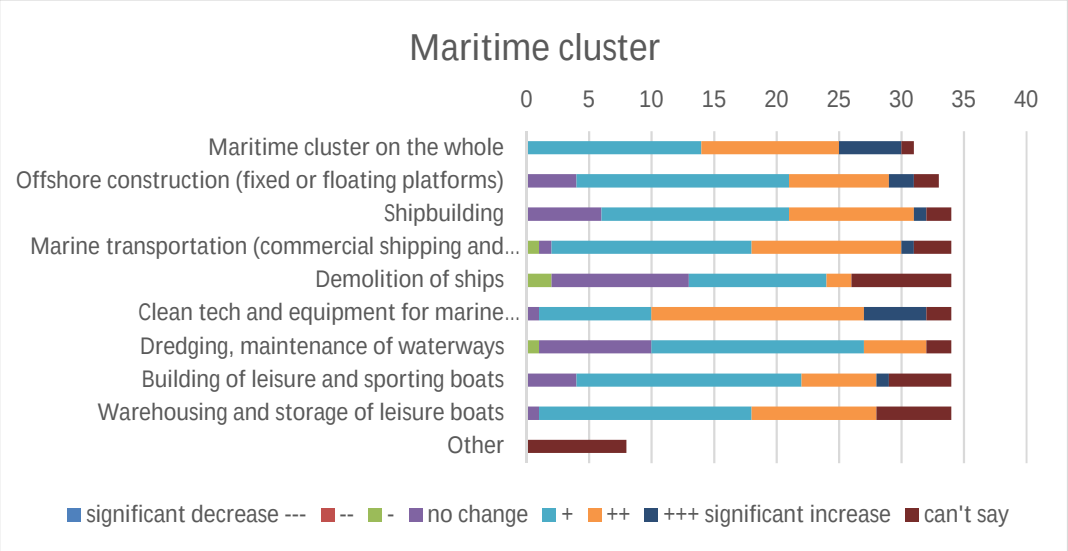


Figure 4.3. Distribution of opinions regarding the changes of production and other activities of the maritime sector in the project area, by the year 2050. The results of on-line questionnaire from Delphi rounds 1 and 2 in 2017 (Annex I).

Ports

The increase in activities of the entire maritime sector were indicated in the vicinity of Turku and Naantali, Hamina, and the Kotka region, as well as near Loksa. It was suggested that the number of Finnish ports could decrease by the year 2050, because the Finnish population will probably centralise in southern Finland. The big ports of southern Finland were estimated to thrive in 2050, in particular those with passenger traffic. In general, the ports located on the Finnish side of the project area were expected to stay in operation until 2050. Most of the cargo ports were estimated to grow, even though changes in industrial production (for example, changes in the paper and wood industry) will affect marine transport and ports, particularly smaller cargo ports,

in the project area. Both enlargement of the ports and specialisation of the smaller ports were mentioned as potential ways to develop in the future. Similarly, on the Estonian side the bigger ports were thought to remain in 2050.

At the Tallinn working group, possibilities to develop multiple services in ports were identified, consisting of multi-use of bigger ports and mobility for:

- energy: serving offshore wind power plants (maintenance); ports as smart energy distribution points
- offshore platforms with several functions and connection with ports; or floating ports (with possibility of 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, and tests of different fuels have been financed by the EU.
- different, new types of cargo, for example, waste as cargo
- new transport routes: cargo through Finland from the north (Arctic passage)—via railway or pipeline.
- fossil fuels from the Arctic
- Russian/Eastern transit cargo
- fairways: traditional and autonomous shipping routes
- tourism: more coastal cruises

Multiple services would need new "waiting areas" for ships near the hub ports, maybe dedicated for several ports together.

Shipping and use of sea space

Over 70% of the Delphi panelists agreed that freight volumes and passenger transport on the Gulf of Finland and Archipelago Sea Area will increase by 2050 (see Figure 4.4). The intensity of commercial shipping was estimated to increase in the middle of the Gulf of Finland around the St. Petersburg area by 2050, in particular in case the transit shipping via Estonian and Finnish ports to Russia would decrease and the transit cargo would be 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 a large extent dependent on the transport needs of the trade and industries. Maritime transport is in general estimated to grow both globally and in the Baltic Sea, with increasing ship size and ongoing automatisation of the ships (e.g. HELCOM 2018, OECD/ITF 2017, Baltic Lines 2016, WWF 2010).

The Helsinki-Tallinn transportation route was estimated to still exist in 2050. However, more cargo and passenger shipping routes across the Gulf of Finland were anticipated, for example, between Sillamäe and Kotka, if Russia agrees to the passing of its economic zone. This would be projected to decrease marine traffic between Helsinki and Tallinn. Research on a new roro route between Loviisa and Kunda, with direct connection and no need to pass Russian waters, was mentioned in an interview (see also REFEC project).

A planned tunnel under the Gulf of Finland between Helsinki and Tallinn was also mentioned, but because the loading and unloading are the most expensive part of transport, shipping was anticipated to be more economical for shippers also in the future. Another economic factor mentioned was the bigger loading potential of ships compared to trains. 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 of the project area. Melting of ice in the Arctic was mentioned as a reason for more northern traffic.

Interviewees expected changes due to digitalisation and environmental issues. At the workshop, it was estimated that the amount of passenger transport would decrease, and on the other hand, digitalisation would lead to autonomous shipping. Interviewees mentioned digitalisation as the second most important factor, and the intelligent fairway project in Finland as an example of digitalisation.

The size of ships was expected to increase and containerisation to continue. However, the effect of global economic growth as a factor affecting the enlargement of ships was not supported unanimously. There are other factors that affect ship sizes, such as the development of land transport capacity, which was considered to make maritime transport volumes more intense. On the other hand, it was anticipated that big vessels would not be used in the Baltic Sea and Gulf of Finland in the future. Larger port areas on land and deeper fairways would probably be needed, but ports' opportunities to expand were considered challenging because of their location near conservation areas, for example NATURA 2000. However, half of the panelists disagreed about the size of ports and vessels becoming smaller by 2050 (Figure 4.4). Another possibility mentioned was distributing to smaller ships from bigger vessels or platforms. Maintenance of waterways was seen to increase almost all the way around the Gulf of Finland because of increased size of vessels.

Shipbuilding and related businesses

The 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 the coastline, thus not greatly affecting the uses of coastal and marine areas. Sensitivity to economic fluctuations of the maritime industry (shipbuilding) was noted. The growth of the maritime cluster was expected to be strong until around the year 2025 (see Figure 4.4), but the development and situation of the maritime industry in 2050 was thought to be difficult to estimate. The number of shipyards was not estimated to increase, and their future presence in the project area was suspected to be partly replaced by production elsewhere. The future of shipbuilding in areas

that are logistically difficult and close to the protected areas was debated. On the Estonian side, the future of current ship repair businesses was questioned. The potential locations for new sites for demolition of ships were placed near the current maritime clusters. Offshore platforms were considered as smart energy systems and distribution systems for the energy supply. These would increase and have new locations in Hanko and Tallinn, for example.

4.2.2 Main drivers

Environmental regulations and legal practices were regarded as the most important driver in Delphi 2018, followed by conditions and trends in the global economy, cleantech and emissions from the maritime cluster, and fuels used in shipping. In the Helsinki workshop 2017, working groups cited digitalisation, high technology solutions, and safety/security issues as well as environmental regulations as important for the development of the maritime cluster and sustainable marine management in the project area. This involved the development of both marine transport and ports (see Table 4.3).

Economic-related drivers gained the most mentions in both the 2018 Delphi workshop and the interviews, followed by technological and political drivers. Trends of the global economy and globalisation were noticed as an important driver which always guides the state of the maritime cluster. Globalisation affects the maritime industry in particular via demand for maritime transport. While everything that is going on in society affects the need to transport cargo and passengers, in this study the social drivers as such did not raise debate regarding the maritime cluster. Increasing competition for a skilled marine workforce was mentioned as an effect of centralisation of the population, which was assumed to continue.

The role of the global economy and regional situation

The interviewees regarded economy-related factors as most important, related to transport demand, status of international competition, and industrial competitiveness. Marine transport is very much dependent on the global economy: progress in the global economy will support marine transport. The global economy emphasises the significance of ports and effects on the volume of maritime transport as well as the volume of shipbuilding orders. Marine transport also affects the economy at the regional level in a positive way.

The global economy has a positive effect on the maritime industry. Transport policy has impacts for ship owners and ports, but the level and extent of co-operation in the Baltic Sea Region was also connected with a safety situation and stability which would increase co-operation in the Baltic Sea area. Different levels of co-operation (as a case in point, relationship with Russia) affect maritime transport via ports of Finland and Estonia, and the future of transit cargo via Estonia and Finland. The regional economic situation will promote co-operation. The better the situation, the greater the increase in shipping. The economic situation controls supply and demand, and the cost of transport modes affects which mode is chosen. The government's support and tax policies for shipping were also mentioned.

The transboundary co-operation in the Baltic Sea Region, safety and stability of the Baltic Sea, regional economic situation, and environmental regulations were considered to have high relevance both to the number of cruise passengers on the Baltic Sea as well as to transport of cargo. Good economic development attracts an increasing number of travellers, and thus larger vessels. When the area remains safe, it attracts tourists into the Baltic Sea from all over the world, the Far East, for example. On the other hand, people want to maintain the fragile ecosystem of the Baltic Sea, and stricter environmental legislation force them toward new solutions. Factors related to transport routes and corridors were mentioned in particular by the interviewees, reflecting the development of land transport.

Environmental aspects

Energy efficiency and clean air were considered to be important drivers in the study area. Environmental policies affect fuels used in shipping, for example, and indirectly, affordability of routes and ports. Because the marine sector uses a lot of fuel, the composition of fuel affects the emissions of shipping—that is, the use of low carbon fuels supports carbon neutrality. Fuel price levels have been recognised 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). In addition, accurate optimisation of transport routes, timetables, and loading of vessels can reduce the need for traffic. Continuous control of pollution and environmental taxes will drive companies towards clean operation.

Strict environmental regulation provides good markets for cleantech and marine construction. In the port sector, there are big regulation-related demands in addition to environmental ones. Attitudes of customers and shippers influence sustainable development of the sector, such as investments in cleantech and fuels. Attitudes influenced by different cultural backgrounds may play a role in operations at a grassroots level and also on attitudes about the environment. This issue was linked with co-operation. It is also geopolitical issue, which affects environmental legislation. EU- and Baltic Sea Region-level information and motivation are needed via the media to raise awareness. Official and unofficial activities were both considered important. One interviewee mentioned that there is clear interest among customers to know about the emissions created by transportation; they do not only want their product transported from one place to another. Changing weather conditions because of climate change was not considered as an important direct driver for the development of maritime transport. Difficult and unpredictable weather conditions were not regarded to affect maritime imports and exports from the northern parts of the BSR.

Improving technological solutions and better infrastructure

The global nature of shipping was seen to lead to global solutions, more sustainability and cleantech, requests for environmental friendly profiles of vessels, and new cargo types. Connection with other transportation types is crucial for the development of the shipping industry: growth in ship size and growth in cargo volume require larger port areas, deeper fairways, areas on land, and better infrastructure, as well as ports' hinterland connections. Land-

sea interaction should be sustainable (e.g. linked to other transport modes and rail services as Rail Baltic). Future multifunctional and automatised vessels will have requirements on port infrastructure. The improvements in information and communication technology as well as digitalisation will enable new types of business and efficiency in the maritime cluster.

Autonomous ships were anticipated to revolutionise shipping altogether, even if the need for some crew for challenging operations (e.g. navigation in archipelago areas) would remain. Cargo vessels were expected be autonomous in a couple of decades. Half of the Delphi panelists agreed but one-third disagreed that most vessels will be autonomous in 2050 (Figure 4.4). When the share of autonomous vessels increases, it was thought to lead to standardisation of ports and to automatisation of seaport operations. Sensors and monitoring will be needed to avoid collisions between autonomous and regular vessels. Service centres for surveillance and monitoring of the vessels (such as VTS centres) would be established, satellites will survey smaller vessels or leisure boats, and drones will operate from artificial or floating islands. Advanced digitalisation 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 digitalisation would require pilot areas for new innovations, also established in the project area. Autonomous shipping and automatisation in shipping will have impacts on maritime spatial planning.

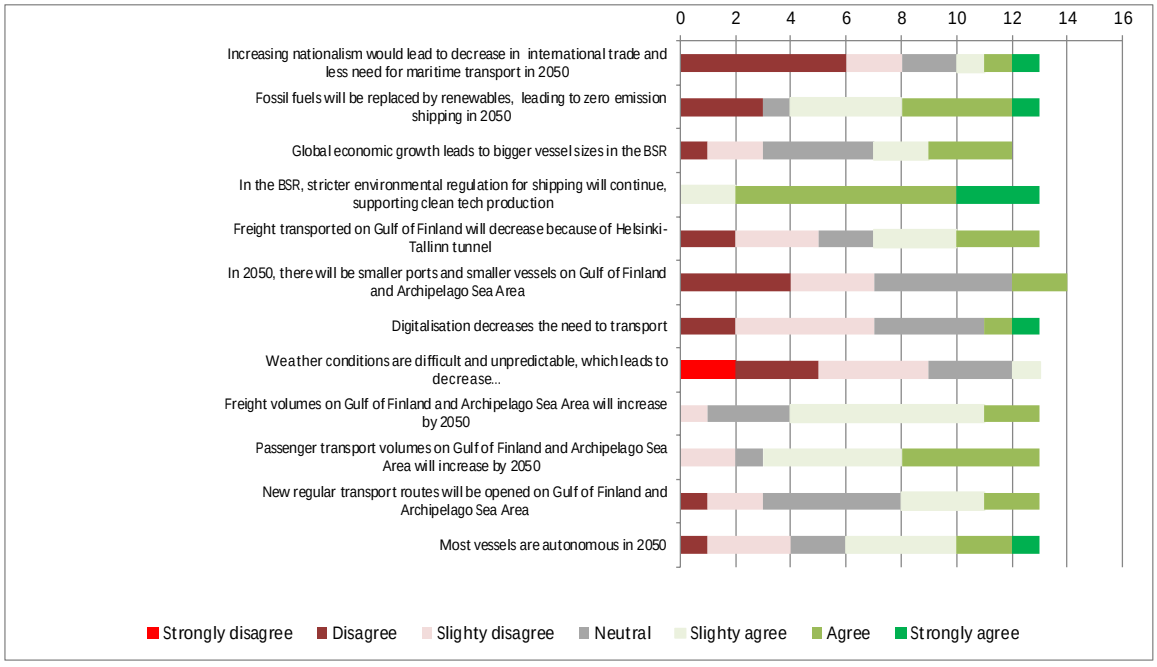


Figure 4.4. Result of Delphi rounds 3-4 statements on the development of maritime sector.

What could decrease the need for maritime transport?

Nearly all views related to scenarios in the Delphi rounds and workshops were of increasing maritime transport. Digitalisation was the only reason considered to possibly decrease the number of passengers. Because of this result, the interviewees in the 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. General economic development could decrease the amount of cargo or passengers. Among the other reasons were black swan-type situations: political circumstances, various crises and sanctions, sudden actualisation of threats, the changing world situation, or the use of force in surrounding areas. A weakening security position could change the situation, particularly in terms of passengers. Economic consequences of politics were mentioned, such as a trade war, custom tariffs, or trade embargos (e.g. Russia, the food industry). In addition, raw material streams and the location of manufacturing, as well as tunnel projects were estimated to have an impact. Environmental issues and uncertainty and changing rules were also mentioned.

Table 4.3. Main drivers for maritime cluster

Driver	N=14	Tallinn workshop Total N=4	Interviews Total N=8	Total
Environmental regulations and legal practices	8		3	11
Conditions and trends of global economy, globalization	6	4	9	19
Clean tech / emissions from maritime cluster (energy efficiency)	6			6
Fuels used in shipping (environmental policy)	5		1	6
Regional economic situation	4			4
Level of co-operation in the BSR - safety situation and stability in the Baltic Sea area	4	1		5
Attitudes of customers and shippers	2	3	1	6
ICT, digitalization	3	2	6	11
Transport routes	1		4	5
Climate conditions	1			1
Drivers added in Delphi rounds 3 and 4 (2018)				0
Development of autonomous ships (without crew)	1		3	4
New drivers from the interviews				
Changes concerning business models			1	1
Government's support and tax policies (for shipping)			2	2
World politics			1	1
Technological trends, especially in shipping			1	1

Environmental topics, resisting climate change, sustainable development			3	3
More competition for skilled marine workforce			1	1
Centralisation of the population will continue; centres and polarization			1	1
Total	41	10	37	88

The experts did not list any specific black swans for the maritime cluster. Weak signals were listed as follows:

- improved battery technology—a game-changing innovation
- the effects of de-globalisation, protectionism, and self-sufficiency

Futures table for maritime cluster is presented in Table 4.4.

