AUTOSHIP

Autonomous Shipping Initiative for European Waters

Project type:	**IA Innovation Action**
Start of the project:	**01/06/2019**
Duration:	**42 months**

[D7.1] Report with the surveys' findings and recommendations

WP n° and title	WP7 - Liability, Regulations and Socio-economic perspective study
Responsible Author(s)	Georgia Rentifi (USTRAT), Prof. Gerasimos Theotokatos (USTRAT)
Contributor(s)	Lars Andreas Lien Wennersberg (STF), Marco Molica Colella (PNO), Jason.McFarlane (KOGM), Siv Randi Hjørungnes (KOGM), Sverre Rye Torben (KOGM), Jerome Faivre (BV), Ann-Sofie Pauwelyn (DVW), Victor Bolbot (USTRAT), EAS, BLL, KOGD
Dissemination Level	PU

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 815012

DELIVERABLE INFORMATION

Status (F: final; D: draft; RD: revised draft):	F
Planned delivery date	31/05/2021 (M24)
Actual delivery date	31/05/2021 (M24)
Dissemination level: (PU = Public; PP = Restricted to other program participants; RE = Restricted to a group specified by the consortium; CO = Confidential, only for members of the consortium)	PU
Type: Report, Website, Other, Ethics	Report

DOCUMENT HISTORY

Version	Date (DD/MM/YYYY)	Created/Amended by	Changes
01	16/12/2020	Georgia Rentifi, Gerasimos Theotokatos	Drafting the report Developing structure
02	17/02/2021	Georgia Rentifi	Incorporating feedback from KOG
03	03/03/2021	Georgia Rentifi	Incorporating feedback from STF (Lars Andreas Wennersberg) and USTRAT (Victor Bolbot)
04	07/04/2021	Gerasimos Theotokatos	Revision Internal Review
05	27/05/2021	Georgia Rentifi	Final contents review
Final	31/05/2021	Carolina Salas	Final template check before submission

QUALITY CHECK REVIEW

Reviewer (s)	Main changes
Lars Andreas Lien Wennersberg (STF)	Quality, Consistency and Editing
Marco Molica Colella (PNO)	Quality, Consistency and Editing

DISCLAIMER AND COPYRIGHT

AUTOSHIP has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 815012. The same disclaimers as they apply to the consortium members equally apply to the European Union employees, officers and organisations.

REFERENCES TO THIS DOCUMENT - ACKNOWLEDGEMENTS

The material in this publication can be reproduced provided that a proper reference is made to the title of this publication and to the AUTOSHIP project (https://www.autoship-project.eu/). References to this document should use the following format, modified as appropriate to the publication where the reference appears:

Rentifi G., Theotokatos G., Wennersberg L.A.L, Molica Colella M., McFarlane J., Hjørungnes S.R., Torben S.R., Faivre J., Pauwelyn A., Bolbot V. "AUTOSHIP deliverable D7.1: Report with the surveys' findings and recommendations", Revision 1.0, May 2021.

The authors listed in the above citation have contributed material that has been included more or less verbatim in this report. The editor and contributors also acknowledge all other comments and inputs to this document from all participants in the AUTOSHIP project.

LIST OF CONTENTS

LIST OF ABBREVIATIONS AND DEFINITIONS

Abbreviation	Definition
AEGIS	Advanced, Efficient and Green Intermodal Systems
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
D	Deliverable
H2020	Horizon 2020
IWW	Inland Waterways
MOSES	AutoMated vessels and supply chain Optimisation for Sustainable short Sea Shipping
MUNIN	Maritime Unmanned Navigation through Intelligence in Networks
NGAS	Next-Generation Autonomous Ships
OPEX	Operating Expenditures
SSS	Short Sea Shipping
WP	Work Package
Short name	**Name**
PNO	Ciaotech Srl
KOGM	Kongsberg Maritime AS
KOGD	Kongsberg Digital AS
KOGN	Kongsberg Nordcontrol AS
STF	Sintef Ocean AS
USTRAT	University of Strathclyde
BLL	Blue Line Logistics
BV	Bureau Veritas Marine & Offshore
DVW	De Vlaamse Waterweg
EAS	Eidsvaag AS

TABLE OF FIGURES

TABLE OF FIGURES

EXECUTIVE SUMMARY

AUTOSHIP project is an H2020 funded project promoting autonomous ships in European waters focusing on two specific use cases, a Short Sea Shipping (SSS) general cargo vessel and an Inland Waterways (IWW) barge. The project objectives include thorough regulatory, societal, environmental, financial, safety, and security analyses to adopt and accept next-generation autonomous ships (NGAS). As part of the AUTOSHIP project, we conducted an online survey focusing on autonomous shipping.

This survey aimed to capture the understanding, perspectives and positions of all the involved stakeholders, including Operators, Owners, Designers, Builders, Technology Providers, Regulators, Flag States, Port Authorities, Seafarers, Environmentalists, Technical Advisors, Legal Advisors, Professional Societies, International Organisations, Research Institutions, Academia and Public. For this reason, we developed a questionnaire that consisted of nine essential questions and their sub-questions, respectively.

This deliverable depicts the followed methodology and the overall process that drove professionals' and public's general perspective, either involved in autonomous shipping or not, nurture. After acquiring their concerns, fears, reflections, and expectations with responding to the becoming real scenario named 'Autonomous Shipping', the report is an illustrative mean. The survey questions covered the topics of the expected impact and benefits for the shipping industry from the transition to autonomous shipping, the level of viability for the different ship types, the biggest challenges for the development of autonomous shipping including the technical limitations when designing and operating autonomous ships, and also the role of governments.

1. METHODOLOGY

This report is part of the AUTOSHIP project (AUTOSHIP, 2019) and its objective is to analyse the perspectives of some interested categories of stakeholders involved in the shipping industry and the public on autonomous shipping. In more detail, the aim was to capture the understanding, perspectives and positions of all the involved stakeholders, including Operators, Owners, Designers, Builders, Technology Providers, Regulators, Flag States, Port Authorities, Seafarers, Environmentalists, Technical Advisors, Legal Advisors, Professional Societies, International Organisations, Research Institutions, Academia and Public. An overview of the methodology followed to accomplish this objective is described in Figure 1.

Figure 1 Flowchart of the Methodology

1.1. MAPPING OF THE KEY STAKEHOLDERS

The starting point was selecting the critical stakeholders by utilising the AUTOSHIP WP9 deliverable D9.6 'Stakeholder Analysis Report' (Molica Colella M. et al., 2021). Then, various forms of questionnaires were designed to match the identified groups expertise to conclude to the final survey format. The Strategic Advisory Group's[1] comments were the first iteration to a unified questionnaire form.

1 Strategic Advisory Group is consisted of specially interested stakeholders that will give direct input to AUTOSHIP development strategies

1.2. SURVEY DESIGN

A workshop and discussion of the AUTOSHIP WP7 activities and the interactions with other WPs took place at SINTEF on 16-17 Oct 2019. During the discussion of the questionnaires and surveys that were held, it was agreed to design generalised questionnaires to target the various groups of stakeholders that would be available to be filled electronically by uploading the link in the project website, social media, or disseminating it to multiple contacts in the shipping sector.

Later, another workshop and discussion about WP7 activities and interactions with WP4 and WP5 took place in Ålesund, Norway, on 13-15 Jan 2020. The expected impact of the field surveys was elaborated, and the specific activities for developing the survey were identified.

1.3. SURVEY DISSEMINATION AND COMPLETION

Based on the feedback received from the partners the USTRAT customised the questionnaire for the general public with some specific segments matching the identified groups expertise and considering the current situation regarding COVID-19 finalised the form. Thereafter, the survey was set available online at the Mentimeter (Mentimeter, 2021) statistic tool website for two months during September-October 2020 until it reached the fineness point with the representative answers data sample of 170 responses.

The results analysis that followed was based on 142 responses, which were considered complete and authoritative, as there were no missing answers in them. Various spider diagrams were created to visualise the results (see Appendices A, B, F, H), and a presentation was designed accordingly to be given to the partners. The respondents were grouped as follows:

- Owners/Operators
- Designers/Builders/Technology Providers
- Regulators/Flag States/Port Authorities
- Legal Advisors/Technical Advisors
- Environmentalists/Professional Societies/International Organisations
- Research Institutions/Academia
- Seafarers
- Public

1.4. SURVEY RESULTS ANALYSIS

The gathered survey data were separated into pivot tables to analyse the results into small groups. The results of every question and sub-question were collated for each defined stakeholder group. (Figure 2). The calculated metrics used for each pivot table were the mean, median and standard deviation values2 (Jarman, 2013). Considering that the appropriate visual aid is significant for analysing the results, we created diagrams, such as the ones illustrated in Figure 3. All the numbers in these diagrams have been ordered from the lowest to the highest values, creating ascending lines, as this can lead the reader from the minimum and maximum values in a very convenient way. Also, a sheer red arrow marks the median value in the analytical per stakeholder diagrams. Various spider diagrams were developed to analyse each stakeholder's group values and the mean values of the groups as a whole (see Appendix A, B, F & H). Each number of the spider diagram (horizontal axis) depicts a response. The vertical axis of these plots illustrates the range of marks per sub-question which is 1-5 or 1-7 **(Figure 4).**

Job title	Research Institutions / Academia
Row Labels	**Environmental benefits**
163	1
165	2
171	2
166	3
164	4
168	5
167	5
172	5
Mean	**3.4**
Median	**4**
Stand. Dev.	**1.60**

Job title	**Environmental benefits**
Public	3.3
Seafarers	3.3
Research Institutions / Academia	3.4
Regulators / Flag States / Port Authorities	3.6
Environmentalists / Professional Societies / International Organisations	3.7
Designers / Builders / Technology providers	3.8
Legal Advisors / Technical Advisors	3.8
Owners / Operators	3.8
Mean	**3.6**
Median	**4**
Stand. Dev.	**0.24**

Figure 2 Some indicative pivot tables

2 The mean value is calculated by adding a group of numbers and then dividing by the count of those numbers. The median is the middle of the set of given numbers, and standard deviation measures the dispersion of a dataset relative to its mean; if the data points are further from the mean, there is a higher deviation within the data set. Thus, the more spread out the data, the higher the standard deviation.

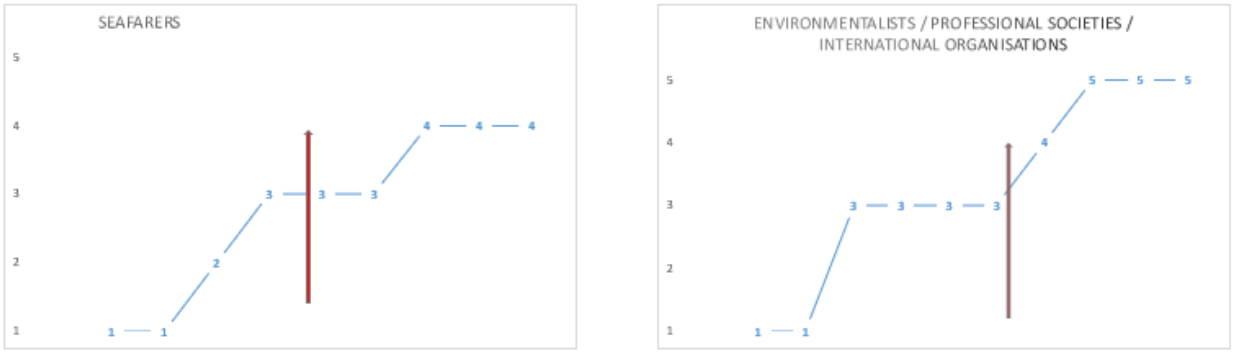


Figure 3 Indicative spider **diagrams**

Q3	Q2	Q4	Q7
1 Extremely Unlikely	1 Strongly Disagree	1 Strongly Disagree	1 No Effect
2 Unlikely	2 Disagree	2 Disagree	2 Minor Effect
3 Neutral	3 Somewhat Disagree	3 Neither Agree nor Disagree	3 Neutral
4 Likely	4 Neither Agree nor Disagree	4 Agree	4 Moderate Effect
5 Extremely Likely	5 Somewhat Agree	5 Strongly Agree	5 Major Effect
	6 Agree		
	7 Strongly Agree		

Figure 4 Indicative ranges of marks

The first presentation of the results to the partners was given on 02nd, December 2020 and a second more detailed was provided upon request by Kongsberg partners on 17th February 2021. In between this period, on 28th, January the survey was delivered again, but this time the audience was exclusively involved in various sectors related to autonomous shipping[3]. The responses received were 41, from which an analysis followed to the complete answers, which were 36. Some of these, perhaps, are included in the first survey.