Table 4.4. 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, globalisation	Global growth, high level of globalisation, increasing volumes in maritime transport. Specialisation of smaller ports.	Increasing volumes in maritime transport. Few investments to new fleet. Bigger vessel sizes, deepening of fairways.	Poor global economy, degrowth. Stagnating maritime cluster, cleantech-based products.	Global growth based on services and virtual products. Increasing automatisation, 3D printing.
Regional economic situation	Sustainable blue growth in BSR; circular economy, cleantech. Zero emission shipping, good markets for cleantech products.	Degrowth in BSR. No attention paid to sustainability. 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 has been built - demand for maritime freight transport 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, digitalisation. Booking online reduces maritime transport units/vessels needed.	Extensive digitalisation e.g. new emerging technologies, local production such as 3D printing, and optimisation have drastically reduced the need for maritime transport.

Cleantech / emissions from maritime cluster (energy efficiency)	Innovations in shipbuilding technologies – cleantech in use.	Minimum requirements fulfilled, fewer innovations, current technologies used in maritime cluster.	Slightly modernised technologies used.	New unknown technologies.
Climate conditions	Almost ice-free navigation year round on the Gulf of Finland and on 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 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.

4.3 Blue bioeconomy and subsea resources

4.3.1 Changes and impact on sea use

In Delphi 2017, the activities and production related to blue bioeconomy and subsea resources were predicted to increase according to 92% of respondents (see Figure 4.5). However, developments were expected to differ by sector. The majority of panelists anticipated that fish farming and aquaculture would grow. Similarly, the interviewees considered the future of fish farming and processing positive.

Commercial fishing was considered to stay on the current level as almost half of the panelists expected no change. According to the interviews conducted in the project, perspectives on the future of the fishing industry overall are considered positive in Finland, and there are continuous opportunities for co-operation with Estonia. Fishery was estimated to be important in 2050 also, but methods will probably develop and change.

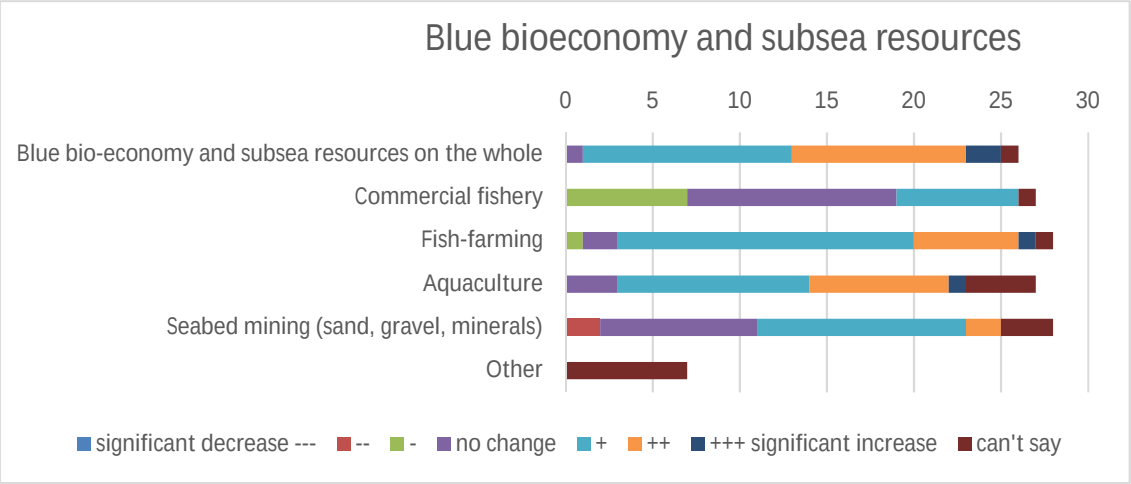


Figure 4.5. Changes in blue bioeconomy and subsea resources (Delphi-panel 2017)

Fishery

In the Helsinki scenario workshop, it was estimated that fishing continues to take place throughout the project area in 2050. 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, whitefish, etc. Fishing will need to be regulated more in the future to conserve fish stocks. Natural and planted or artificial reefs were suggested on the Estonian coast in order to promote fish species.

Aquaculture

Potential areas for aquaculture were projected to be located in the Archipelago Sea and the coast of the Gulf of Finland in 2050, noting, however, 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 aquaculture will possibly develop towards the Bothnian Sea, outside the project area. The Helsinki workshop participants mentioned that more offshore aquaculture developments are already planned and those were judged to be desirable, especially with smart solutions for aquaculture production and new offshore aquaculture technologies.

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

Seabed mining and mineral extraction

Subsea sand, gravel, and mineral areas in Estonia are in Haapsalu, where mud bath spas are currently a tourist attraction. Mud is dug close by from the nearby sea area and from Hiiumaa. Naissaar was thought to be a potential area for sand mining, but since plenty of sand and gravel is available on land, less need was estimated for subsea mining in the future. In Finland most gravel and sand excavation is also located outside the project area and on land, even though in some sea areas, sand digging has been performed. However, potential sites for minerals such as iron were mentioned to be located south of Örö.

4.3.2 Main drivers

Political drivers gained the most mentions, followed by environment-related, technological, and legal drivers. Policies concerning the use of natural resources were considered the most important driver according to Delphi panellist. Cleantech innovations for blue businesses, environmental regulations and legal practices, state of the environment, attitudes, and conditions and trends of the global economy were selected as important drivers having impact on the blue bioeconomy and the use of subsea resources (Table 4.5).

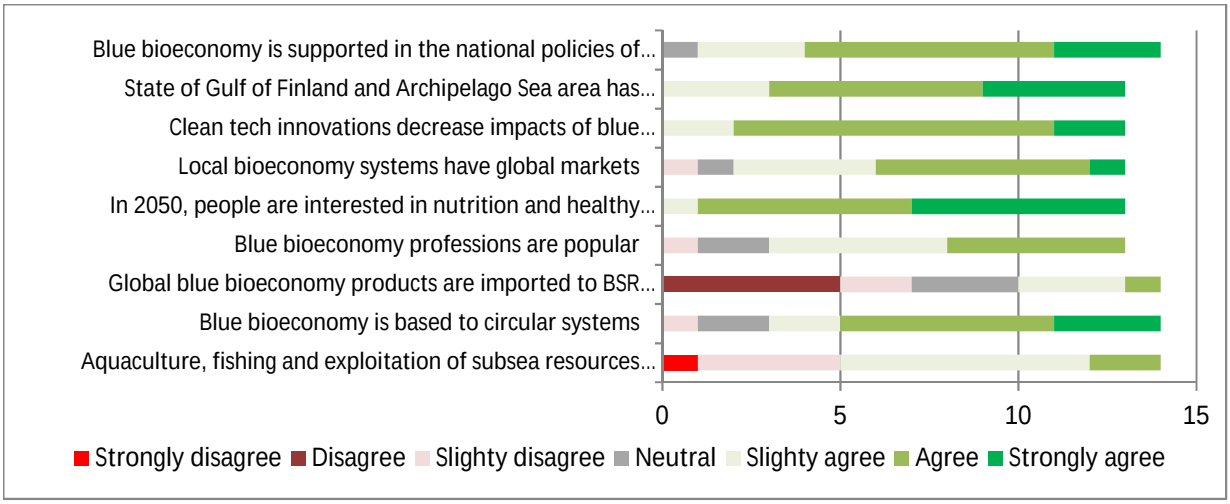


Figure 4.6. Result of Delphi-rounds 3-4 on statements on the development of blue bioeconomy sector.

Impacts of policies and global economy

A clear majority of Delphi panelists thought that the blue bioeconomy is supported in the national policies of Estonia and Finland, and in the Tallinn workshop, it was noted that ministries are supporting the development of multitrophic aquaculture in Finland and Estonia (see Figure 4.6). In Delphi 2017, state subsidies as part of the structural support provided in Finland were regarded as a significant positive element, for example, in developing fish farming. Subsidies of the European Maritime and Fisheries Fund were mentioned to have a positive impact in Estonia. However, the application process for EU subsidies was thought to be very bureaucratic. One Delphi panelist stated that, "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 behaviour".

Strong policy instruments were seen as drivers to study marine ecosystems and, for example, the use of algae as a raw material of biofuels. The impact of the global economy on coastal fisheries was considered "definitely negative" in Delphi 2017, which may be linked with the large share of imported fish being consumed.

Environmental aspects

It was considered that if environmental regulations and legal practices change in favor of development of the blue bioeconomy, it will give people a positive signal of the importance of the blue bioeconomy, perhaps changing attitudes in a more positive direction. Environmental permissions for fish farming, for example, were considered as important drivers in Delphi 2017. Nevertheless, one of the business interviewees also noted that even though taking care of the

environment is important, environmental issues are a challenge for fish farming, as the focus is on conservation and overprotecting the environment, which hampers businesses. In addition, environmental restrictions were also seen as a negative driver for the blue bioeconomy by one panelist, meaning that there are not enough suitable marine areas and resources to support the bioeconomy.

The state of the environment was considered to have a strong impact on the possibilities of blue growth on the Baltic Sea. To reduce eutrophication, biomasses from the sea should be used more extensively. Mussels may be used to filter out the excessive nutrients; in a closed system, they just use the nutria from fish. In shallow areas, mussels use the seabed nutrients.

If marine resources are not in good condition, it was considered to lead to an ineffective bioeconomy. For example, the Estonian Marine Strategy Plan 2016 identifies the three most important pressure factors in the Estonian Maritime Area: eutrophication, hazardous substances, and fisheries. Environmental protection was regarded to benefit fisheries directly, as biological disturbances and selective fishing, for example, have negative effects on fisheries. The sustainable management of aquaculture, fish farming, mussels, and algae cultivation was thought to be equally important. Aquaculture farms are largely exposed to both nutrients and hazardous substances, which in turn increases the eutrophication of water bodies. Invasive species is a driver causing economic losses of aquatic ecosystems, such as fisheries. The moral aspect was also considered important; current generations have a responsibility to maintain marine areas and fish stocks for future generations.

Delphi panelists had a strong belief that the state of the Baltic Sea will improve in the future, with 93% of them considering that the state of the Gulf of Finland and the Archipelago Sea area will have improved by the year 2050 (see Figure 4.6).

The impact of new technology and cleantech

New technologies in fisheries and aquaculture were regarded to have positive effects on businesses. Cleantech solutions could enable independent (e.g. floating) aquaculture units and automation in blue bioeconomy and subsea sectors, as well as reduction of eutrophication. Thus, cleantech solutions would enable the more extensive use of biomasses from the sea. Ice conditions were mentioned to have an impact on different structures and platforms located on the sea for a long time, though the average sea ice area would decrease because of climate change. The Delphi panelists unanimously agreed that cleantech innovations would decrease impacts of the blue bioeconomy on the sea. One panelist stated that if cleantech innovations were adopted in fish farming, for example, the state of the environment could be maintained or even improved, and at the same time, attitudes towards bioeconomy on the sea will be improved.

Well-being as a social driver

The increasing demand for health services provided by nature (well-being from nature, green care and blue care) was considered to have a positive effect on blue economy. Ethical issues and interest in nutrition and healthy eating were connected to egoism: "A selfish interest in nutrition and healthy eating can also highlight the issues on a more general level". Panelists unanimously agreed that in 2050, people are interested in nutrition and healthy eating (Figure 4.6). In addition, an attempt to substitute meat is a strong driver in food sector.

Table 4.5. Main drivers for blue bioeconomy sector identified in Delphi rounds 3-4 (2018). Main drivers identified and discussed in Tallinn energy working group are counted as one mention.

Driver	Delphi 2018 Total N=15	Tallinn workshop	Interviews Total N=3	Total
Policies concerning the use of natural resources	10	1	2	13
Clean tech innovations for blue businesses	9	1		10
Environmental regulations and legal practices – industrial policy	8	1		9
State of the environment	7	1	1	9
Attitudes	3	1		4
Attitude towards blue bioeconomy as a profession	2			2
Ethical issues / interest on nutrition and healthy eating	1			1
Conditions and trends of global economy, globalization	1	1		2
New drivers mentioned in Delphi 2018	2			
Creating new business to exploit resources	1			1
Environmental restrictions	1			1
New drivers mentioned in the interviews				
Too much focus on protection, overprotecting			1	1
Employment of skilled people is difficult, big challenge			1	1
Domesticity			1	1
Uniqueness			1	1
Total	43	6	8	57

Weak signals for blue bioeconomy and subsea resources

- Fish spawning areas are destroyed/disappearing in the sea. If they are not restored in time, some important fish species might disappear.
- For development of aquaculture, land-based production

Black swans

- Fish farming and aquaculture on land, in circular systems
- Development of closed circulation fish farming on land may have unexpected impacts on offshore fish farming.

Futures table for blue bioeconomy and subsea sector is presented in Table 4.6.

Table 4.6. 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 on 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 and aquaculture.	Fishing and aquaculture supported by the policies.	Digital-based production and circular economy supported by the policies.
Conditions and trends of global economy, globalisation	Local bioeconomies, 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 in cultivating one's food and self-sufficiency of households because of global effect of climate change.	No interest in 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 in nutrition and healthy eating	New bio-based products cultivated in the sea (e.g. algae-based products). Interest in local food, produced nearby.	Low interest in the origin of the food.	Interest in nutrition and healthy eating. "Health boom and foodies"	Low interest in the origin of the food. Individual choices possible.
Cleantech 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 modernised 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 of the environment. Disintegration of habitats threatens species.	Climate change seems to proceed fast.	Overwhelming digitalisation has increased the need for natural resources, unexpected impacts to the environment.
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.

4.4 Tourism, culture, and services for leisure activities

4.4.1 Changes and impact on the sea use

Sea and coastal tourism is the largest subsector of tourism, the largest single maritime economic activity, and the key economic driver in many coastal regions and islands in Europe (European Commission 2014). Coastal tourism is also considered one of the key blue growth industries in the Plan4Blue project area (see Pohjola et al 2018b). Similarly, all the Delphi panelists considered that the sector "Tourism and culture, services for leisure activities" on the whole will increase in the study area by 2050 (Figure 4.7). All the subsectors of tourism, culture, and the services for leisure activities are estimated to increase or remain at the same level as currently (Figure 4.7). The views of the experts follow the same positive development indicated in the quantitative economic analysis of Plan4Blue and other reports.

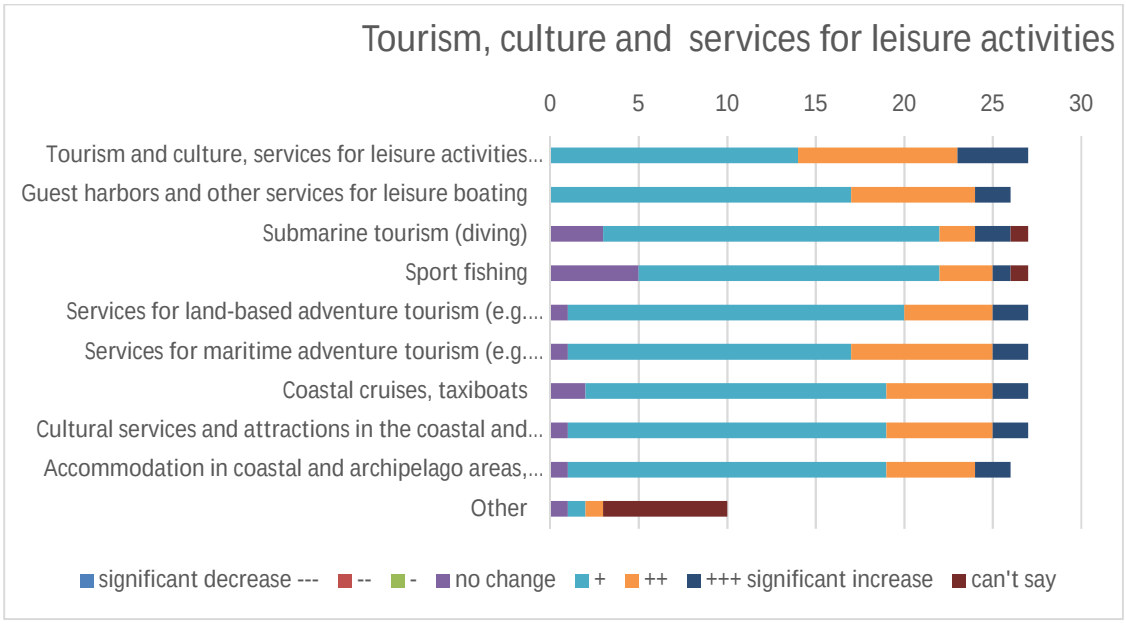


Figure 4.7. Changes in tourism, culture, and services for leisure activities

The future of the different subsectors of tourism were assessed in Tallinn workshop. "Nature tourism" and "Cultural heritage" were considered more stable subsectors, which could probably grow in the future because they do not need so much money; economic situations could change. "Nature tourism" includes recreation and camping. "Cultural heritage" includes such landmarks as old factories.

In the "unlimited growth" scenario, tourism was expected to have extensive spatial impacts, in case all the different planned transport options are realised: Rail Baltic, Helsinki-Tallinn tunnel, other possible tunnels. In this scenario, various kind of cruises and small boat routes would go

all around the Gulf of Finland. There would be artificial islands near Tallinn, and a new nuclear power station would have to be built.