What distinguishes the first survey from the second is that in the first survey the spectrum of participants is ranging between stakeholders involved in conventional or autonomous shipping and the public. While, in the second survey, the stakeholders that participated are engaged in autonomous shipping exclusively. Considering that the number of responses of the second survey is quite limited, and a detailed analysis might not indicate each stakeholder that voted, the process followed was to consider the second survey voters mostly as one group, the stakeholders involved in autonomy group. A comparative study between the two surveys is incorporated into the next section, 'Data analysis', covering only the questions in which

[3] The questionnaire was delivered and completed by the participants during the joint AUTOSHIP-MOSES-AEGIS workshop dated on 28th January 2021.

the results between the two surveys differentiate. Appendix G includes the detailed metrics analysis of Survey No. 2. However, Appendices E, F and H contain statistical information and diagrams relevant to Survey No. 2.

1.5. FINAL REPORT

This report is the complete result analysis product after incorporating the partners' feedback.

2. DATA ANALYSIS – STAKEHOLDERS SURVEY

This part includes a systematic analysis of the data gathered from the surveys. Appendices A, B, C and D include all the relevant and detailed tables and diagrams for each specific question from Survey No. 1. In contrast, Appendices E, F, G and H include the respective information for Survey No. 2. This section mainly provides the analysis of Survey No. 1.

Since Survey No. 2 appears to assimilate in the most points with Survey No. 1, there is also a reference to Survey No. 2 only where differences are observed. The results and main findings for each question are reported below in this section.

Question No. 1: Which of the following categories most closely matches your job title?

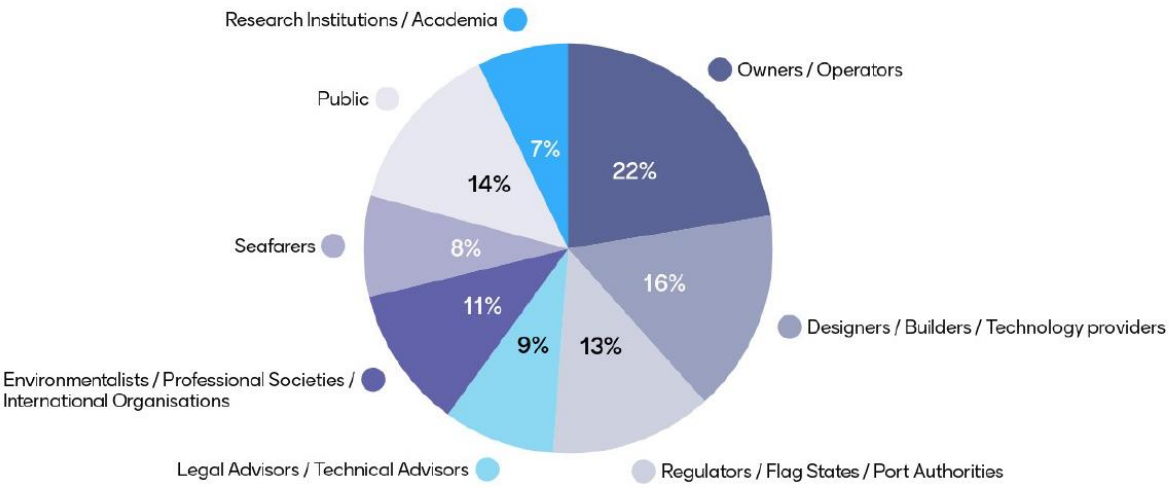


Figure 5 SURVEY No. 1: Stakeholders and public participants pie chart - percentages

The pie chart diagram shown in Figure 5 was selected to illustrate the stakeholders' groups and public proportion in Survey No. 1. This first question is introductory to the more detailed and specific questions to follow and set the basis for analysing the results. Respectively, the pie chart diagram shown in Figure 6 depicts the percentages of the involved in Autonomy stakeholders that participated in Survey No. 2.

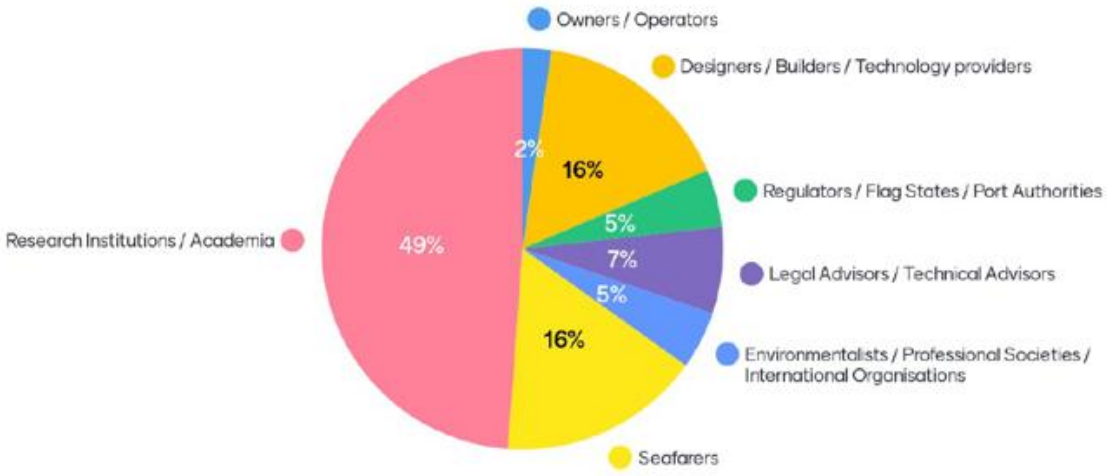


Figure 6 SURVEY No. 2: Autonomy stakeholders participants pie chart - percentages

Question No. 2: In my opinion, there is a need for the transition from conventional to autonomous shipping.

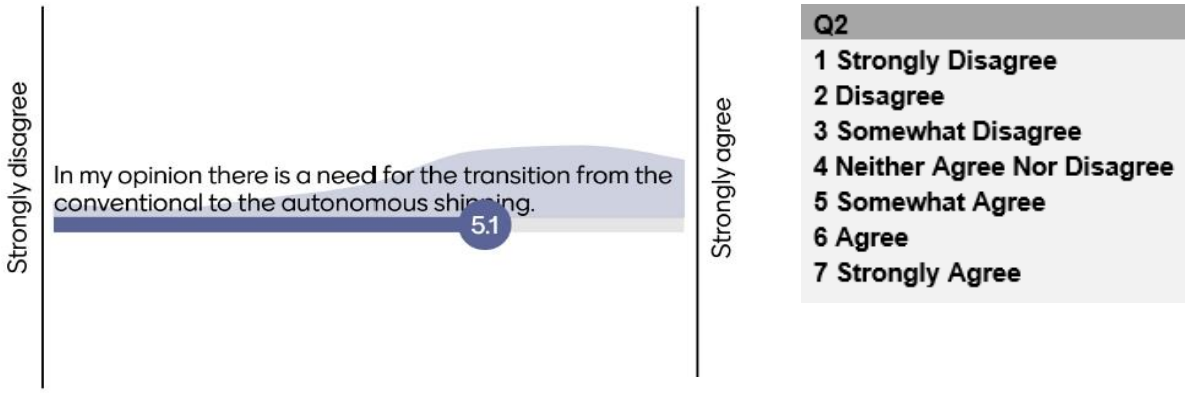


Figure 7 SURVEY No. 1: Question 2 - Mean ranking and ranking characterisations

Most of the responses to this question are positive. The majority of the stakeholders somewhat agree with the necessity for the transition from conventional to autonomous shipping. As it is inferred from the results presented in Table 1, the most pessimistic group is the Seafarers group, while those who believe primarily in this change are the Owners/Operators.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree
Mean	5.1	5.1	5.1	4.7	5.3	5.5	4.9	5.3	3.8	4.6
Median	5	5	5	5	5	6	5	5	5	5
Standard Deviation	1.65	0.53	1.43	1.79	1.42	1.96	1.58	1.20	2.15	1.92

Table 1 SURVEY No. 1: Question 2 - Metrics and Characterisation

In the Seafarers group, we can notice that those firmly against the transition equals the number of those who strongly agree (Figure 8). On the opposite, the Owners/Operators group argues for the transition by expressing either "Agree" or "Strongly Agree" (Figure 8). In general, we can notice a pretty normal dispersion with a few disagreements (Figure 9).

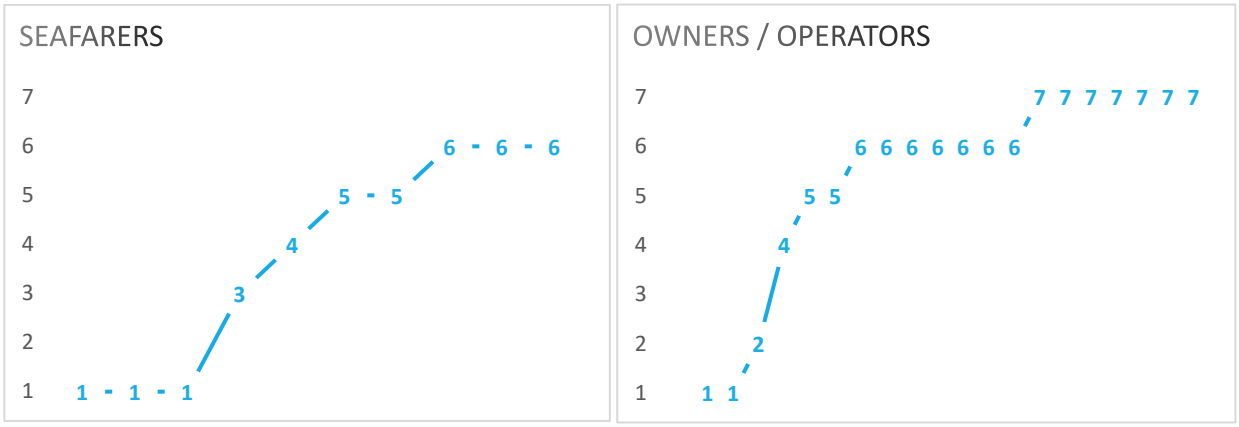


Figure 8 SURVEY No. 1: Question 2 – Seafarers' and Owners/Operators' responses

METRICS	STAKEHOLDERS								
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators	Flag States		
			Technology Providers	International Organisations			Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Strongly Agree	Agree	Agree	Somewhat Agree	Strongly Agree	Somewhat Agree
Mean	5.7	5.7	6.2	6.5	6.0	6.0	4.5	6.8	5.3
Median	6	6	6	7	6	6	5	7	5
Standard Deviation	1.20	0.77	0.84	0.71	0.00	-	0.71	0.50	1.30

Table 2 SURVEY No. 2: Question 2 - Metrics and Characterisation

Comparing the two surveys (Figure 9) it is clearly defined that the perspective of the respondents involved in autonomy is slightly more optimistic. Remarkably, the Seafarers group in Survey No. 2 gave the highest ranking. Generally, in Survey No. 2, the participating groups agree with the transition, whereas in Survey No. 1 are more conservative but partially agree with the transition from conventional to autonomous shipping as the most responses are between "Somewhat Agree" and "Strongly Agree".