The interviewees considered the future of tourism positive and future growth steady. International tourism was expected to increase. On the other hand, domesticity and locality were also mentioned as trends, and national tourism was expected to increase as well. In addition, different types of tourism were anticipated to increase. Services for maritime adventure tourism as well as services for leisure boating (e.g. guest harbours) were expected to increase moderately or significantly by 35-37% of the panelists. Leisure boating was expected to increase by the interviewees, too; however, changes in ownership were expected: the sharing economy and co-ownership may step into the boating sector.

International tourism

In both Delphi and the Helsinki workshop, the number of international tourists, in particular from the Far East and from the Asian middle class, was expected to increase. India was also mentioned in the interviews. These tourists are interested in pristine nature and pure water. Flights between Asia and Helsinki were estimated to increase tourism to Tallinn also. Asian tourists were projected to focus on bigger cities and package holidays, but they were not anticipated 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, but on the other hand, its attractiveness among younger generations was questioned. Luxury tourism was mentioned as well. Aside from the current cruises in summertime, winter cruises were mentioned as a new trend by an interviewee.

It was unanimously estimated that Helsinki and Tallinn will also be important tourist destinations in future. The Helsinki-Tallinn tunnel was anticipated to be a possible additional connection for tourists to Tallinn. Rail Baltic would also increase tourism connected by tunnel. In addition, commuting between Helsinki and Tallinn was estimated to increase by the tunnel. In Finland, the Kotka-Hamina region was mentioned as one of the key areas of tourist development. In addition, the Hyperloop from Turku to Stockholm and Helsinki to Tallinn was mentioned.

Culture and nature destinations

Public right of access prevails currently in Finland and in Estonia, even though there are some differences: approaching the coastline is allowed only by foot in Estonia, and there are noise restrictions in some places. These rights were assumed to stay in effect in the future, making possible an increase in “easy access nature tourism”, such as sites close to cities with marked paths and good infrastructure. About 70% of the Delphi panelists expected a slight increase in services for land-based adventure tourism and submarine tourism as well as accommodation in coastal and archipelago areas (Figure 4.7.)

National parks were believed to be important areas for tourism in the project area, both on land and in water areas. A “national park boom” (i.e. trips to islands and coastal areas) was

mentioned and expected to increase. Ecological trends and tourist activities such as snorkelling and diving have also been identified as having potential for tourism development in Estonia and Finland (Ecorys, 2013). With increasing leisure time and tourism in water areas, noise may be an increasing problem, especially when water scooters or jet skis are used. A clear majority, 93%, of the Delphi panelists considered that cultural destinations will attract increasing numbers of tourists to the Baltic Sea Region (Figure 4.8).

Underwater cultural heritage and in particular on-land sites were mentioned as resources for tourism (Roose et al. 2017). Because the wood of shipwrecks is preserved well in brackish water, underwater cultural heritage areas were also thought to be important in the Baltic Sea region in the future. Diving in the underwater cultural destinations was estimated to increase in such archaeological sites as the Kronprins Gustav Adolf Underwater Park off Helsinki. However, in the eastern part of the project area, off Kotka and Narva, current poor underwater visibility was expected to hinder underwater tourism. There are some underwater destinations on the Estonian side, but their usability as tourist destinations should be further developed.

Leisure boating and sport fishing

The number of small boats in Estonia was estimated to increase in future, and the anticipated increase was mostly due to the growth of leisure boating on the Estonian coast (Roose et al. 2017). In Finland, leisure and small boating is already very popular, and this will probably continue in the future. Thus, both Estonian and Finnish leisure boats were estimated to increasingly cross the Gulf of Finland, which indicates that the need for marinas is evident in Estonia. The number of guest harbours was desired to increase evenly on the Finnish and Estonian sides, especially in the outer coast (Roose et al. 2017). Also, the Tallinn tourism working group considered that the use of small boats will increase, there would be new routes all around the project area, and yachting along the coast would be common.

Increasing leisure boating across the Gulf of Finland also means that the safety issues of leisure boating will be an issue in the future, as the region is one of the most heavily trafficked commercial shipping areas in the world (e.g. HELCOM 2018, Baltic Lines 2016, WWF 2010). Commercial shipping is guided by VTS in the project area (cf. Roose et al. 2017). While small boating and yachting was estimated to increase in the busy Gulf of Finland, the navigation and other skills of the boaters and yacht crews need to improve. Currently, pilots of small boats are not educated for navigation, which increasingly creates risks, such as collisions with commercial ships. On the other hand, in 2050 there will probably be mobile applications available, or other types of portable or wearable technology, including better interactive map applications, etc.

Sport fishing is projected to increase centralized around the sea areas of Tallinn (Roose et al. 2017). It was noted that tourism both in Finland and Estonia could benefit from restoration of river water systems. For example, hydropower and dams have prevented and are still hindering fishing tourism and leisure fishing in many rivers in the coastal areas. Their restoration would restock and open waterways for valuable fish species. If necessary, hobby fishing should be banned in rivers that are spawning sites for salmonids.

Main tourist attractions in the study area

The centres of culture and accommodation are the middle Archipelago Sea and the vicinity of Tallinn (Roose et al. 2017). Current coastal tourist attractions outside the project area in Estonia were estimated to remain as such also in the coming decades (Saaremaa, Hiiumaa, Haapsalu, Noarootsi and Pärnu). The entire Estonian coast was mentioned to have tourism potential—the Paldiski area, for example—while the services and infrastructure need to be developed in the future. These areas may attract, for instance from Germany, more birdwatching tourism. The Haapsalu region has very popular mud bath spas. Locals from Tallinn region use Tallinn, the Loksa area, Pakri, and Väike-Pakri for recreation. Recreation infrastructure development was mentioned to be growing in Estonia. In the Tallinn workshop, it was noted that areas traditionally used for recreation and leisure will be used for similar purposes also in the future.

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

Areas of tourist interest in Finland are places quite close to population centres where services and infrastructure are ready to serve tourism and recreation. In the Helsinki workshop, it was estimated that the tourist attractions will be concentrated in the same coastal areas as currently: around the Archipelago Sea and its biosphere area and national park; Örö and areas around it; and the Archipelago Trail. All groups estimated that Helsinki city and its archipelago, as well as areas around it both to east and to west, would remain as important tourist attractions 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 was anticipated to increase in the future because of clear and cleaner waters than in southern sea areas. Coastal cruising was considered to be a possibility to create more synergy with tourism and ports, for example, by establishing waterbus routes site-to-site along the Finnish coast (Roose et al. 2017). A new eastern ferry line between Finland and Estonia was also mentioned.

Options for leisure interests

The future options for various types of leisure interests and new connections were discussed at the Tallinn workshop. Ecotourism versus mass tourism was debated, but many opinions pointed towards mass tourism. Health tourism as a trend may lead to new health services on the market, such as spas, mud procedures, ice-hotels, etc. Boating and sailing could be connected with the food sector. Fishing and cooking on the boat can be a tourist attraction. There is a possibility that new invasive species may be edible.

Extreme tourism is growing, as things that are not extreme to us can be extreme for tourists from other cultural backgrounds. This may be part of “Offshore water sports”, that is, diving,

fishing, or canoeing. Local tourism may increase as different types of coastal regions in Estonia and Finland could attract tourists. Tourists will probably concentrate in some areas on the natural shoreline.

4.4.2 Main drivers

Social drivers gained the most mentions in this sector, followed by political and environment-related ones. Among the individual drivers, the state of the environment was considered the most important driver for the tourism sector in Delphi 2018, followed by safety and security in Baltic Sea region (See Table 4.7). In addition, attitudes of travellers and tourists, conditions and trends of the global economy, as well as leisure interests were identified as important drivers.

Social drivers

Social drivers were estimated to have strong influence in the tourism sector. Particularly important for the blue economy were the aging population, urbanisation, and the depopulation of remote districts interlinked with each other. Challenges to employ people was mentioned in interviews as a factor affecting the development of tourism. This may be connected to the depopulation of the remote districts and seasonality of the tourism business in the Baltic Sea Region. The lack of suitable skills and competences as well as an aging workforce have also been identified as problems for future development in EU's Sustainable Blue Growth Agenda for the Baltic Sea Region (European Commission, 2014). Similarly, Parkkinen (2017) notes that the most significant barrier to hindering or even preventing a desirable future for tourism in the Baltic Sea region was the lack of relevant skills, expertise, and education.

The increasing degree of education among the younger tourists is expected to affect their interest in travel. 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. Tourists were agreed to prefer local and regional destinations by 71% of the panelists (Figure 4.8). More interest towards local destinations instead of tourist hubs was indicated also in the opinions of Delphi 2018. However, half of the panelists anticipated that international tourists would visit mainly touristic hubs in the Baltic Sea Region. This may indicate a tendency towards locality in the tourism sector.

Pure nature

In Delphi 2017, for example a "Back to nature" trend among younger people was identified. In addition, urbanisation may lead to interest in experiencing nature destinations. The state of the environment is crucial for maritime tourism and connected strongly with the driver attitudes of tourists. Pure nature will be an even more valuable resource in the future; it defines whether the Baltic Sea region or Gulf of Finland is attractive. People enjoy a clean environment and nature, and they are more and more interested in spending time outdoors. For example, if the

sea suffers from the negative effects of excessive eutrophication, such as cyanobacterial blooms, and it is not possible to swim in it, the visitors will avoid the area.

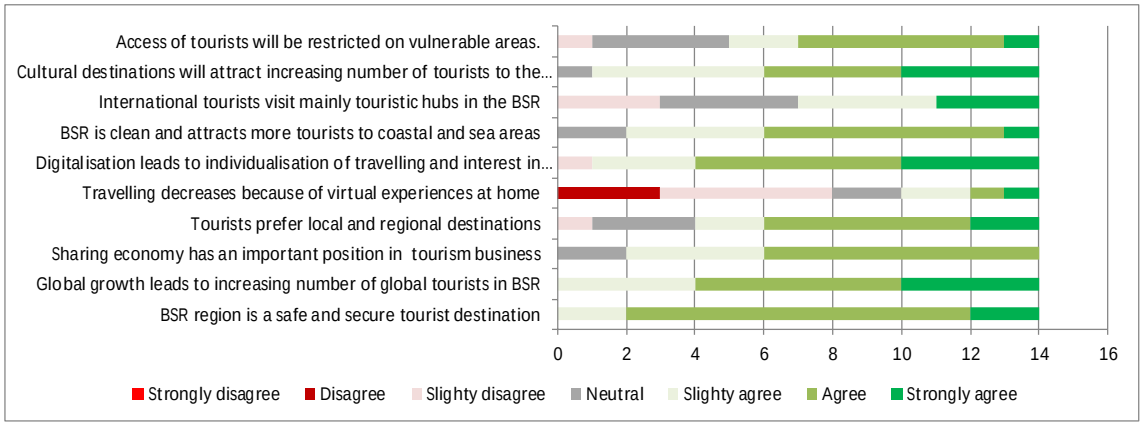


Figure 4.8. Result of Delphi rounds 3-4 (2018) statements on development of tourism, culture, and services for leisure activities.

Because of climate change, even Central Europe could be too hot by 2050. The cool climate attracts the tourists because the weather is more stable. Clean air, nature, food, and water will become more valued and wanted, and travelling in the BSR may grow remarkably. The majority of the respondents of Delphi had a positive forecast of the state of the environment in the Baltic Sea region: 86% of them projected that in 2050 the region is clean and attracts more tourists to coastal and sea areas (Figure 4.8). One of the Delphi panelists argued that sustainable development needs to be emphasised in relation to the continued growth of travel and its future development, including all the pillars of responsibility and sustainability of cultures. Without preparing for that, tourism may even become uncontrolled.

Safety and security

Safety and security affect all travellers, and global security has even more impact on the development of tourism at a global level, for example, affecting incoming tourists from Asia. Global terrorism or wars lead to less secure environments for travelling, different destinations, and perhaps even whether travellers choose close or distant destinations. Another safety aspect mentioned in interviews was flight accidents.

A high level of safety and security in the Baltic Sea Region can attract large numbers 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 travel, increasing the need for flexible and fluent travel chains. Delphi panelists in 2018 unanimously agreed that the Baltic Sea Region is a safe and secure tourist destination in 2050 (Figure 4.8).

Attitudes and knowledge on destinations

A Delphi panelist noted that tourism needs good communication and advertising as people need knowledge to make their travelling decisions. “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).

Attitudes and tourist routes can change through time, and more information may change attitudes of the tourists. Globalisation raises new attitudes via different cultures. People will continuously search new places, where mass tourism is not yet so popular, and create then new mass tourism areas that will change the environment of these areas. Discussions about the sustainability of tourism will define what forms of tourism will grow in the future. In Estonia, an interviewee noticed increasing awareness about the sea, in particular because of the Year of the Maritime Culture (2016).

The change in global travelling and in consumer behavior is anticipated to be noteworthy. Services for travelling are being planned, reserved, and paid online, and peer reviews have significant importance. Experiencing 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 this situation, the enterprises have to invest in digital services and know-how. Marketing of travel will change, and regional marketing companies will become more destination-development marketing and managing organisations.

Economic and technological drivers

Delphi panelists unanimously agreed that global growth leads to an increasing number of global tourists in the Baltic Sea region (Figure 4.8). Tourism and local entrepreneurship were considered to affect the regional economy of coastal areas in a positive way. Economic well-being was considered to have 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, increased income was mentioned as affecting the sales of boats positively. On the other hand, it was noted that boats are expensive, and sharing and chartering of boats were expected to increase in the future. As people want more and different types of services, the sharing economy was expected to have an important position in the tourism business.

Digitalisation was regarded as another reason for individualised leisure interests. Over 90% of the Delphi panelists agreed that digitalisation leads to individualisation of travelling and interest in unique travel destinations (Figure 4.8). Tourists want more and more to search, book, and pay online because of the development of information and communications technology and digitalisation. Digitalisation and self-service development may influence negatively high

predictions of employment, even though they would bring new solutions and faster sharing of information.

The Helsinki-Tallinn tunnel would create and encourage new ways to travel. This is a globally known and connected region and may attract wealthy people from Central Asia. Currently Estonia has very good ferry connections, but flight connections are weaker. 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 the 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. According to a Delphi panelist "BSR [Baltic Sea region] and islands provide in 2050 'something totally different' for incoming tourists, a glimpse of "old time" experience of nature. It takes much time to find nature so clean [as] 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 travellers, 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 for access to restricted tourism experiences in the islands".

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!

Black swans

- military situation, the purity of nature will be lost because of a disaster

Table 4.7. Drivers for tourism, culture and services for leisure activities. The drivers selected in the workshop were all given one mention as the working group did not vote.

Driver	Delphi 2018, Total N=14	Tallinn workshop	Interviews, Total N=7	Total
State of the environment	9	1	2	12
Safety and security in BSR region	8	1	3	12
Attitudes of travelers / tourists	7	1	1	9
Conditions and trends of global economy	4	1	1	6
Leisure interests	4		4	8
Tourist destinations in areal development	3			3
ICT - digitalisation	2		2	4
Globalization	1	1		2

New drivers mentioned in Delphi and Tallinn workshop 2018	4			
Accessibility of services	1			1
Economic wellbeing	1		2	3
Accessibility	1		2	3
New ways of traveling: technologically changing opportunities				
Climate change				
New factors mentioned in interviews 2018				
Sharing economy			1	1
Sustainable development and responsibility			2	2
Energy efficiency			1	1
A big challenge to employ people			1	1
Overall employment of young people in Estonia			1	1
Total	41	7	23	71

Futures table for tourism, culture and services for leisure activities is presented below in Table 4.8.

Table 4.8. Futures table for tourism, culture, and services for leisure activities

Futures table – tourism, culture, and services for leisure activities				
Future images 2050	Sustainability above all!	Unlimited growth	Sustainability dilemma	Virtual reality
Attitudes of travellers / tourists	Positive attitudes towards decarbonisation, sustainability and responsibility among travellers.	Attitudes towards environment and sustainability are negative or careless.	Polarisation of opinions; e.g. some 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 a 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, globalisation	Good global economy enables global travelling and mass tourism.	Strong growth, fewer 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 travelling, 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 nature" trend among the young generation. Leisure interests in travelling in close sustainable destinations (in the vicinity of cities) "easy access tourism"	No need to travel because of virtual experiences.
ICT - digitalisation	Effective, unified ICT systems, digitalisation allows easy use of travel related data for e.g. planning, reservations, and information on the destination.	Traditional means of travelling, as "ICT" and "smart" have not developed. Unsustainable ways of travelling prevail.	Availability of different "smart" technologies; their usability and advantages have not been realised, 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 urbanised areas attracts tourists.	Development of new types of blue care, health services from the sea.
Tourist destinations in area development	Restrictions for tourists to enter certain conservation areas. Local people benefit from tourism.	Development of tourist hubs. Conflicts with local people.	Many smaller tourist destinations scattered to coastal areas.	Plenty of cultural heritage sites in 5D, virtual 3D models. Airbnb.