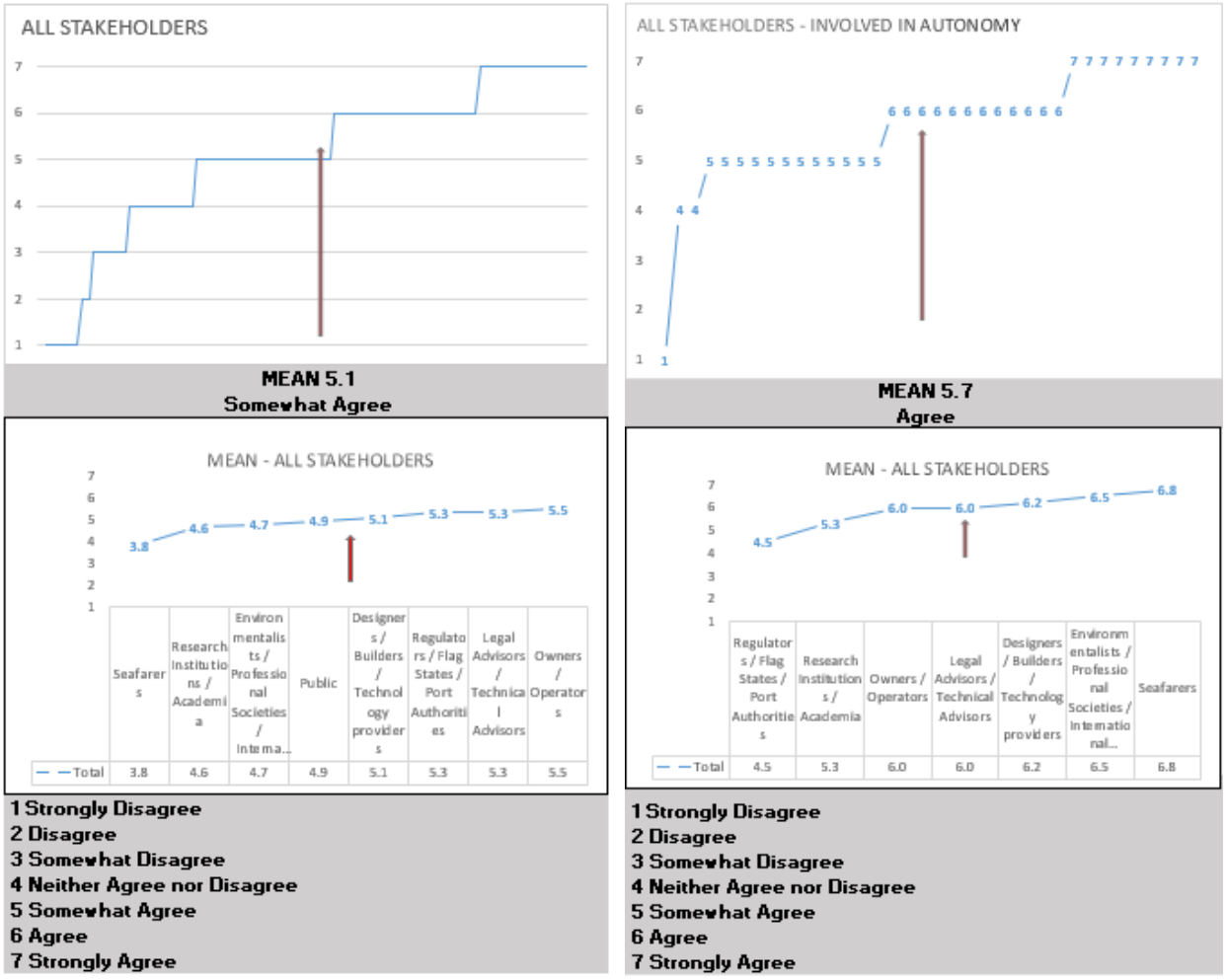


Figure 9 SURVEYS No. 1 and 2: Question 2 - Overview

Question No. 3: Which would be the benefits from the transition to autonomous shipping; financial, environmental and social benefits, increased safety, added resilience in case of major worldwide disruptions

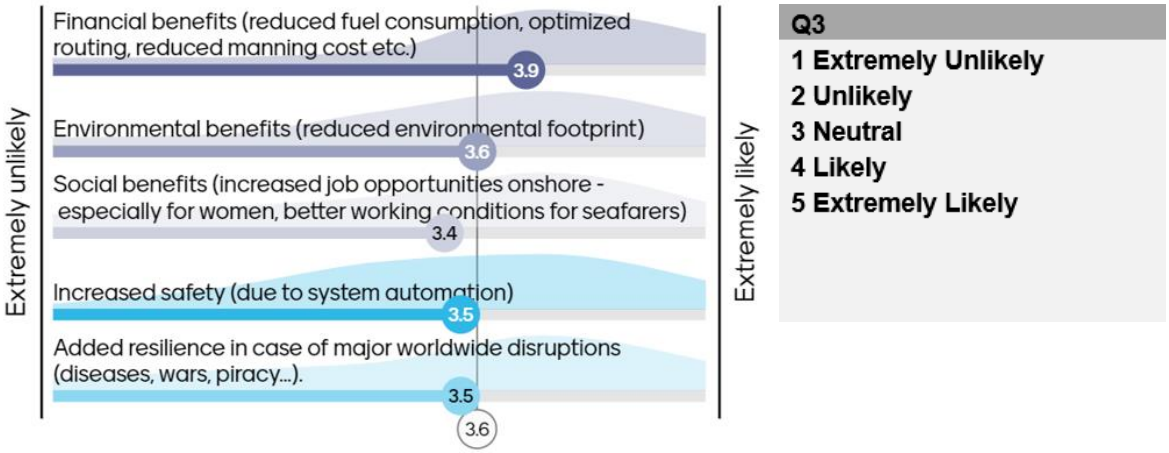


Figure 10 SURVEY No. 1: Question 3 - Mean ranking and ranking characterisations

There is a neutral to positive perspective regarding the benefits of the transition to autonomous shipping (Table 3). The lowest marks, which are neutral, are expressed by the Seafarers and Academia/Research Institutions group, while the highest grade derives from the Owners/Operators group. It is observed that the standard deviation for all the stakeholder groups is low, which depicts that the sub-questions mean markings are very close to each other and similar to the overall mean marking.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Likely	Likely	Likely	Likely	Likely	Likely	Likely	Likely	Neutral	Neutral
Mean	3.6	3.6	3.6	3.7	3.7	3.8	3.6	3.6	3.0	3.3
Median	4	4	4	4	4	4	4	4	4	4
Standard Deviation	0.08	0.56	0.20	0.20	0.20	0.10	0.28	0.31	0.22	0.35

Table 3 SURVEY No. 1: Question 3 - Metrics and Characterisation

Question No. 3.1: Financial benefits (reduced fuel consumption, optimised routing, reduced manning cost etc.)

The results provided in Table 4 illustrate that most of the stakeholder groups consider probable or highly probable that the transition to autonomous shipping will be financially beneficial. As inferred from Figure 11, those opposed mostly are the Seafarers, whereas the public seems to be the most positive of the groups gathering almost the same grade from each group separately. There is a small number of individuals from the other groups that do not expect such a benefit. Nevertheless, it is noteworthy that the Owners/Operators directly concerned with the maritime business's financial part are firm believers that the transition will be profitable. Besides, they share the same opinion with the Designers/Builders and Technology Providers.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Likely	Likely	Likely	Likely	Likely	Likely	Likely	Likely	Neutral	Likely
Mean	3.9	3.9	4.1	3.8	3.7	4.1	4.2	3.9	2.8	3.5
Median	4	4	4	4	4	4	4	4	4	4
Standard Deviation	1.06	0.40	0.85	1.40	1.25	1.09	0.77	0.47	1.40	0.76

Table 4 SURVEY No. 1: Question 3.1 - Metrics and Characterisation

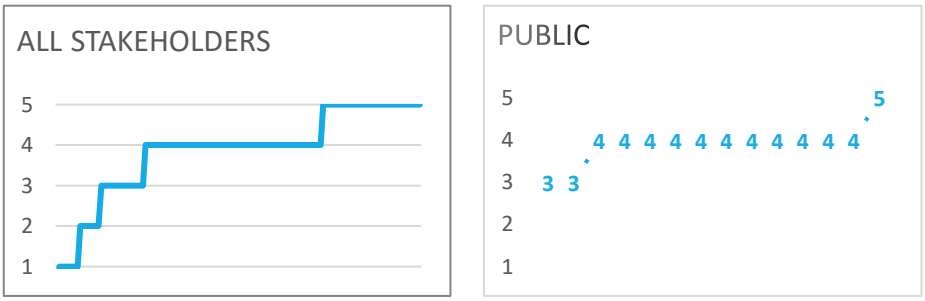


Figure 11 SURVEY No. 1: Question 3.1 – All Stakeholders' and Public' responses

Question No. 3.2: Environmental benefits (reduced environmental footprint)

According to the results presented in Table 5, the stakeholders' general view is that the transition to autonomous shipping will benefit the environment. Most of the responses are neutral or consider as likely this event. The least supportive of such an expectation is the public, while the Owners/operators figures present that such a change will benefit the environment. A few individuals believe that it is implausible that the transition will be beneficial to the environment (Figure 12). The most frequent answer was "Likely", and the second in selection was the "Neutral".

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Likely	Likely	Likely	Likely	Likely	Likely	Neutral	Likely	Neutral	Neutral
Mean	3.6	3.6	3.8	3.7	3.8	3.8	3.3	3.6	3.3	3.4
Median	4	4	4	4	4	4	4	4	4	4
Standard Deviation	1.10	1.60	1.03	0.90	0.79	1.29	1.10	0.63	1.06	1.60

Table 5 SURVEY No. 1: Question 3.2 - Metrics and Characterisation

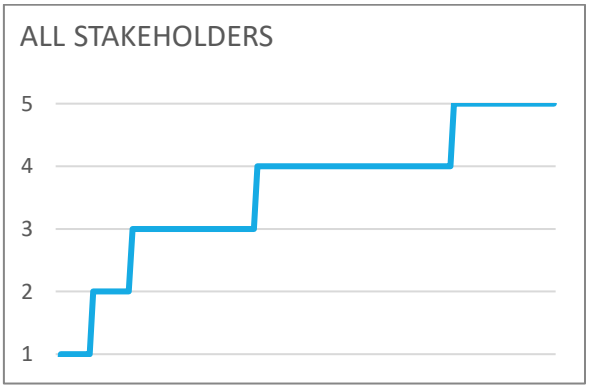


Figure 12 SURVEY No. 1: Question 3.2 - All Stakeholders responses

Question No. 3.3: Social benefits (increased job opportunities onshore - especially for women, better working conditions for Seafarers)

The results presented in Table 6 illustrate that all stakeholders have a neutral to a slightly optimistic view of any social benefits that could arise from the transition to autonomous shipping. As shown in Figure 13, a small number of participants voted against the view that social benefits could arise with autonomous shipping. In contrast, a more significant number stands in favour of the opinion that the transition will be advantageous in the social part). There might be an expectation that the Seafarers would be keen on this idea, but the results illustrate that this group believe the least. In the meanwhile, their answers are equally divided into those against and those for. On the contrary, the Owners/Operators gave the highest marks.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neutral	Neutral	Neutral	Likely	Neutral	Likely	Neutral	Neutral	Neutral	Neutral
Mean	3.4	3.4	3.5	3.6	3.3	3.7	3.4	3.3	2.8	2.9
Median	4	3	4	4	4	4	4	4	4	3
Standard Deviation	1.20	0.32	1.22	0.97	0.82	1.28	1.30	1.07	1.62	1.55

Table 6 SURVEY No. 1: Question 3.3 - Metrics and Characterisation

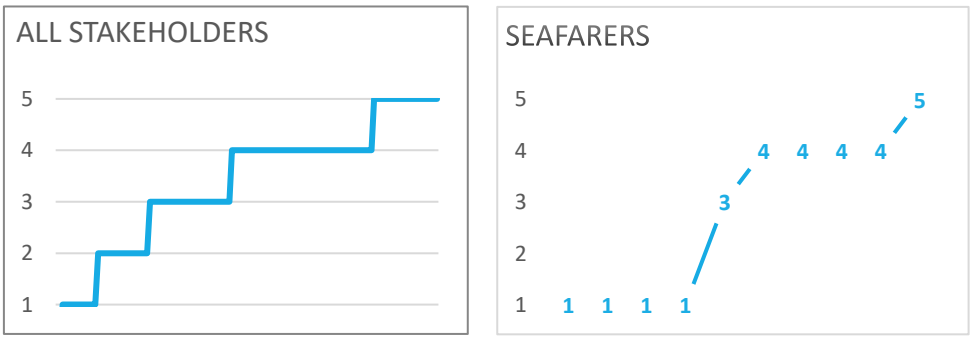


Figure 13 SURVEY No. 1: Question 3.3 - All Stakeholders' and Seafarers' responses

Question No. 3.4: Enhanced safety (due to system automation)

In this question, the stakeholders gave more positive feedback than in the previous question, considering the enhanced safety as a possibility from the transition to autonomous shipping. Designers/Builders/Technology Providers, International Organisations/Professional Societies/Environmentalists and Port Authorities/Flag States/Regulators are the groups that support most this view (Table 7). The Owners/Operators are mostly either neutral or very keen on enhanced safety deriving from the autonomous ships (Figure 13). At the same time, the Seafarers express the lowest mark having a normal dispersion of values in their answers, ranging from 1 to 4.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers / Builders / Technology Providers	Environmentalists / Professional Societies / International Organisations	Legal Advisors / Technical Advisors	Owners / Operators	Public	Regulators / Flag States / Port Authorities	Seafarers	Research Institutions / Academia
Characterisation	Neutral	Neutral	Likely	Likely	Likely	Neutral	Likely	Likely	Neutral	Neutral
Mean	3.5	3.5	3.8	3.8	3.8	3.5	3.5	3.8	2.7	3.4
Median	4	4	4	4	4	3	4	4	3	4
Standard Deviation	1.05	0.38	1.07	1.17	0.92	1.15	0.83	0.70	1.16	1.06