5 ASSESSMENT OF THE IMPACTS AND RELATIONS OF THE DRIVERS

Relations between the drivers were discussed at the scenario workshop in Helsinki only briefly because of limited time. They were not asked about in the 2017 Delphi questionnaire either, because the aim was to map the general views of panelists considering the drivers. However, the Helsinki scenario workshop participants' opinions were that blue economy sectors are integrated between each other and the presented drivers are connected. They also observed that there was not enough variation between the drivers. For example, global and regional economic trends could be merged, and global megatrends could be combined with those drivers that were mostly supported in Delphi.

It was noted that driving forces may be counteractive, and thus impacts are different for different blue economy sectors. A driver or its consequences may have variable effects on society, economy, or environment as a whole; for example, increased marine tourism may be good for the blue economy but bad for the sensitive environment.

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

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

In the 2018 Delphi and the Tallinn workshop, the consequences of selected main drivers were assessed regarding each blue economy sector. The results gave a more in-depth indication on the importance of drivers both for specific sectors and for the blue economy overall (the results are combined in the description of alternative future scenarios in chapter 6). The importance of drivers classified with PESTEL on different blue economy sectors has been assessed (see Table 5.1). Political drivers had the most mentions in the energy sector, as well as the blue bioeconomy and subsea sectors. In the maritime sector, economic drivers dominated, followed by technological drivers. Social drivers were considered the most important ones for the tourism sector.

Attitudes influence the manner in which the blue economy will be promoted by policies. Without positive attitudes, development will hardly take place, and on the other hand, attitudes can cause major impacts in many policies. However, it was projected that attitudes are likely to become more widespread in future, which will be reflected in the overall policy frameworks. The results will depend on the prevailing political climate. For example, attitudes towards the location of windmills on land have inhibited the development of wind energy; however, opinions towards offshore wind energy may be more positive. Attitudes also matter in the behaviour of individual people in their roles as consumers or tourists, or, for example, their opinions against

certain blue bioeconomy professions. Attitudes on tourism sector link with spatial requirements and different attitudes towards the environment.

Table 5.1. Drivers identified in Delphi-panel, workshop and interviews

	Energy			Maritime			Tourism			Blue bioeconomy			Subtotal, blue economy			Total, drivers
Drivers	DELPHI	WS	INTER-VIEWS	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		19	4	3	26
Conditions and trends of global economy, globalization	3	1	1	6	1	9	4	1	1	1	1		14	4	11	29
Cooperation / safety situation and stability in the Baltic Sea area	3			4	1		8	1	3				15	2	3	20
Environmental regulations, legal practises	6	1	2	8		3				8			22	1	5	28
Main energy options supported by energy and environmental policies	7	1	7										7	1	7	15
Fuels used in shipping (environmental policy)				5		1							5		1	6
Policies concerning the use of natural resources										10	1	2	10	1	2	13
Industrial policy	2												2			2
Clean tech innovations (for energy / maritime / blue businesses)	8	1	3	6						9	1		23	2	3	28
ICT, digitalization	2		2	3	1	6	2		2				7	1	10	18
Regional economic situation	3			4									7			7
State of the environment							9	1	2	7	5	1	16	6	3	25
Climate conditions				1									1			1
Transport routes				1		4							1		4	5
Leisure interests							4		4				4		4	8
Tourist destinations in aerial development							3						3			3
Globalisation							1						1			1
Ethical issues - interest on nutrition..										1			1			1
Attitudes towards blue economy as a profession										2			2			2
Urbanisation																
Total	41	5	16	40	4	24	38	4	13	41	9	3	160	22	56	238

Conditions and trends of global economy/globalisation was considered to have the most impact on the maritime sector, which was reflected in the results of the interviews. Globalisation affects maritime exports and imports, and the maritime sector fluctuates the most of the blue economy sectors. In addition, maritime regulation is more global compared to other sectors. In the field of tourism, globalisation affects where tourists come from. In the blue bioeconomy sector, global issues were discussed in the context of global markets for locally developed circular aquaculture systems and products.

Cleantech innovations had the most mentions of all drivers among the sectors of energy, maritime, and blue bioeconomy. Reflected with the results of Delphi and workshop 2017 on drivers for the blue economy, the results of sector-specific drivers strengthen the position of cleantech innovations as the most important technological driver. Innovations for cleantech was expected to have an impact on development of new energy modes, such as for the possibility to utilise wave energy in the Baltic Sea region. ICT or digitalisation was the most often mentioned factor in the interviews. These technological drivers have mostly an indirect link with Maritime Spatial Planning; however, automatisation would require attention on its impacts on fairways and ports. In addition, dedicated pilot areas such as Jaakonmeri were proposed within the

project area, too. Advanced digitalisation may link maritime more intensively with inland transport.

In the tourism sector, ICT and digitalisation enable searching information on prospective destinations globally, as well as booking and paying online. In the field of blue bioeconomy, cleantech was considered a backbone of sector's development: that would enable utilisation of sea-based biomasses, as well as a new kind of circular aquaculture, leading to development of more sustainable practices.

Environmental regulations, legal practices had the second most mentions in three sectors: energy, maritime, and blue bioeconomy. Environmental legislation and stricter demands were considered to force development of new solutions. In the tourism sector, "Environmental regulations, legal practices" was not listed as a driver, but there is an indirect effect from the regulations of other sectors. Co-operation between the authors representing different sectors has a strong effect.

The state of the environment was considered an important driver, in particular for tourism and blue bioeconomy. A good state of the environment was considered a key issue for maritime tourism, and it has a strong impact on the possibilities of the blue bioeconomy. With a new kind of aquaculture, it is possible to reduce the amount of the nutrients in the sea.

Of the drivers analysed in the sectors, urbanisation was presented only in the energy sector, but it had no mentions. This may reflect the fact that the Plan4Blue project area already is the most urbanised both in Finland and in Estonia.

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

6 ALTERNATIVE FUTURE SCENARIOS FOR BLUE ECONOMY SECTORS

There are different approaches to building scenarios based on futures table results (e.g. Majamaa 2010). For the Plan4Blue scenario process, the approach was based on values, as Blue Growth as a concept is based on socioeconomic sustainability and sustainable use of maritime regions (European Commission 2018a, Table 6.1). Attitudes are presented as variables for all the blue economy sectors, as the basic value of the scenarios is sustainability, and attitudes influence decision-making and reflect people's choices. As a probable future, we chose "virtual reality"—an extensively digitalised future and one of the global megatrends which will have considerable effect on all business sectors in one way or another. Digitalisation was also mentioned in many connections during the first phase of the scenario process. While estimated future changes have been presented separately in the beginning of each chapter describing a blue economy sector, the "sustainability dilemma" (i.e. business as usual) is not the same as experts' predictions but an elaborated version of an alternative scenario.

Table 6.1. The four alternative scenarios for the blue economy sectors.

THE FOUR ALTERNATIVE SCENARIOS FOR BLUE GROWTH IN THE SECTORS OF ENERGY, MARITIME, TOURISM, AND BLUE BIOECONOMY & SUBSEA			
SUSTAINABILITY ABOVE ALL!	UNLIMITED GROWTH	SUSTAINABILITY DILEMMA	VIRTUAL REALITY
The most desirable future regarding the sustainable uses of marine resources.	Worst case scenario	Continuation of the current state – business as usual, quantitative changes.	Extensively digitalised future with sustainable and unsustainable developments.

The alternative future images for the sectors of energy, maritime, tourism and blue bioeconomy and subsea are presented in Table 7.1 and the main pathways in Table 7.2-7.5.

6.1 General remarks regarding the building and contents of the scenarios

"Sustainability above all!"

The key to changing towards sustainability in the "sustainability above all!" scenario would be changing attitudes, both of citizens and political decision makers. Policy will, strong environmental leadership and legislation, and a global climate agreement were projected to lead to the "sustainability above all" scenario. Regional and local awareness should increase. The change would start with children, as they are the key to the future. In order to achieve and strengthen the goals on sustainability, the future scientists and decision makers should establish a solid base at school. Committing to pilot environmental solutions and enabling digitalisation with agile regulation will lead towards sustainability.

Faster changes in consumer behaviour may only follow major negative, even catastrophic, changes in environmental conditions or climate. One respondent considered that it would be difficult to see sustainability coming from 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.” Another respondent called for a general flat energy tax on every resident, company, and organisation, as soon as possible.

“Unlimited growth”

The aim of this alternative scenario was to present and remind participants of possible outcomes of negative, unsustainable developments. When the possibilities leading to negative developments are contemplated, they may be prepared for, and thus they might be avoided. In this scenario, awareness of environmental problems is low, and there is no co-operation between the countries and media. There will be no political will to lead society towards sustainability: no policies and commitments, no strategies with visions of sustainable economy, no environmental leadership, only short-term decisions and a lack of knowledge.

International agreements and commitments exist, but environmental legislation and its enforcement will weaken. 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. The status quo will lead to a path of least resistance—for example, traditional energy production. One reason was considered to be the “post-truth” ethos that has gained visibility in recent years. For example, there will be very creative applications of environmental impact assessments, and they do not have any impact on decisions. There will be no new conservation areas in the coastal and marine areas, although the existing ones may stay.

“Sustainability dilemma”

Weak political will on sustainability and not enough common will were mentioned as reasons for the “sustainability dilemma” scenario. Other reasons mentioned for the “sustainability dilemma” were international differences in the level of environment related policies and legislation introduced in the Baltic Sea Region states. For example, BSR states have different levels of environmental policies and legislation, some of them are moving on a more sustainable path, others less sustainable, and policies used to steer towards sustainable future are different. International agreements will not proceed due to geopolitical disputes. In this sense, the “sustainability dilemma” has the same kind of elements as the “unlimited growth” scenario, and, in fact, the former might lead to the latter.

Decision makers are unwilling to change old systems; young people are primarily interested in economic growth at the expense of environmental issues; there is no willingness to co-operate. Lack of knowledge prevails. Targets are not clear, and there is no commitment to piloting cleantech innovations. As one of the Delphi panelists stated: “Prerequisite is that environmental

attitudes in private, public, and industrial etc. sectors need to change/develop. Attitudes (mindset) have not changed. Damage to planet is not too visible yet. Some garbage in sea may look bad, but extinction of hundreds of species is not visible 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."

"Virtual reality"

In Delphi, this scenario was considered a bit of a science fiction scenario. Fast population increase was mentioned as one reason for development towards "virtual reality". Infrastructure and 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 distance working. Software development will be needed to support this; granting special resources for program support would also support the pathway towards "virtual reality".

6.2 Energy sector

6.2.1 "Sustainability above all!" scenario on energy sector

The attitudes will probably change in time as people realise that decarbonisation and reduction of emissions is needed to gain the good state of environment and to slow down climate change. Upheaval in energy production and consumption will be needed to reach the sustainable scenario. For that, energy-saving campaigns should be implemented. To enable lower energy consumption, companies could support customers with their products and applications, e.g. digital systems that survey energy consumption. Immediate political decisions will be needed to promote renewable energy. If electricity consumers become active partners, they will have more bargaining power, and energy companies will have to consider the wishes of consumers more.

On the other hand, energy-saving campaigns was not envisioned to have a strong enough effect, but "Sufficiently strong renewable energy growth objectives for 2030 and 2050 would change the situation, not individual trial-type projects". An environmental tax system was proposed, which would drive consumers vigorously to energy saving. It was also proposed that instead of other taxes, all government income should be collected from taxation of energy and natural resources. Implementation of this type of tax would lead people to start optimizing their systems and saving energy immediately, as energy would cost 2-3 times more for the end consumer and the business sector. Another proposal was that fossil, wood, wind, and other not clean or half-clean energy production techniques must be subject to an energy tax. The support mechanism for renewables should be ceased. Abolition of all subsidies to the fossil fuel industry, direct and indirect, was also proposed. Instead, there should be promotion of investments in sustainable energy for innovations in cleantech and smart grids.

The green energy sector will be strong, and science-based policy and incentives will be called for. Solar-hydrogen solutions, hydropower from natural rivers (similarly to Norway), and even nuclear energy will be the only supported energy sources. Support will also be dedicated to offshore wind; to non-commercial, unstable technology to mature the offshore wind power to the same extent as onshore wind power. Offshore wind farms will exist, but there will be a renewable energy mix, as other sources such as biomass would be used.

Photosynthesis by growing biomass or vegetation could be a major solution to remove CO_2 from the atmosphere, and the way to carbon-neutral energy. Decarbonisation should be seen as recarbonisation, i.e. recycling of carbon by renewables. The regulation on the inclusion of greenhouse gas emissions and removals from land use and forestry by, for example, EU's land use and forestry regulation (LULUCF) would give space for CO_2 removals. In addition, it was mentioned that emission allowance price seriously guides energy production.

In Table 6.2, one possible pathway towards "Sustainability above all!" regarding the development of wind energy, produced at Tallinn scenario workshop is presented.

Table 6.2. Pathway towards "Sustainability above all!" regarding the development of wind energy

Pathway towards "Sustainability above all!" regarding the development of wind energy
Soon there will be new innovations for saving energy; for example, personal energy calculators which promote responsibility of people and business. Steps will be taken towards sustainability: strong environmental policy and legislation will be introduced; new, stricter targets will be agreed on; and an environmental tax system will be introduced. States will develop hybrid grids. Starting in 2020, Pan-European energy auctions will be arranged. The high CO_2 price will promote sustainable development policy.
Compromise between nature conservation and wind power will be reached in the 2020s, which means that areas will be easier to approve for offshore wind energy. This will enable easier planning policy. New protected areas would exist only if there are data needed to establish them.
The 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 innovations for saving energy—for example, personal energy calculators which promotes people's own responsibility. Regional and local awareness also increases. States 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 starting in 2035; e.g. floating offshore wind farms, which will be located in the middle of the sea. The efficiency of windmills 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.
By 2040, no fossil fuels will be used anymore, but totally renewables, which may happen earlier because of increased prices. The negative attitudes towards wind energy have been changed and thus, for example, resistance against offshore wind power has ceased in Finland. New wind power areas are established, for example, in the Hanko region. Banned areas will still exist in the Sillamäe region on the Estonian side, for military reasons and because there is not enough wind. The military area between Loksa and Kunda would even expand. Building new windmills in Southeast Finland will have been ceased due to military security regulations.
In 2045, magic innovation technology: e.g. invisible wind turbines; technology avoiding collisions with bats and birds. There could be some multi-use platforms (MUPs).
In 2050, offshore wind farms would not be the only option; there would be a renewable energy mix, aside from wind, other sources such as biomass would also be used. Fuel from algae (biodiesel) would probably be further developed as there are some pilot projects already ongoing.

6.2.2 "Unlimited growth" scenario on energy sector

In the "Unlimited growth" scenario, attitudes will be careless, and continuation of global growth could lead to this scenario as the consumption of fossil energy would probably increase. Currently, fossil carbon has no price in international climate agreements. In this scenario, policy instruments will not be used in pricing carbon, or to introduce a "user pays" principal. Fossil fuels will be needed, as otherwise there would not be enough energy available.

In addition, the current infrastructure supports centralised energy 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 forests would reduce the need to use marine energy sources as renewable energy. Damaged infrastructure would lead to this, as the transportation of biomass from forests to energy production sites requires properly maintained road infrastructure, in particular in the Finnish countryside.

Nuclear power will continue to be used, and Hanhikivi nuclear power plant will be built in northern Finland. In Estonia, nuclear power is projected unrealistic, even though small-scale nuclear energy plants may change this. In Finland small-scale nuclear plants have been discussed recently. It was noted that in any case nuclear power probably will be a major part of energy production.

In the "unlimited growth" scenario, support will be granted for fossil energy and there will be less support or investments for renewable energy solutions or innovations. One Delphi panelist referred to the continuation of non-transparent tax, grant, support, and other EU-current financial systems, which "support energy and resource wasting, bureaucracy and irresponsible behaviour of organisations and persons". Cheap fossil energy will delay the change to renewable

energy modes. “Energy above all others” – attitude matters: there will be no common effort to reduce energy demand. Importance and use of pipelines will increase.

The current consumption-based attitudes and lifestyle will continue in this scenario. The popularity of air travel will increase and be available for the masses. Increasing tourist flows from China will continue without restriction, as tourism has become an important business sector, especially for Finland.

No energy production initiatives will be banned, and conservation decisions in some areas may be resolved. No new conservation areas will be established. Thus marine wind energy may have a strong position and reach strong growth. Better and extended grid (grid enforcement) will be implemented to enhance growth of wind energy. On the other hand, if nuclear and fossil energy were used as energy options, there would probably be no wind energy at all.

6.2.3 “Sustainability dilemma” on energy sector

Political situation in neighbouring area will lead to highlighting energy self-sufficiency, which will slow down development of alternate production and its promotion. Increasing energy efficiency and evening out production peaks (i.e. carrot and stick for the citizens by fiscal guidance) will aim to decrease emissions of fossil energy. Slightly modernised technologies will be used.

The economic reason given for this scenario was weak development of a global economy that has taken ground on development. ROI (return on investment) of smart and green energy investments will not be enough to overtake fossil energy. In addition, CATNAP (i.e. cheapest available technology narrowly avoiding prosecution) attitude will dominate. If this type of attitude prevails, no one will invest more than the minimum to meet the requirements. It was noted that “If the 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“.