Table 7 SURVEY No. 1: Question 3.4 - Metrics and Characterisation

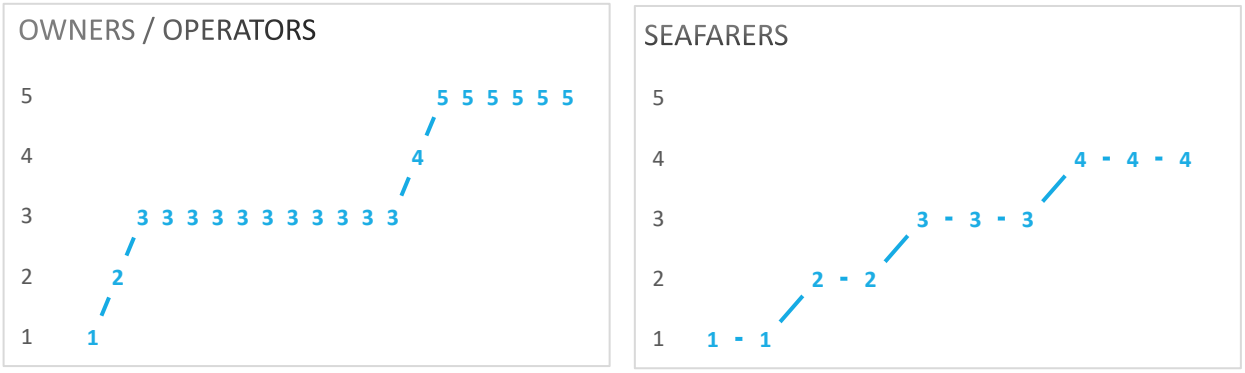


Figure 14 SURVEY No. 1: Question 3.4 – Owners/Operators' and Seafarers' responses

Question No. 3.5: Added resilience in major worldwide disruptions (diseases, wars, piracy...)

In this question again, the answers' mean is positive in part, with those considering the added resilience as an effect arising from autonomous shipping as likely or highly likely (Table 8). The Designers/Builders/Technology Providers seem to be the least convinced, whereas the Legal Advisors/Technical Advisors are the most certain. The majority of the Seafarers is persuaded of the added resilience, and only a scattering of them are disbelievers (Figure 15).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neutral	Neutral	Neutral	Likely	Likely	Likely	Neutral	Neutral	Neutral	Neutral
Mean	3.5	3.5	3.0	3.8	3.9	3.7	3.5	3.3	3.2	3.4
Median	4	3	3	4	4	4	4	4	4	4
Standard Deviation	1.21	0.31	1.37	1.17	0.74	1.32	1.41	1.2	1.32	1.19

Table 8 SURVEY No. 1: Question 3.5 - Metrics and Characterisation

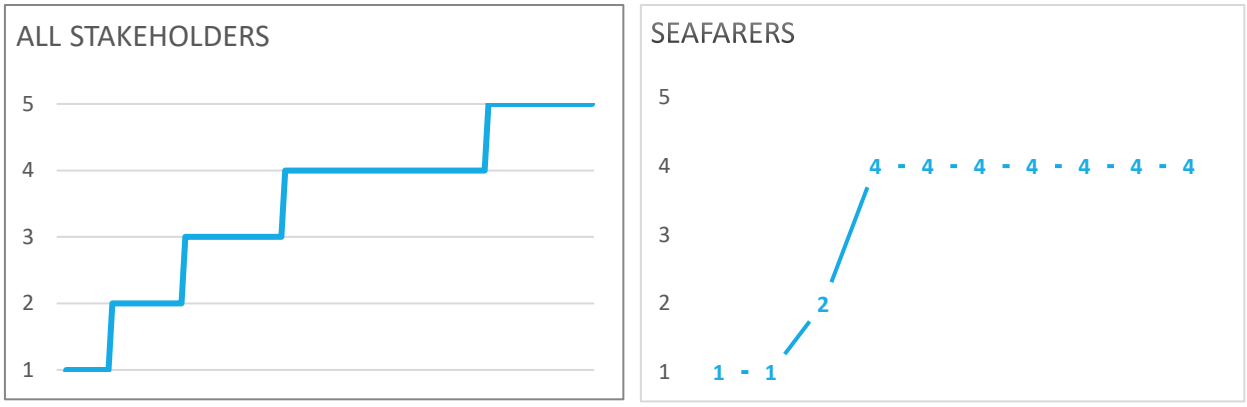


Figure 15 SURVEY No. 1: Question 3.5 - All Stakeholders' and Seafarers' responses

Question No. 4: How would the transition to autonomous shipping impact the shipping industry; increase the income, profitability, number of employees, improve access to financing and crisis resilience

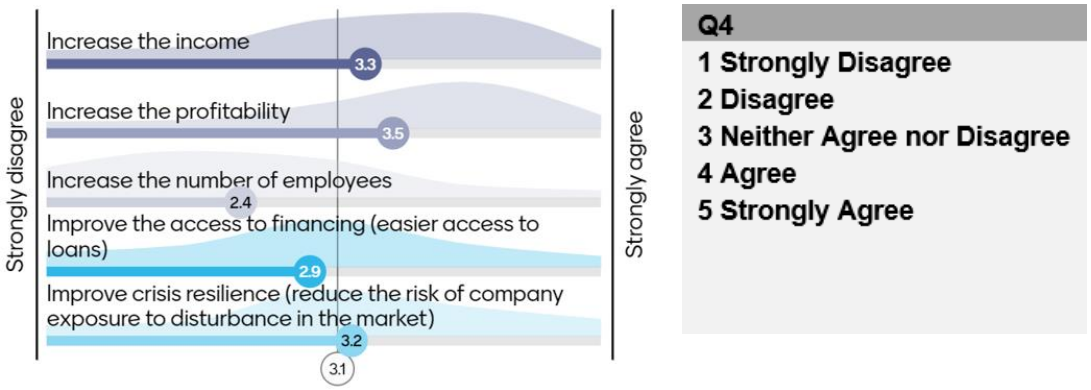


Figure 16 SURVEY No. 1: Question 4 - Mean ranking and ranking characterisations

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.1	3.1	3.0	3.2	3.3	3.1	2.9	3.3	2.8	3.0
Median	3	3	3	3	3	3	3	4	3	3
Standard Deviation	0.04	0.07	0.07	0.13	0.28	0.13	0.13	0.36	0.11	0.25

Table 9 SURVEY No. 1: Question 4 - Metrics and Characterisation

The general perspective of this question is neutral, as depicted in Table 9. The lowest marks, which are neutral, are expressed by the public, while the highest grade derives from the Port Authorities/Flag States/Regulators and Technical Advisors/Legal Advisors groups. It is observed that the standard deviation for all the stakeholder groups is low, which depicts that the sub-questions mean markings are very close to each other and similar to the overall mean marking.