Political budget support and financial systems will be too much linked, corrupted, and not interested in 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”. The advantage of fossil fuels and one of the reasons for their continuing use is that they can be stored and used easily, although they are imported energy.

6.2.4 “Virtual reality” scenario on energy sector

There were varying opinions on the energy demand in an extensively digitalised society. In Delphi 2018, 43% of respondents agreed with the statement “In a fully digitalised society, consumption of energy increases”, whereas 29% disagreed (Figure 4.2). All energy modes will be needed if energy consumption increases because of the fast-paced developments of information technology and digitalisation. For example, strong governmental support for virtual solutions

will lead to further digitalisation and thus, increase in energy demand. There will be no time to pay attention to energy consumption of new technologies. One interviewee noted that the need for electricity will increase, for instance, due to replacing fuels in transport with electricity. On the other hand, development of technological solutions should also increase energy efficiency and possibly even decrease the energy demand. If increasing digitalisation and developments in information technology decrease people's mobility, the consequence could be a decrease in energy consumption.

Producers of new technologies may want to minimise energy consumption, for example, to extend battery life. Indeed, innovations in battery technology were mentioned as a black swan in the maritime sector. Another possibility is that people will consume much less, because the internet of things will monitor energy consumption of every device and place: "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."

If renewable energy is to be used more extensively, the energy grid would need to be partly renewed. There will be more energy interconnections and links. Importance of smart energy systems will increase; however, a major breakthrough in smart grids will be needed, which will provide compelling evidence of their operationality. A large grid of a decentralised energy system will be "the best battery". A strong focus on renewable energy technology at universities and colleges will be needed. Electrification will be taken extremely far, but that does not mean emission-free production of electricity.

Full or extensive digitalisation will enable development of massive energy efficiency, but systems will be very vulnerable to disturbances. This fact may be exploited in an uncertain global situation. Extreme dependence on energy will mean that society will be at a standstill from time to time, until systems are operational again.

New unknown technologies or current technologies will be developed further, e.g. safer and cleaner nuclear energy. Wave energy is not possible with current technologies, but major innovations in future will change the situation, for example, with technologies which will make short waves more efficient.

6.2.5 Assessment of the alternative scenarios on energy sector

Co-operation with other sectors and between other countries was considered to lead to the "sustainable above all!" scenario, which would be reachable only through global agreements. Timing of such a change depends on a global wake-up call and US policies. The possibility of decarbonisation was considered smaller globally than in the Baltic Sea Region.

The draft of the "unlimited growth" scenario received critical comments at the Tallinn workshop. A scenario based only on fossil fuels was considered too caricatured, even though the purpose of this scenario is to propose worst case development regarding sustainability. However, using

old technologies and lacking innovation in the midst of economic growth was not considered logical. Workshop participants argued that the scenario might be realised, but that it is unrealistic as it is just a combination of existing threats. More "smart thinking", innovation, and positive development was called for into this scenario. Notably, a majority of respondents in Delphi did not propose any changes to the scenario, but "unlimited growth" was even understood to be similar as a "business as usual" scenario.

The "sustainability dilemma" scenario had firm support both from Delphi panelists and at the Tallinn workshop. It was described as "Description of the current state of affairs". It was also commented on as follows: "It's happening already today, balancing between different interests", and "I can imagine this scenario being realised if we do not actively work against it. If we just continue the way the development is heading, this is where we land".

In the Tallinn workshop, the participants of the energy working group assessed that the future in 2050 would be something between scenarios "sustainability above all!" and "virtual reality". If no decisions supporting sustainability have made, it may lead to "unlimited growth" or to continue the business as usual as in the "sustainability dilemma" scenario. The responses reflect that the policies and support system would in these cases be 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 support energy and resource wasting, bureaucracy, and irresponsible behaviour of organisations and persons".

The use of renewable energy in different scenarios

In Delphi 2018, most of the panelists considered that attitudes towards renewable energy will turn mainly positive, and renewable energy will be the main energy option used in 2050 (See Figure 4.2). These opinions would indicate development towards the "sustainability above all" scenario. These views are supported by current strategies that aim to decarbonisation and use of renewable energy. By 2050, the EU aims to reduce greenhouse gas emissions by 80-95% compared to 1990 levels (European Commission 2018b). In addition, the aim of the EU is to meet half of the EU's energy needs by 2030 by using renewables, with a clear increase from a 29% share of renewables in 2014 (European Commission, 2016). Figures from Finland and Estonia on meeting the aims of the EU towards the use of renewable energy support this trend. The share of renewables in Finland is currently 39.3% and in Estonia 28.6% (Eurostat 2017).

The potential of renewables was reassessed in interviews. It was considered optimistic to say that nuclear power would be completely excluded and replaced by renewable energy in 2020-2030. While nuclear energy connects with the "unlimited growth" scenario, it may also be one of the main solutions to fighting climate change, depending on political and public support (cf. Ea Energy Analyses / BASREC 2012). It was forecast that bioenergy is a big renewable energy source in Finland, hydropower has been installed in Finland, and wind power has a good chance to increase the share of renewables. The greatest opportunities are seen in liquid biofuels and biogas (Ministry of Economic Affairs and Employment 2017). The use of renewable energy

sources was anticipated to increase as energy storage measures are developed. In Estonia, oil shale will probably be used more for producing oil than for electricity. One interviewee noticed that discussion of energy production at sea should not be limited to offshore wind and the 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 population. However, no big industrial wind farms are allowed to be established in protected areas.

The share of renewables from marine sources is miniscule. Marine energy and especially wind energy are not the focus of the Finnish government's report the National Energy and Climate Strategy for 2030 (Ministry of Economic Affairs and Employment 2017), nor listed in the actions to achieve EU 2030 objectives (Energiateollisuus 2016). However, it is also anticipated that the marine wind power produced in Finnish sea areas will increase in the 2020s and will be 19% of total energy production in Finland by 2030 (Granskog et al 2018). The BASREC report (Ea Energy Analyses 2012) states also that wind power will likely "play a much greater role" in the Baltic Sea Region in the future, both onshore and offshore. In Estonia, the Renewable Energy Action Plan Until 2020 foresees investment support for marine wind farms, but only for those installed by 2020 (Majandus- ja Kommunikatsiooniministeerium, 2010). The Estonian National Development Plan of the Energy Sector until 2030 (ENMAK 2017) aims to reach the targets without additional national support, under open electricity or heat market conditions.

In the "sustainability dilemma" scenario, balancing between fossil fuels and renewables would be possible with some expansion of wind energy, but not as much as 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 already possible to be deployed into the market (WindEurope 2018). For wave energy, recognition in national and international strategies would enable bigger projects and ensure a part in international electricity production.

Political aspects of energy production

Co-operation with other blue economy sectors and between other countries was considered to lead development to "sustainable above all!" scenario, however, the scenario as such would be reachable only through global agreements. According to the Estonian energy sector development plan, until 2030 and probably even until 2050, part of the energy used will be fossil fuels; however, the efficiency of using such fuels will be doubled. The 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 were 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 aims to achieve energy independence by 2030 (ENMAK 2017), which may affect decisions on wind energy onshore and offshore.

Most of the panelists thought that digitalisation supports the use of smart energy systems (Figure 4.2), which could lead to the 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 (2018a) lists concrete steps with which Finland promotes uptake trends in global developments, such as augmented reality, the Internet of Things, automation, artificial intelligence, and Machine-to-Machine communication. Thus in Finland, there is strong governmental support for virtual solutions, which was noticed in the context of the “virtual reality” scenario.

According to a business interviewee, the period of the next 10 to 20 years seems to be 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 the development of electricity prices and market prices, for example.

6.3 Maritime cluster

6.3.1 "Sustainability above all" scenario

Technological solutions, ICT, and digitalisation will lead to sustainability in shipping. 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 of fuel is an advantage for all; however, it is not expected to be realised with renewables as their current share is low.

Policy will lead to a global climate agreement and strong legislation proposing zero emissions will be introduced. Legislation of zero emissions would lead to sustainable marine transport in a very short time, one to two decades. In 2040 no fossil fuels would be allowed to be used in shipping, only renewables (e.g. algae, electricity, waste and garbage as energy source). Biofuels of good quality will be used in maritime traffic and in vehicles for heavy cargo—electric cars are also more common. Favourable attitudes regarding environmental performance will be created in a few years’ time by increasing and strengthening the environmental content in maritime education.

Most vessels will be autonomous, and use is apparently planned on main routes only. In addition to automatisation of vessels, it is expected that automatisation of cargo management will continue to increase and develop further. Automatisation will increase efficiency in loading and unloading cargo. In 2045, ports and ships will use their waste to the maximum level (circulation). New pilot areas for new innovations, testing of cleantech, and shipbuilding are established both on the Finnish and Estonian sides of the project area.

Innovations are needed; resources need to be allocated to science and technology, along with platforms for collaboration. Wind will be used as an energy source; modern sail systems are available already (Viking Line 2018). Co-operation on all levels will be required (e.g. governments and industry in developing business models), and it will lead to sustainability in one decade. “Baltic Sea Region needs to be globally competitive, it cannot act alone”.

6.3.2 “Unlimited growth” scenario on maritime sector

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. All opportunities will be available and no licenses will be needed. Reasons for “unlimited growth” are, for example, the following: regulation is not ambitious, or global, and economic growth or cargo is not regulated at all.

There will be more industrial production, vessels will be bigger, and people will buy more. Traffic will be increasing in the Baltic Sea because of the increase in global consumption. The growth of newly developing areas (e.g. in Africa) will lead to the need for raw materials and/or products from the Baltic Sea Region. Heavy maritime traffic will cause more traffic on the east-west directed deep water route in the Gulf of Finland and will lead to port congestion. But there will be no interest in optimizing ship traffic.

No support for programmes in sustainability in universities will lead to fewer innovations and less involvement. In addition, the strong interests of fuel companies will be in the way of developing more sustainable shipping. Thus there are no determination or investments to pilot environmental solutions. Parochialism and insufficient support for science and technology prevail. Possible changes in geopolitical situations and geo-economics may also change maritime transport.

The maritime cluster has concentrated into certain regions, in which there is also ship building, cleantech production, etc. Ports will not be able to respond to growth, and there are limits for port area growth because of urbanisation (i.e. conflicts between ports and housing development). More land infrastructure will be needed. The use of ports will be so intense that not all ships can enter the port at same time. Anchoring sites would be in front of all main passenger and cargo ports. In Finland, the northern ports also have capacity to grow, and they are connected with the railways. In Estonia, growth will take place only in the northern part of Estonia. Most of the key fairway areas in the project area will expand. The use of deep water navigation will increase in this scenario.

In the “unlimited growth” scenario, the 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 the 2040s, multifunctional ships will be built to carry new cargo types, such as waste. Ports will specialise in different cargo types. There will be more services on the sea (offshore) by 2050. Strong interests of fuel companies are in the way of development towards sustainability. Passenger transportation to the port of Hanko, and maybe to Paldiski, was estimated to increase.

6.3.3 “Sustainability dilemma” scenario on maritime sector

The “sustainability dilemma” scenario was considered for there being no common line with decision makers, which leads to no new laws on sustainability being established. Conflicts between decision makers will confuse companies, which therefore do not dare to invest fully in renewable fuels and in more modern and environmentally friendly ships. On the other hand, political systems and businesses are too closely linked. Profit drives the business; both politicians and businesses are beneficiaries of the current system, hence there will be no motivation to change the system, leading to weak environmental leadership. Environmental friendliness and

sustainable operations are assets, though their advantages will be simultaneously measured with strictly economic criteria. Not strong enough policies will be combined with too low a rate of return on investment (ROI) for green fuel investments. Investments in sustainable development will be low.

There is not enough economic growth to be able to keep up with environmental targets: if economic growth is not stable, all eyes will be on 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. A good bet is passenger vessels, in particular if the particle emissions, etc. of renewables will be kept in control.

Renewable energy will be used where it is reasonable and possible to use. Different alternative fuels, e.g. LNG, will be taken into use where it is technologically reasonable to replace marine diesel. In addition, 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 otherwise. In "sustainability dilemma", environmental friendliness and sustainable operations are assets, though their advantages are simultaneously measured with strictly economic criteria.

6.3.4 "Virtual reality" scenario on maritime sector

Extensive digitalisation and local production such as 3D printing, and optimisation of logistics will drastically reduce the need for maritime transport, except raw materials. However, half of the Delphi panelists disagreed as to the decrease in travelling, for example: "Digitalisation may have decreased cargo traffic, but simultaneously people and goods are moved between countries on record levels. Far Eastern tourists increase the number of travellers, and they want to experience the fresh climate and beautiful islands in the Baltic Sea. Automatisation combined with digitalisation has done a breakthrough in all transport and in travel chain. Because of this, vessels' turnaround times are short and traveling efficient.

Unmanned vessels will operate on the Gulf of Finland and Archipelago Sea according to this scenario. Traditional shipping routes will be autonomous (a Finnish pilot of intelligent fairway "Älyväylä" was mentioned with regard to first steps towards autonomous routes). The internet of things will be applied in cargo handling. However, one of the panelists imagined the future development of autonomous shipping also as follows: "Unmanned vessels were trialled, 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."

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 will take place in close co-operation 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 pace and with no problems. Renewal of business models will take place as the digitalisation and automatisation proceed.

6.3.5 Assessment of the alternative scenarios on maritime sector

The "sustainability above all!" scenario was accepted by the majority of Delphi panelists and workshop participants, similarly to "unlimited growth" and "sustainability dilemma". If comparing these scenarios with strategies, the aims of current strategies are concordant with the increase in sustainability while they still aim at economic prosperity. The main strategy paper is the EU's White Paper on Transport (EU 2011), the aim of which is to shift 30% of the cargo load from roads to water transport by 2030 and 50% by 2050. In the scenario process, possible new roles and services linked with globalisation were expected for ports, which has an impact on port planning (e.g. spatial impacts). Potential synergies exist between cargo, passengers, energy; within land-sea interaction linking to other (sustainable) transport modes. Cleantech may locate in ports or in their vicinity; maintenance of equipment, for instance, 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 emphasises smooth functioning of Finnish imports and exports year-round and a 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 as well safety and sustainable targets, and in addition, development of transit traffic. Estonian Marine Policy (see e.g. Majandus- ja Kommunikatsiooniministeerium, 2011; Marine Systems Institute at Tallinn University of Technology , 2015) covers also aspects of marine tourism and the marine construction sector. Objectives include increasing the competitiveness of subsectors of shipbuilding and repair as well as recreational craft building and repair. Notably, the Estonian Marine Policy and Transport Development Plan (Ministry of Economic Affairs and Communications Estonia, 2018; Majandus- ja Kommunikatsiooniministeerium, 2017) include also quantified targets, e.g. for cargo in different segments, as well as monetary targets.

These strategies have sustainable aims, but they do not include clear targets towards sustainability. However, maritime transport is regulated with international and global regulations, in particular IMO's Marpol convention. In April 2018, IMO adopted an initial IMO strategy on reduction of Green House Gas (GHG) emissions from ships. The aim is to reduce total annual GHG emissions by at least 50% (from 2008 levels) by 2050. It also includes reduction of CO_2 emissions per transport work, as an average across international shipping, by at least 40% (compared to 2008) by 2030, pursuing efforts towards 70% by 2050 (IMO 2018a). In the Baltic Sea, restrictions are tighter, and the respondents of Delphi considered that stricter environmental regulation for shipping will continue, supporting cleantech production. However,

even though the growing world economy and increasing consumption increases traffic on the sea in the "unlimited growth" scenario, one of the Delphi panelists asked "is it credible that environmental regulations would be loosened?"

Automatisation of ships

Views of panelists reflected uncertainty about the future, which is most remarkable in "virtual reality" scenario. One of the Delphi panelists noted that the "virtual reality" scenario would realise in 30 years' time. Another Delphi panelist stated: "I am not sure if full and complete digitalisation with unmanned ships would help. Perhaps it would be a 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." Related to the "virtual reality" scenario in the maritime sector, IMO is the main regulator for international maritime transport; without IMO, there would be no progress in automatisation 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). Topics include how to proceed with regulatory scoping exercises, the human element, safety, security, interactions with ports, pilotage, responses to incidents, and protection of the marine environment, for different levels of autonomy. An interdivisional maritime autonomous surface ships taskforce within the IMO Secretariat will be formed to support the "work on this important matter." (IMO, 2018b).

Decisions on transport routes and corridors important for future transport

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 is positive regarding financing for development projects on the corridor. Helsinki is located on another transport corridor, as 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, the 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, the Port of Tallinn belongs to the core network and the Ports of Paldiski and Sillamäe to the comprehensive network (see e.g. European Commission 2018c, country fiches)

The corridors are linked with the probability of Helsinki-Tallinn tunnel. According to the Helsinki-Tallinn tunnel task force (Ministry of Transport and Communications 2018b), 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 extending 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 the growing importance of the Arctic policy (European Commission, 2018d). This is an indication of realisation of the tunnel as there would be landside connection also in Finland.

6.4 Blue bioeconomy and subsea resources

6.4.1 "Sustainability above all" scenario in blue bioeconomy and subsea sector

Local bioeconomies and fish and aquaculture production within a circular economy will be predominant in this scenario. It was pointed out that global economy could also be sustainable. Ministries in Finland and Estonia are already supporting the development of multitrophic aquaculture. In the Tallinn workshop, the economic potential of the local circular aquaculture system in the global markets was identified in "Sustainability above all!" scenario. "And suddenly we have the massive ecologic (and economic) value!"

Adaptation and mitigation of climate change will be important, as climate change will continue even though all GHG emissions would be cut down. However, the state of the Baltic Sea environment will be improving or reach a good state. Decreasing pollution of the environment and declining eutrophication will be enabled in multitrophic aquaculture (e.g. circular fish farming), as for example, mussels or algae are consuming nutrients that are released in fish farming. Cleantech and innovations in blue bioeconomy technologies will be required to gain multitrophic aquaculture, as well as efficient interaction of different "smart", ubiquitous technologies. Aside from fish farming, subsea mineral extraction will also apply the principles of circular economy.

Floating offshore aquaculture will be developed towards a closed system. The availability and price of energy along with targets to reduce greenhouse gases will regulate closed circuit aquaculture. Currently the circular economy has an impact on the blue economy; however, one panelist argued that it is difficult to anticipate whether this enthusiasm will last until 2050. The new aquaculture sites will be established in the coastal waters off Helsinki and Tallinn.

Leadership and commitment

Strong environmental leadership and innovation will be required to promote the "sustainability above all!" scenario. For example, a panelist proposed a radical change to the tax system. Commitment that permeates the whole community will be needed, such as a willingness by both fishermen and decision makers to develop sustainable models that allow fishing in the region to remain without harming the environment. Greater efforts will be needed in schools to develop

understanding of circular economics and ecosystems. The goal will be "sustainable world in 2050, all actors contribute to it all the time."

Two new key fishing areas along the Estonian coast, one to the west and one to the east, were added in this scenario in Tallinn workshop. These areas will also have two sites for industrial fishing.

In the Tallinn scenario workshop, the working group created a future pathway according to which the Helsinki-Tallinn tunnel will be built. In addition, two new routes/tunnels were drawn to connect Hanko-Paldiski and Loviisa-Kunda. Cargo and passengers will be moved via these tunnels and new routes or airborne. This will allow the establishment of a huge open aquaculture area in the Gulf of Finland, which will not only include traditional fish farming, but also, for instance, zooplankton and fishing.

One panelist's view of the future was the following: "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."

6.4.2 "Unlimited growth" scenario on blue bioeconomy & subsea sector

Attitudes towards the environment and sustainability are careless. Subsea resources and fish stocks will be overexploited in the project area. For example, new key fishing areas will spring up evenly along the Estonian coast, industrial fishing will be increased along the western side of the Estonian coast, and on the east coast, new fish farming and aquaculture sites will be established. The production and availability of the blue bioeconomy will be decreased because of the unsustainable management of coastal and aquatic environment as well as increasing human pressures.

In addition, aquatic flora and fauna suffer from deterioration of the environment and the negative consequences of climate change, which will change the aquatic ecosystems. The existing Marine Protected Areas are hard-pressed because of increasing human activities, and suffer from the deterioration of the entire Baltic Sea ecosystem.

The pathway to this scenario starts from awareness of the current problems of sustainability. But there will not be environmental education or focus on sustainability in schools. Thus the future decision makers lack basic knowledge on environmental issues and blue bioeconomy. EU legislation and strategies as well as international agreements affect environmental activities only until 2030, and afterwards big changes will take place as there is no strong leadership to take care of sustainability issues.

Accelerating economic development and a continued economic boom will increase the flow of tourists in the Baltic Sea Region, influencing also unsustainable overexploitation of the sea space in many ways. Building the Helsinki-Tallinn tunnel will increase sand and gravel extraction, and there will be more fish farms on the coasts. In addition, a new tunnel from Tallinn to somewhere between Inkoo and Helsinki will be constructed.

Until 2040 population is increasing in the project area, and at the same time the state and quality of the environment is decreasing. Political tensions emerge due to the resource crisis by 2040. In 2050, resources and stocks are heavily overexploited.

6.4.3 "Sustainability dilemma" on blue bioeconomy & subsea sector

People are aware of environmental problems and their impacts on the blue bioeconomy, but still, old technologies are used instead of innovative systems. Old customs and consumer habits prevail. One of the hindrances to the use of new technologies is their high price. Depth and ice conditions may also hinder more extensive introduction of floating platforms.

Conflicts about sea use continue. Small measures address environmental impacts despite concerns and sea pollution. Currently there are no big conflicts on the Gulf of Finland sea area, as the pressure to exploit the sea areas is small.

Weak environmental leadership and no innovations supporting sustainability for the blue economy will lead to this scenario. The price of new technologies continues to be high. In addition, there will be no common-level focus on implementation of the circular economy. The Baltic Sea Region states will proceed at different paces regarding their operations to develop sustainable blue economies and to protect the fragile marine ecosystem.

6.4.4 "Virtual reality" scenario

All components of the virtual reality scenario were considered to exist already nowadays. Aquaculture will flourish in this scenario. Huge technological leaps will be taken, such as autonomous offshore fish cages. There will be, for example, self-moving aquaculture platforms that move according to environmental conditions and demand for fresh fish. During the winter, they will sink under the ice cover. Several platforms will be maintained from one large vessel as the platforms move to the service vessel. Zero-emission innovations will make it possible for aquaculture to locate on marine conservation areas. Environmental legislation will be changed so that in fish farming, instead of the current location-specific permits, moving platform permits can be granted.

Development of the "virtual reality" scenario needs new solutions from information technology, and building of new business models. Business and enterprise will take risks, making risk investments with the support of EU funding. The focus will be on digital solutions in universities

and colleges, and research funding should be aimed at digital development. The prevailing attitude and concern on the state of marine environment, with legislation which on the one hand guides the operations and on the other hand restricts unsustainable operations, would create a multitude of new enterprises to consider more sustainable modes of operation to exploit marine ecosystems.

Most of the focus is on the individual, not on the society and the environment. Everything will be "open source", and thus the development will be faster and possible for everyone. Investment and innovation opportunities in the blue bioeconomy will be promoted widely in the society to make actors in other sectors interested. Digital communities will be easier to motivate to make statements. According to a Delphi panelist, "the trend will be towards a more practical oriented digitalised world from the present 'mantra' type of belief. No digitalisation unless it will provide added value. This will happen bit by bit as people gather understanding." One possible pathway towards "virtual reality scenario" is presented at Table 6.3.

Table 6.3. Pathway towards "virtual reality" scenario

Pathway towards "virtual reality" scenario
2018-20: Digitalisation proceeds and information technology solutions are developed. Business and enterprise will take risks. EU funding will be applied and provided for experimental projects and for risk investments. New products and service models will be built. Actors involved will be aquaculture enterprises, scientists, and engineers.
2020 – 2025: Environmental legislation will be changed so that permits to moving platforms can be granted, and sensors and satellites monitoring the platforms will be introduced
Between 2030-2035 it will be possible to produce "sustainable and effective aquaculture and different products, with no emissions! " According to experts, another possibility is shellfish and mussel farming in rivers to filter the water.
In 2050: effective and sustainable aquaculture will prevail, and many different products will be available; not only fish but medicine, for example, and algae products.

6.4.5 Assessment the alternative scenarios on blue bioeconomy & subsea sector

The main aspects of the "sustainability above all!" scenario were accepted by Delphi panelists and participants of the Tallinn workshop: "The only remaining factor not agreed in sustainability is the time span and pace. This is very dependent on the technical innovations." This scenario was anticipated to require technological leaps, and for this reason the opinion was that to some extent the sustainable scenario is already happening (e.g. autonomous offshore fish cages). The strategies support the aims of the "sustainable" scenario in general, but without clear long-term targets, the "sustainability dilemma" scenario and business as usual operations may continue in the blue bioeconomy sector.

The “sustainability dilemma” scenario was considered to lead towards the “unlimited growth” scenario. Reasons for this were considered to be lack of co-operation between countries and lack of sharing knowledge and common views for sustainability. The commitments to environmental agreements will last for 10 years, but gradually the scenario “unlimited growth” will be reached. It was also mentioned that disagreements between younger and older generations could arise in future: “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.”

The reasons for development towards “unlimited growth” were debated. Lack of leadership regarding environmental issues was mentioned as a main reason leading to the “unlimited growth” scenario: “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 co-operation. Decision makers are not educated on issues related to blue bioeconomy.” Currently, the environmental regulations seem to work, and there are positive prospects regarding the improvement of water quality. Deterioration of the aquatic environment or catastrophic events could turn the positive development back in a negative direction? Diseases and eutrophication are big problems affecting the fish farming industry. Negative effects may culminate sometime in the future, if, for example, the closed circuit systems were not taken into use.

The national level strategies of Finland and Estonia include clear targets—only, however, until 2020/2022. Estonian aquaculture strategy (Tallinna Ülikool, Eesti Maaülikool, 2013) sets high targets for Estonian aquaculture production: to achieve more than a 50% share of the Estonian internal market and a more than 5 million Euro export of aquaculture products by 2020. This means an 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 a starting point of production of 870 tonnes in 2017. According the sources identified in (Pohjola et al, 2018a), there is no functioning marine aquaculture in Estonia, although some test pilots are ongoing. In the Finnish aquaculture strategy (Maa- ja metsätalousministeriö (MMM) 2014), the target is that Finnish aquaculture would grow from the 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).

Quickly developing aquaculture

In the Tallinn workshop, the “virtual reality” scenario was considered to be happening quickly within just a few years. 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”. The year 2050 was considered excessively far for the draft future image storyline. 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. In this case, the panelist doubted that the situation would change in the next decades.

In the "virtual reality" scenario, aquaculture is doing well. There is good closed-circulation technology development and good potential. The 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 of the Baltic Sea region as a testbed, such as mentioned in the context of adaptation to maritime environmental regulations in the context of stricter sulphur regulations. Aside from the "virtual reality" scenario, cleantech is linked to development of the "sustainability above all!" scenario: "If we cannot solve/start cleantech innovations business/processes, to produce food, no sustainability or better quality of environment can be reached". Cleantech enables clean food production and a cleaner and healthier environment. Innovation was considered to have a strong impact on reaching the "virtual reality" scenario.

In EU's Blue Growth Strategy (European Commission 2012), aquaculture has been recognised as one of the five most potential blue growth areas, along with maritime and coastal tourism, marine energy, marine mineral resources, and blue biotech. EU's Common Fisheries Policy (European Commission 2013a) aims to support the traditional European fisheries sector by making fishing sustainable and, simultaneously, to improve the economic and social situation of fishermen. In (Pohjola et al. 2018b) greater growth potential was identified in the development of aquaculture solutions and services.

The goal of the 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…" (European Commission 2013a, Article 2(1)). European Commission Vision 2030 (ECORYS 2017) points 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 (Pohjola et al. 2018b)

6.5 Tourism, culture, and services for leisure activities

6.5.1 "Sustainability above all" scenario in tourism, culture, and services for leisure activities

Changing attitudes of travellers towards sustainability was considered the key issue leading to a sustainable future pathway. Sustainability will be developed by co-operation of different blue economy sectors, requiring a holistic view. Improved security and strong environmental leadership will be necessary for sustainability. Better opportunities will be created for people to be personally more involved in environmental adventures. Strong Baltic Sea Region-wide co-operation, political will, and decisions at the regional level will further develop sustainability and sustainable solutions for tourists. However, sustainability in tourism depends also on sustainability of technologies and behaviour in other sectors of the economy.

To reach a clean environment in the Baltic Sea region, natural and cultural values can be enjoyed to the greatest extent possible, but at the same time, without damaging valuable natural areas. The responsibility of tourists will be emphasised: visitors should understand development of natural values in a sustainable way, and also understand the area's unique environmental values, their importance, and the importance of protecting them. People will help to create, restore, and protect ecosystems and protection areas—for example, tourists may be engaged to rebuild ecosystems as nature workshop events. Tourists will be active in creating the nature that they want to experience in the future. More effective ways for waste handling in natural areas, garbage management, and new sea-cleaning technologies in the mass tourism areas will help reduce littering.

Joint marketing will actively promote sustainable tourism. More information in different languages will be available locally. An open and participatory way to develop the destination will be implemented: the needs of local people will be heard, channels of influence will be created for them, and local people will define their own living environment and relation to traveling. Responsible marketing and building a brand will be based in reality and not, for example, on an image of the past (ref. Sami; image of old reindeer management and current management with motor sledges versus contradictory expectations of the tourists).

Different new technologies will enable much more extensive information on the destinations via augmented reality. Information and promotion will be available digitally and through IT solutions as much as possible. Services and infrastructure will be developed in co-operation between regional areas and between different parties in the same region to create smart packages that attract tourists. Packages including mixed activities could be, for example, organised hiking in natural areas with organised activities to sights, adventure parks, nature reserves, etc. According to Delphi panelist "Tourism has become a strong backbone of Finland's national economy. Joint understanding has been reached in 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 into a well-known product of service-export/concept." One possible pathway towards "Sustainability above all!" is presented at Table 6.4.

Table 6.4. Pathway towards "Sustainability above all!" scenario

Pathway towards "Sustainability above all!" scenario
2018-2020: Grassroots 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 urbanisation. 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.

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

A self-absorbed society with no interest in nature or cultural values will prevail. Sustainable tourism policies and regulations will be lacking. Growth of mass tourism will be fast in the region, including ecologically sensitive places, such as the Finnish archipelago areas. There will be no conservation areas anymore, or they will fail in achieving their conservation goals. Cultural heritage and all environmental values will be ignored. Cultural heritage sites will be lost. Tourism will be very intensive everywhere and will cause pressure on nature.

The Finnish archipelago areas will be used very intensely. Massive privatisation of shorelines in Finland and Estonia will take place. Regulations will not guarantee free shoreline laws anymore; people will be able to approach shoreline and build as close to the sea as they want. Increasing environmental damage will be caused by intensive tourism and climate change. "Low prices; lack of regulations; lack of knowledge".

Short-term profit will be attained, and people will not think about the future or sustainability. Rich and wealthy "can do anything". New restaurants and hotels, as well as services related to them, will be established. Strong growth will lead to increasing mass tourism and environmental damage. Vulnerable areas will suffer, and littering will get worse. There will be no more guest harbours. The ecologically sensitive areas and areas valuable for ecotourism will not be taken into account any more in leisure boating. Eutrophication will increase.

Attitudes will not value nature. Attitudes towards the environment and sustainability as well as local residents are careless. Unsustainable ways of travelling will prevail. Clear water will become important and rare.

All the different planned transport options will be realised; the Helsinki-Tallinn tunnel will be built, and there will be artificial islands. At first, tourism will increase. There will be a lot of different cruise ships and routes, and, for example, fishing tourism. Later, tourism will start to decline because of the deterioration of the environment. One possible pathway towards "unlimited growth" is presented in Table 6.5.

Table 6.5. Pathway to "Unlimited growth" in tourism

Pathway to "Unlimited growth" in tourism
All the different planned transport options will be realised. In 2025, Rail Baltic has been built. In the beginning, tourism will increase. There will be a lot of different cruise ships and routes, and, for example, fishing tourism. Later, tourism will start to decline because of the poor state of the environment.
The 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 and Tallinn. Artificial islands (linked with tunnel) near Tallinn, casino island, etc.
Unlimited growth leads to building of 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 with no limitations will cause frequent boat accidents and oil spills.
Limitations due to pollution and environmental damage will be accepted; tourists accept that the sea and the entire environment are not clean.
In 2050, white nights and dark days. Drinking water is imported. People use protective suits to go into the water. Extreme weather, climate tourism (refugees). Many conflicts between people

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

The tourism industry will develop but without co-operation between different parties. There will be no common goal. Global tourism will be increased. Tourists will have different likes; various means of travelling will be used and different destinations will be visited. Concern about the impact of tourism on the environment will prevail, but there will be a lack of environmental leadership and preparedness for the rise of tourist flows.

Different smart technologies will available but they are not user-friendly. Weak environmental leadership, lack of knowledge and information, as well as too-cheap travel will characterise tourism. Weak digital skills, poor preparedness, and restricted possibilities of companies reacting fast to constantly changing global user needs will affect tourism negatively. Joint "tourist efforts" and acts to promote tourism will be lacking. Unique tour organisers and entrepreneurs will compete fiercely with each other without co-operation. Many applications will be offered but they are "arty-crafty" styled.

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

People will travel less, preferring to experience destinations at home with augmented reality. Encouragement and support will be available for projects that develop various types of virtual services. 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 digitalisation will lead to development of virtual 3D models of sites (augmented reality). Knowledge, resource-efficiency, concerns on sustainability will take place in 20 years, according to a Delphi-panelist. Internet of things (IoT)—objects will be more extensively connected. Avatars will be used extensively, as well as expanded memories and emotions. In 2050, plenty of cultural heritage sites will exist also in 5D modes. People will experience, for example, virtual tours around the Baltic Sea. Old cultural values will be forgotten, and they will be overshadowed by the new. Change in family models will affect tourism. One possible pathway towards "virtual reality" is presented in Table 6.6.

Table 6.6. Pathway towards "virtual reality".

Pathway towards "virtual reality"
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 such as military action or 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 an 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.

6.5.5 Assessment of the alternative scenarios in tourism sector

The strategies and action plans identified indicate development towards scenarios "sustainability dilemma", or "unlimited growth", which the experts consider to lead towards an unwanted, unsustainable future, and possibly even towards "virtual reality". The passive attitudes of this region were considered a reason for this type of development: the tourism industry in the project area will only respond to global needs of tourism and will not take action with their own hands. On the other hand, maritime targets and regulations on sustainability and reduction of emissions affect, for example, cruise tourism.

First, unlimited growth may take place

A reason mentioned for "unlimited growth" was that it has not been prepared for 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 in coming and witnessing the damages. Too much power has been given to market forces—the fast increase in the number of tourists has been considered a good means to survive for the desolate 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. In the main tourist attractions, restaurants and hotels were estimated to create increased pressures on nature in the future.

The social aspects of tourism and impacts on the life of the local 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 travellers 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 centres and locals cannot afford to live there."

It was mentioned that digital skills and preparedness are weak in companies, but travel is already digital, and this trend intensifies further. One panelist considered that it is not possible to refrain from constantly developing technology and content to be more user-friendly, because traveling is an extremely big business opportunity now. The problem now, and probably also in the future, is that traveling is 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.

Virtual tourism in the end of the road?

According to the experts, virtual tourism was estimated to increase by 2050, but extensive digitalisation would not be the only reason for the "virtual reality" scenario. "Unlimited growth" was assessed to lead to the "virtual reality" scenario: if most of nature was deteriorated, tourists will accept that the sea and the entire environment is not clean. The traditional tourist experience in nature would be replaced by digital and virtual means.

A "virtual tourism" scenario was considered unpredictable, and there were some doubts among the Delphi panelists: "A clearly undesired future is that travellers would not travel any more but explore the destinations virtually." This was considered unlikely, even if it is possible, because human encounter is one of the most important experiences of traveling. One panelist believed that this type of "future vision of traveling" is farther away than 2050 and will take place when intensive actions to restrict emissions may be necessary and more easily accepted. In other words, "virtual tourism" would be a result of the "unlimited growth" scenario, but before that, in the coming decades, we would see a huge tourist wave around the world, when the travellers from the Far East rush to the west. In the near future, vast masses in China and India will reach such a standard of living which allows people travel around the world.

One of the Delphi panelists considered the "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 the "sustainability dilemma" scenario. Another statement was that tourism is not considered our problem. It was assessed that if there were flat energy and resource taxes on every person, company, service, and product, price would adjust the flow of tourism to sustainable level.

Restrictions as part of sustainability

Restricting certain areas from tourism was discussed by Delphi panelists and in the Tallinn scenario workshop. There is a dilemma: to avoid sensitive areas and use other areas more intensely or plan maritime spaces with mixed uses (including buffer zones)? To sacrifice some areas for mass tourism in order to protect other areas? Some opinions were for regulation and control of tourism activities in vulnerable natural areas, and application of systems to stay in such areas only with a competent guide or more environmental inspectors. Actually, virtual reality instead of 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 travellers willing to come to BSR, that it has been needed to restrict the number 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 from 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 on 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 a different way than restrictions; investments may be directed, for example, to keep a destination for nature/ecotourism. Conflicts in the project area were identified at the coastline between summer cottages and free shoreline by the Tallinn workshop.

Policies affecting tourism

In the tourism sector, the EU has emphasised 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. The 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 (Maritime Affairs 2016). Tourism and the maritime sector interact and link with IMO's MARPOL regulations to reduce the 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 (ECORYS, S.Pro 2017) aims to respect capacity limits of destinations, discussed in the context of the "sustainability above all!" scenario. Sectoral policies' impact on 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.

In Finland, theme-based tourism (linked with "individualism") and food tourism are supported in specific tourism programmes (Pohjola et al. 2018 b). Current tourism product development relies on diversification, and global trends such as well-being and demand for nature stimulate markets (Pohjola & De Andres Gonzalez 2018). Different industries may move to other parts of the world, but tourism is inherently regional. It can be combined with regional needs, e.g. aging, often, elderly people stay in the area and thus, for example, floating nursing homes were suggested in the 2017 Helsinki workshop. There are aims and targets on increasing the number of tourists—for instance, in Estonia, the goal has been set to increase the tourism sector by approximately one-third even by 2020 (Ministry of Economic Affairs and Communications Estonia 2015).

7 SUMMARY OF THE BLUE GROWTH SCENARIOS

7.1 Summary of the future images

The short narratives of each business sector, the future images are presented in Table 7.1 below.

Table 7.1. Futures images of blue economy sectors

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 cluster	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.

BLUE ECONOMY SECTOR	SUSTAINABILITY ABOVE ALL!	UNLIMITED GROWTH	SUSTAINABILITY DILEMMA	VIRTUAL REALITY
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 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-exploitation of subsea resources.	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 bioeconomies and the subsea.

7.2 Main pathways to futures images

The main pathways to futures images are presented in the tables 7.2.-7.5. below.

Table 7.2. Main pathways to the future images of the 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”	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 7.3. Main pathways to the future images of the maritime cluster

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 7.4. Main pathways to the future images of blue bioeconomy and subsea resources

Blue bioeconomy and subsea resources	
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. multitrophic 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.

Table 7.5. Main pathways to the future images of 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?

8 REFERENCES

Aldred R (2011). From community participation to organizational therapy? World Café and Appreciative Inquiry as research methods. Community Development Journal 46/1, 57–71.

Aguilar F J (1967). Scanning the Business Environment. The Macmillan Company, New York. 239 p.

Baltic LINes (2016). Shipping in the Baltic Sea – Past, present and future developments relevant for Maritime Spatial Planning. Project Report I. 35 p. Available at https://vasab.org/see-the-report-shipping-in-the-baltic-sea

BaltSea Plan (2011). BaltSea Plan Vision 2030: Towards the sustainable planning of Baltic Sea Space. Available at: http://www.baltseaplan.eu/index.php/BaltSeaPlan-Vision-2030;494/1

Carlsson-Kanyama A, Carlsen H & K-H Dreborg (2013). Barriers in municipal climate change adaptation: result from case studies using backcasting. Futures 49, 9-21.

Ea Energy Analyses (2012). Energy Policy Strategies of the Baltic Sea Region for the Post-Kyoto Period – focusing on electricity and district heating generation. Prepared for BASREC. Available at http://basrec.net/wp-content/uploads/2013/09/Post-Kyoto-Main-report-final-030512.pdf

ECORYS (2012). Blue Growth Scenarios and Drivers for Sustainable Growth from the Oceans, Seas and Coasts, Maritime Sub-Function Profile Report Short Sea Shipping. Available at https://ec.europa.eu/maritimeaffairs/publications/blue-growth-scenarios-and-drivers-sustainable-growth-oceans-seas-and-coasts_en

ECORYS (2013). Study in support of policy measures for maritime and coastal tourism at EU level, Final Report produced for DG Maritime Affairs & Fisheries. Available at https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/docs/body/study-maritime-and-coastal-tourism_en.pdf

ECORYS, S.Pro (2017). Towards an implementation strategy for the sustainable blue growth agenda for Baltic Sea region. Available at https://publications.europa.eu/en/publication-detail/-/publication/60adf799-4f19-11e7-a5ca-01aa75ed71a1

Energiateollisuus (2016). Älykkäillä investoinneilla kohti tavoitteita. Available at https://energia.fi/files/1212/KEIS_infograafi_2016.pdf

Estonian National Development Plan of the Energy Sector until 2030 (ENMAK 2017). Available at https://www.mkm.ee/en/objectives-activities/development-plans

European Commission (2011). The white paper 2011. Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system. Available at https://ec.europa.eu/transport/themes/strategies/2011_white_paper_en

European Commission (2012). Blue Growth. Opportunities for marine and maritime sustainable growth. COM 494 final. Available at https://ec.europa.eu/maritimeaffairs/publications/blue-growth-opportunities-marine-and-maritime-sustainable-growth_en

European Commission / EUNETMAR (2013). Study on Blue Growth, Maritime Policy and the EU. Strategy for the Baltic Sea Region. Final report. Available at https://webgate.ec.europa.eu/maritimeforum/en/node/3550

European Commission (2013a). Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy. Available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R1380

European Commission (2013b). Strategic Guidelines for the sustainable development of EU aquaculture - COM/2013/229 - Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (29/04/2013). Available at https://ec.europa.eu/fisheries/cfp/aquaculture_en

European Commission (2014). Commission staff working document. Sustainable Blue Growth Agenda for the Baltic Sea Region. Available at https://ec.europa.eu/maritimeaffairs/content/delivering-sustainable-blue-growth-agenda-baltic-sea-region_en

European Commission (2016). Commission publishes new market design rules proposal. 01 December 2016. Available at https://ec.europa.eu/energy/en/news/commission-publishes-new-market-design-rules-proposal

European Commission (2018a). Website on Blue Growth. Available at https://ec.europa.eu/maritimeaffairs/policy/blue_growth_en

European Commission (2018b). The European Commission calls for a climate-neutral Europe by 2050. Available at https://ec.europa.eu/clima/policies/strategies/2050_en

European Commission (2018c). Infrastructure - TEN-T - Connecting Europe. Available at https://ec.europa.eu/transport/themes/infrastructure_en; 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

European Commission (2018d). Connecting Europe Facility – Annex I (Transport). Extension of the Trans-European Transport Network (TEN-T). [7.6.2018]. Available at https://ec.europa.eu/transport/sites/transport/files/2018-06-06-cef-annex-memo.pdf

Eurostat (2017). Main tables. Available at http://ec.europa.eu/eurostat/web/europe-2020-indicators/europe-2020-strategy/main-tables

Granskog A, Gulli C, Melgin T, Naucler T, Speelman E, Toivola L, Walter D (2018). Cost-efficient emission reduction pathway to 2030 for Finland. Opportunities in electrification and beyond. SITRA studies. Erweko, Helsinki, Finland. 78 p.

HELCOM (2018). HELCOM Assessment on maritime activities in the Baltic Sea 2018. Baltic Sea Environment Proceedings No.152. Helsinki Commission, Helsinki. 253pp. Available at http://www.helcom.fi/Lists/Publications/BSEP152.pdf

Herkül K, Aps R, Kostamo K, Kotta J, Laamanen L, Lappalainen J, Lokko K, Peterson A, Varjopuro R (2017). The Gulf of Finland marine and coastal environmental vulnerability profile. Plan4Blue report. Deliverable T2.1.1. Available at http://www.syke.fi/en-US/Research__Development/Research_and_development_projects/Projects/Maritime_Spatial_Planning_for_Sustainable_Blue_Economies_PLAN4BLUE/Publications

IMO (2018a). UN body adopts climate change strategy for shipping. Briefing: 06 13/04/2018 Available at http://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx

IMO (2018b). IMO begins scoping exercise on autonomous vessels. 16/05/2018. Available at http://www.imo.org/en/MediaCentre/WhatsNew/Pages/Archive-2018.aspx

Kemiläinen M & A Keinänen (2016). Ympäristövaikutusten arviointi lainvalmistelussa: Parempaa säädösvalmistelua vai jo ennalta valitun keinon puoltamista? Ympäristöpolitiikan ja -oikeuden vuosikirja IX, 175–215.

Kuusi O, Kinnunen J, Ryynänen O-P, Myllykangas M & J Lammintakanen (2004). Terveydenhuollon tulevaisuus. Eduskunnan kanslian julkaisu 3/2006. In Finnish.

Linturi H & A Rubin (2011). Toinen koulu, toinen maailma. Oppimisen tulevaisuus 2030. Tulevaisuuden tutkimuskeskus, TUTU-julkaisuja 1/2011. 170 p.

de Loë R C, Melnychuk N, Murray D & R Plummer (2016). Advancing the State of Policy Delphi Practice: A Systematic Review. Evaluating Methodological Evolution, Innovation, and Opportunities. Technological Forecasting & Social Change 104, 78-88.

Maa- ja metsätalousministeriö (MMM 2014). Vesiviljelystrategia 2022. Kilpailukykyinen, kestävä ja kasvava elinkeino. Valtioneuvoston periaatepäätös 4.12.2014. Available at: http://mmm.fi/kalat/strategiat-ja-ohjelmat/vesiveljelystrategia

Majamaa M (2010). Ennakointimenetelmiä. Available at www.pilkahdus.fi/aineistopankki/download/675 (29.9.2017)

Majandus- ja Kommunikatsiooniministeerium (2010). Eesti taastuvenergia tegevuskava aastani 2020 (in Estonian). Available at https://www.mkm.ee/sites/default/files/taastuvenergia_tegevuskava.pdf

Majandus- ja Kommunikatsiooniministeerium (2011). Estonian marine policy 2012-2020. Available at https://www.mkm.ee/en/objectives-activities/transport/marine-sector.

Majandus- ja Kommunikatsiooniministeerium (2017). "Eesti merenduspoliitika 2012-2020". Rakendusplaan aastateks 2017-2020 ("Estonian marine policy 2012-2020" implementation plan for 2017-2020). Available at https://www.mkm.ee/sites/default/files/vvk_merpol_rak_2017-2020.xlsx.

Maness J (2012). Techniques, Methods & Applications in Futures Studies. EBSCO Publishing: eBook Collection (EBSCOhost). Copyright © 2012. The English Press.

Marine Systems Institute at Tallinn University of Technology, OÜ Alkranel (2015). Strategic environmental assessment of national development plan “Estonian Marine Policy 2012–2020” Draft report (12.10.2015). Tartu-Tallinn.

Maritime Affairs (2016). First Regional Cruise Dialogue for the Baltic, Copenhagen, 18 October 2016. Available at https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/2016-balticcruisedialogue_conclusions_en.pdf

Milestad R, Svenfelt Å & K H Dreborg (2014). Developing integrated explorative and normative scenarios: The case of future land use in a climate-neutral Sweden. Futures 60, 59-71.

Ministry of Economic Affairs and Communications Estonia (2 April 2015). Available at https://www.mkm.ee/en/objectives-activities/construction-and-housing-sector/tourism

Ministry of Economic Affairs and Communications Estonia (30 January 2018). Available at https://www.mkm.ee/en/objectives-activities/development-plans

Ministry of Economic Affairs and Employment (2017). Government report on the National Energy and Climate Strategy for 2030. Publications of the Ministry of Economic Affairs and Employment. Energy. 12/2017. Available at https://tem.fi/en/energy-and-climate-strategy

Ministry of Rural Affairs. Estonian Fisheries Strategy for 2014–2020 (2013). Available at https://www.agri.ee/en/objectives-activities/european-maritime-and-fisheries-fund-emff-2014-2020/estonian-fisheries

Ministry of Transport and Communications Finland (2018a). Turning Finland into the world leader in communications networks – Digital infrastructure strategy 2025 (in Finnish). Available

at https://www.lvm.fi/-/digital-infrastructure-strategy-turning-finland-into-the-world-leader-in-communications-networks-985076

Ministry of Transport and Communications (2018b). Helsinki – Tallinn tunnel task force. Report of the main findings. Available at https://valtioneuvosto.fi/hanke?tunnus=LVM039:00/2018

Nylén T & H Tolvanen (2017). Collection of contemporary Gulf of Finland maps for scenario building. Deliverable T3.5.1. of Plan4Blue project. For use in Delphi panel and scenario workshop. 25.4.2017. 10 p. Unpublished report.

OECD/ITF (2017). ITF Transport Outlook 2017, OECD Publishing, Paris. Available at http://www.oecd-ilibrary.org/transport/itf-transport-outlook-2017_9789282108000-en

Paas T, Tverdostup M & G Ashyrov (2017). Assessment of the role of marine industries in the region. Plan4Blue Draft Report, Deliverable T.1.3.1. Available at http://www.syke.fi/en-US/Research__Development/Research_and_development_projects/Projects/Maritime_Spatial_Planning_for_Sustainable_Blue_Economies_PLAN4BLUE/Publications

Paas T & M Tverdostup (2018). Assessment of the role of marine industries in the region. Plan4Blue Draft Report, Deliverable T.1.8.1.

Parkkinen M (2017). Insights on Futures of Baltic Sea Region Tourism 2030. Questionnaire results. 10th Baltic Sea Tourism Forum, November 2-3, 2017. Finland Futures Research Centre, University of Turku. 31 p.

Peabody M A & S Noyes (2017). Reflective boot camp: adapting LEGO® SERIOUS PLAY® in higher education. Reflective Practice 18/2, 232-243.

Pohjola T & O De Andres Gonzalez (2018). Report on the current status of blue economy business sectors and development trends of key sectors. Deliverable T1.1.1. of Plan4Blue project. Available at http://www.syke.fi/en-US/Research__Development/Research_and_development_projects/Projects/Maritime_Spatial_Planning_for_Sustainable_Blue_Economies_PLAN4BLUE/Publications

Pohjola T, Lähteenmäki-Uutela A, Kuris M, Nieminen L & O De Andres Gonzalez (2018a). Report on existing strategies of key maritime sectors and their future development trends. Deliverable T1.1.2. of Plan4Blue project. Available at http://www.syke.fi/en-US/Research__Development/Research_and_development_projects/Projects/Maritime_Spatial_Planning_for_Sustainable_Blue_Economies_PLAN4BLUE/Publications

Pohjola T, Lähteenmäki-Uutela A, De Andres Gonzalez O, Nieminen L & M Kuris (2018b). Report on blue economic potential, sectors strategies and development trends. Deliverable T1.6.1. of Plan4Blue project.

REFEC project. Available at https://www.refec.fi/

Rikkonen P & P Tapio (2009). Future prospects of alternative agro-based bioenergy use in Finland—Constructing scenarios with quantitative and qualitative Delphi data. Technological Forecasting & Social Change 76, 978–990.

Robinson J B (1988). Unlearning and backcasting: Rethinking some of the questions we ask about the future. Technological Forecasting & Social Change 33, 325-338.

Roose M, Nylén T, Uusitalo H & H Tolvanen (2017). Maps visualizing first versions of blue growth scenarios. Deliverable T3.6.1. of Plan4Blue project. Unpublished report.

Seppälä Y (2013). Tulevaisuustaulukkomenetelmä – Sovelluksena vanhustenhuolto. In Kuusi, O. Bergman, T. Salminen, H. (eds.). Miten tutkimme tulevaisuuksia? In Finnish. Vammalan kirjapaino, Sastamala, 137-153.

Tallinna Ülikool, Eesti Maaülikool (2013) Eesti vesiviljeluse sektori arengustrateegia 2014–2020. In Estonian. Available at https://www.agri.ee/sites/default/files/content/arengukavad/vesiviljelus-arengustrateegia-2014-2020.pdf

Tuominen A, Tapio P, Varho V, Järvi T & D Banister (2014). Pluralistic backcasting: Integrating multiple visions with policy packages for transport climate policy. Futures 60, 41-58.

Varho V & P Tapio (2013). Combining the qualitative and quantitative with the Q2 scenario technique – The case of transport and climate. Technological Forecasting & Social Change 80, 611-630.

Viking Line (2018). Fresh winds with the new rotor sail (press release 11.4.2018) Available at: https://www.vikingline.com/en/the-group/viking-line/vessels/ms-viking-grace/rotor-sail/

Vuorinen T (2013). Strategiakirja: 20 työkalua. Talentum, 1.painos. 284 p.

Webropol survey tool. Available at www.webrobol.com.

WindEurope (2018). Floating offshore wind energy: a policy blueprint for Europe. 1 October 2018. Available at https://windeurope.org/policy/position-papers/floating-offshore-wind-energy-a-policy-blueprint-for-europe/#

WWF (2010). Future Trends in the Baltic Sea. WWF Baltic Ecoregion Programme. Available at http://wwf.panda.org/wwf_news/?194764/Future-trends-in-the-Baltic-Sea

ANNEXES

Annex I

The Content of the Plan4Blue, Delphi round 1-2 Questionnaire in English. There were also identical Finnish and Estonian versions. First and second pages were for introduction, guidance and background data.

PAGE	QUESTIONS	ITEMS / SELECTIONS	Scales
3 IDENTIFICATION	Identification of panelist	Name	
4 PANELIST'S BACKGROUND	Gender	Male, Female	
	I consider my main expertise to be		< 10 years, 10-19 years, 20-30 years, > 30 years
	Years of work experience in the field of my main expertise	Several selections allowed: Environmental issues, conservation; Spatial planning; Marine transportation; Fishing; Societal issues; Energy; Aquaculture; Tourism; Culture and cultural heritage; Politics; Sub-sea resources; Offshore construction, shipbuilding; Sub-sea construction; Other, please specify	
	My primary employment is in	Government institution; Regional/county administration; Business support organization; Association; Non-governmental organization (NGO); Research and education; Municipality; National enterprise; International corporation	
	Regions I mostly operate within	National level in Estonia; National level in Finland; Kymenlaakso; Harju; Uusimaa; Southwest Finland; Lääne-Viru; Other	
	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 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?	Energy sector on the whole and its subsectors (Table 1); Other, please specify	Significant decrease ---, --, -, no change 0, +, ++, +++ significant increase, cannot say.

	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?	Maritime cluster; Blue bio-economy and subsea resources; Tourism and culture, services for leisure activities and their subsectors (Table 1); Other, please specify *2	Significant conflicts, some/ possible conflicts, both conflicts and synergies, some/possible synergies, significant synergies, no interaction, cannot say.
	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:		Open-ended question
6 ENERGY SECTOR ON A MAP	Mark the areas where you think that the production or other activities of the energy businesses should be increased or decreased, to claim new areas or to be totally banned. Yellow squares are the business locations of the energy sector on the base map. See map layers button on the upper right corner. If needed, please see guidance and background data from page 3.	Point symbols for the following: Energy sector on the whole and its subsectors (see Table 1).	For each subsector a symbol placed on a map a dialogue box opens and the direction of the change is selected: increase, decrease, claim new area, total ban.
7 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?	Maritime sector on the whole and its subsectors (Table 1); Other, please specify	Significant conflicts, some/ possible conflicts, both conflicts and synergies, some/possible synergies, significant synergies, no interaction, cannot say.
	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?	Energy cluster; Blue bio-economy and subsea resources; Tourism and culture, services for leisure activities and their subsectors (Table 1); Other, please specify *2	Significant decrease ---, --, -, no change 0, +, ++, +++ significant increase, cannot say.
	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:		Open-ended question
8 MARITIME CLUSTER ON A MAP	Mark the areas where you think that the production or other activities of the maritime cluster should be increased or decreased, to claim new areas or to be totally banned. Purple crosses are the business locations of the water transport sector on the base map. Green triangles are the business locations of the marine construction sector (offshore, shipbuilding). See map layers button on the upper right corner. If needed, please see guidance and background data from page 3.	Point symbols for the following: Maritime sector on the whole and its subsectors (see Table 1).	For each subsector a symbol placed on a map a dialogue box opens and the direction of the change is selected: increase, decrease, claim new area, total ban.
9 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	Blue bioeconomy and the subsea resources on the whole and its subsectors (Table 1); Other, please specify	Significant decrease ---, --, -, no change 0, +, ++, +++ significant increase, cannot say.

	and on sea (onshore and offshore), by the year 2050?		
	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?	Energy sector; Maritime cluster; Tourism and culture, services for leisure activities and their subsectors (Table 1); Other, please specify *2	Significant conflicts, some/ possible conflicts, both conflicts and synergies, some/possible synergies, significant synergies, no interaction, cannot say.
	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:		Open-ended question
10 BLUE BIOECONOMY AND SUBSEA RESOURCES ON A MAP	Mark the areas where you think that the production or other activities of the blue bioeconomy and the exploitation of the subsea resources should be increased or decreased, to claim new areas or to be totally banned. Red rings are the business locations of the blue bioeconomy and subsea resources on the base map. See map layers button on the upper right corner. If needed, please see guidance and background data from page 3.	Point symbols for the following: Blue bioeconomy and subsea resources on the whole and its subsectors (see Table 1).	For each subsector a symbol placed on a map a dialogue box opens and the direction of the change is selected: increase, decrease, claim new area, total ban.
11 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?	Tourism and culture, services for leisure activities on the whole and its subsectors (Table 1); Other, please specify	Significant decrease ---, --, -, no change 0, +, ++, +++ significant increase, cannot say.
	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?	Energy sector; Maritime cluster;Blue bioeconomy and subsea resources and their subsectors (Table 1); Other, please specify *2	Significant conflicts, some/ possible conflicts, both conflicts and synergies, some/possible synergies, significant synergies, no interaction, cannot say.
	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:		Open-ended question

12 TOURISM, CULTURE, SERVICES FOR LEISURE ACTIVITIES ON A MAP	Mark the areas where you think that activities of the tourism, culture and the services for the leisure activities should be increased or decreased, to claim new areas or to be totally banned. Blue stars are the business locations of the tourism, culture and leisure activities on the base map.See map layers button on the upper right corner. If needed, please see guidance and background data from page 3.	Point symbols for the following: Tourism and culture, services for leisure activities on the whole and its subsectors (see Table 1).	For each subsector a symbol placed on a map a dialogue box opens and the direction of the change is selected: increase, decrease, claim new area, total ban.
13 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; Cooperation between Finland and Estonia; Cooperation with Russia; Cooperation with international bodies of the Baltic Sea Region; The conflicts of the sectoral policies in EU; The conflicts of the sectoral policies in Finland; The conflicts of the sectoral policies in Estonia; Increased political tensions in the Baltic Sea.	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to Significant effect
	Environmental policies as a whole; Energy policies on the whole; Industrial policies (incl. fishing); Housing policy and land use planning; Traffic policies on the whole.	Slider switch, steps from -5 to 5 (starting from 0)	Negative effect (-5) to Positive effect (+5)
	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:		Open-ended question
	Legal drivers affecting the blue businesses		
	Employment laws in Finland; Employment laws in Estonia; Tax laws in Finland; Tax laws in Estonia; Environmental laws in Finland; Environmental laws in Estonia; Finland: Environmental regulations and permitting processes on the whole (incl. ISO-standards); Estonia: Environmental regulations and permitting processes on the whole (incl. ISO-standards); Tight orders of environmental permits;	Slider switch, steps from -5 to 5 (starting from 0)	Negative effect (-5) to Positive effect (+5)
	The weak preparation of the laws and regulations; Weak expertize and differing interpretations of regulations of the permitting officials; Intellectual property (e.g. patents)	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to Significant effect
	Please describe, if in your view there are some regulations that may have exceptionally strong		Open-ended question

	positive or negative effect on some business sectors by the year 2050:		
14 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; The depopulation of the remote districts; Ageing; Immigration;	Slider switch, steps from -5 to 5 (starting from 0)	Negative effect (-5) to Positive effect (+5)
	The increasing degree of education; The increasing polarization of population groups; Positive attitudes towards blue businesses; Negative attitudes towards blue businesses	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to 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:		Open-ended question
	Economic drivers affecting blue businesses		
	Aim to increase circular economy; Aim to low carbon society; The conditions and trends of global economy	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to Significant effect
	In your opinion, which businesses are affected most by the global economies, and in which way: negative or positive?		Open-ended question
	The conditions and trends of the regional economy in the Baltic Sea	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to Significant effect
	In your opinion, which businesses are affected most by the regional economies, and in which way: negative or positive?		Open-ended question
	Government support to the businesses ability to compete on the whole	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to Significant effect
	Please comment the negative or positive effects of the government support to the businesses in Finland:		Open-ended question
	Please comment the negative or positive effects of the government support to the businesses in Estonia:		Open-ended question
	In your opinion, are there any other economic drivers that may affect the blue businesses by the year 2050? Please mention those drivers:		Open-ended question
15 PESTEL-ANALYSIS: ENVIRONMENTAL AND	In your opinion, which environmental and technological drivers will probably have effects of the blue businesses of the project area? Please		

TECHNOLOGICAL DRIVERS	mark those drivers or add them the text boxes below.		
	Environmental drivers affecting the blue businesses		
	Eutrophication of the sea waters; Increasing precipitation; Decreasing salinity; Increasing temperatures; Sea level rise; The proliferation of extreme weather phenomenon; Invasive species; Disintegration of habitats; Chemicalization of the environment; Increasing amount of litter; Microplastic litter; Lesser and shorter winter ice coverage; Reduction of atmospheric emissions: CO2, SOx, NOx, black carbon; Reduction of water emissions: nutrients, oil, hazardous substances; Expansion of environmental protectorates	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to 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:		Open-ended question
	Technological drivers affecting the blue businesses		
	The development of the information and communications technology (ICT); Expanding internet of things (IOT); Increasing automatization; Increasing robotization; Clean tech innovations for blue businesses	Slider switch, steps from 0 to 5 (starting from 0)	From Insignificant effect to 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:		Open-ended question
	In your view, do the technological drivers have especially positive or negative effects on some businesses? Which businesses?		Open-ended question
16 THE LOCAL IMPACTS OF THE PESTEL DRIVERS	Some of the PESTEL drivers affect the entire project area. However, do you think some drivers may have exceptionally strong effect in some locations by the year 2050? Please mark those areas on the map. All the business locations from previous map pages are presented on the base map. See map layers button on the upper right corner. If needed, please see guidance and background data from page 3.	Point symbols for the following drivers: Political, Economic, Social, Technological, Environmental, Legal.	For each driver a symbol placed on a map a dialogue box opens with open-eended question: "Specify the ... driver", e.g. "Specify the political driver"

17 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?	Open-ended question
	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?	Open-ended question

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 contents of the Plan4Blue, Delphi round 3-4 questionnaire in English. The first and second pages were for introduction, guidance and background data.

PAGE	QUESTIONS	ITEMS / SELECTIONS	SCALES
Identification	Identification of panelist	• Name, organisation	
Panelist background	Expertise	• 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	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. What would be possible effects of these 3 drivers you have selected, in particular for development of wind energy and renewable energy sector?	• 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 – digitalisation • Clean tech innovations for energy • Environmental regulations and legal practices • Other variable not mentioned above, please specify	
	Future scenarios for energy sector. Time frame for all statements is year 2050.	• 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	Strongly disagree – Disagree – Slighty disagree – Neutral – Slighty agree – Agree - Strongly agree

		• 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.	
	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?		
	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?		
	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?		
	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?		
Futures of the maritime sector	Please choose the 3 most important variables which in your opinion would have a major impact on the development of maritime cluster in 2050. What would be possible effects of these 3 drivers you have selected, in particular for development of maritime transport?	• 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	
	Future scenarios for maritime cluster. Time frame for all statements is year 2050	• 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	Strongly disagree – Disagree – Slighty disagree – Neutral – Slighty agree – Agree - Strongly agree

		• 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	
	How 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 happen/occur?		
	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?		
	What would be the reasons for the "Sustainability dilemma" to realize on maritime sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?		
	How would the "Virtual reality" scenario - full 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?		
Futures of tourism, culture and services for leisure activities	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. What would be possible effects of these 3 drivers you have selected for development of the sector?	• 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	
	Statements on future scenarios for tourism, culture and services for leisure activities. Time frame for all statements is year 2050.	• 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 individualization 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.	Strongly disagree – Disagree – Slighty disagree – Neutral – Slighty agree – Agree - Strongly agree
	How the "Sustainability above all!" -scenario would 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?		
	What would lead to the "Growth unlimited" scenario in tourism, culture and ervices for leisure activities? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?		

	What would be the reasons for the "Sustainability dilemma" to realize in tourism, culture and services for leisure activities? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?		
	How would the "Virtual reality" scenario - full digitalized future – be reached in tourism, culture and services for leisure activities? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?		
Futures of the blue bio-economy and subsea resources	Please choose the 3 most important variables which in your opinion would have major impact on the development of blue bioeconomy and subsea resources? What would be possible effects of these 3 drivers you have selected for development of the sector?	• 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	
	Future scenarios for blue bioeconomy and subsea sectors. Time frame for all statements is year 2050	• 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	
	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?		
	What would lead to the "Growth unlimited" scenario in blue bioeconomy and subsea sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?		
	What would be the reasons for the "Sustainability dilemma" to realize in blue bioeconomy and subsea sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?		
	How would the "Virtual reality" scenario - full digitalized future – be reached in blue bioeconomy and subsea sector? Name 3-5 activities, events or decisions. When would you think these activities, events or decisions will happen/occur?		
	If you have any other comments regarding futures scenarios, or other feedback to the questionnaire, please add your views here.		

Annex V. Interview guide

Business questions

- How do you see the future of your business/your company …say in 2025-2030?
- 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)?
- Do you see an increasing or perhaps a decreasing trend in your business/in the business of this field?
- 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?
- Is it anything you would like to say about the future of your business or the business of this field?

A sector specific question:

Energy sector

- Please estimate the share of renewable energy / wind energy in 2030/2050 in Finland / Estonia.

Ports and ship owners

- How do you see the development of autonomous shipping in Gulf of Finland & Archipelago Sea Area?
- What would turn or change the currently increasing trend in shipping?

Blue bioeconomy and subsea resources (no sector specific question)

Tourism, culture, and services for leisure activities

- What kind of tourism do you see will be increasing / decreasing in the future?
- Should some areas be banned / closed from (mass) tourism?

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:

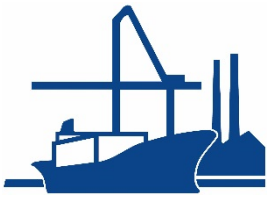
- What do you see as a future in cross-border networking in Gulf of Finland and Archipelago sea area in your sector? Between sectors? Between Estonia and Finland? Is it increasing? Decreasing? Why?
- What characteristics dominate the future networks in Gulf of Finland and Archipelago sea area? Why?

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?



Brahea Centre at the University of Turku
CENTRE FOR MARITIME STUDIES

FI–20014 TURUN YLIOPISTO

www.utu.fi/mkk

UNIVERSITY
OF TURKU