Question No. 4.1: Increase the income

The figures present that most stakeholders agree there will be an increase in income with the transition to autonomous shipping. At the same time, there is a significant population to remain neutral and some few that somewhat or strongly disagree (Table 10). The group of Environmentalists/Professional Societies/International Organisations is the least positive to this sub-question while on the contrary, the group of Regulators/Flag States/Port Authorities is mostly in favour. The Owners/Operators are in the middle, expressing a kind of neutral opinion, which is almost similar to the view that the Designers/Builders/Technology Providers have. In this question, nearly all the responses received by the Seafarers are positive (Figure 17).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.3	3.3	3.4	3.1	3.5	3.3	3.3	3.7	3.3	3.4
Median	3	3	3	3	3	3	4	4	4	4
Standard Deviation	1.04	0.18	1.01	1.04	0.71	1.28	1.28	0.48	1.25	0.74

Table 10 SURVEY No. 1: Question 4.1 - Metrics and Characterisation

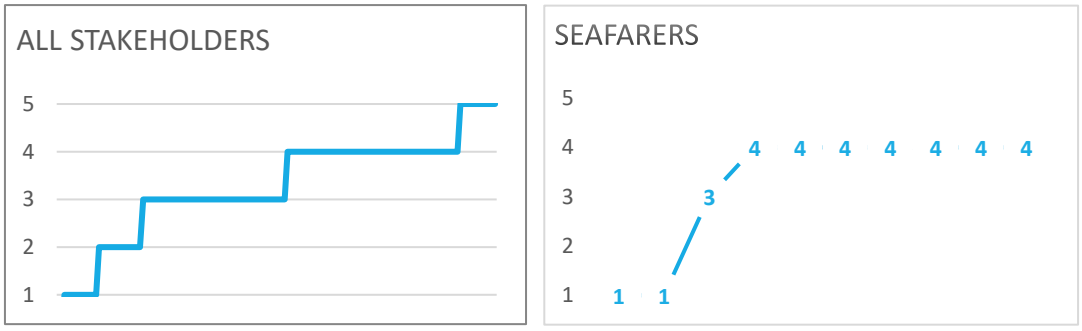


Figure 17 SURVEY No. 1: Question 4.1 - All Stakeholders' and Seafarers' responses

Question No. 4.2: Increase the profitability

The general aspect is that the stakeholders either agree or are neutral regarding the increase of profitability in the transition to autonomous shipping (Table 11). The group of Environmentalists/Professional Societies/International Organisations present the lowest marks. On the other hand, the Regulators/Flag States/Port Authorities group-voting diagram (Figure 18) illustrates a significant uniformity range in positive answers leading to the highest marks compared to the other groups. The Designers/Builders/Technology Providers group is neutral mainly, with some indicative more positive views. The Owners/Operators diagram depicts a fluctuation in answers. There is only one "Strongly Disagree" vote, while the other voices have an almost similar range (Figure 18).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree
Mean	3.5	3.5	3.5	3.1	3.7	3.5	3.5	3.8	3.3	3.5
Median	4	3	3	3	4	4	4	4	4	4
Standard Deviation	1.06	0.21	1.07	1.04	0.67	1.21	1.36	0.6	1.34	0.93

Table 11 SURVEY No. 1: Question 4.2 - Metrics and Characterisation

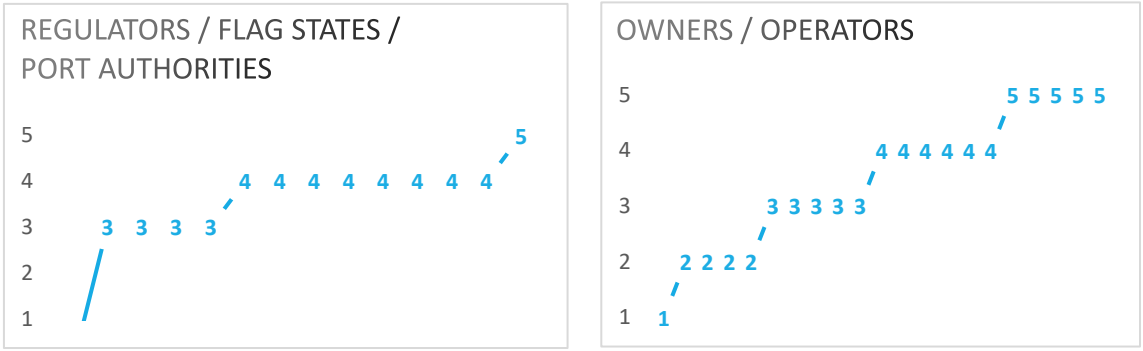


Figure 18 SURVEY No. 1: Question 4.2 – Regulators' and Owners' responses

Question No. 4.3: Increase the number of employees

Almost all the stakeholders express disagreement regarding the numbers of employees' boost due to the transition to autonomous shipping (Table 12). The most preferences in a specific mark are gathered in the "Strongly Disagree" selection, while apart from the neutral view, there are a few positive marks (Figure 19). The public is the group with the lowest marks; half of them present an intense disagreement. The highest mean mark is that of the Environmentalists/Professional Societies/International Organisations, which approaches the neutral outcome. The Owners/Operators group show a Disagreement in general. The most preferences in a specific mark are gathered in the "Strongly Disagree" selection, while apart from the neutral view, there are a few positive responses.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Disagree	Disagree	Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Disagree	Disagree	Disagree	Disagree	Disagree
Mean	2.4	2.4	2.3	2.9	2.7	2.4	2.0	2.3	2.2	2.4
Median	2	2	2	3	3	2	2	2	2	2
Standard Deviation	1.09	0.29	1.15	1.04	0.95	1.47	1.13	1.07	1.14	0.52

Table 12 SURVEY No. 1: Question 4.3 - Metrics and Characterisation

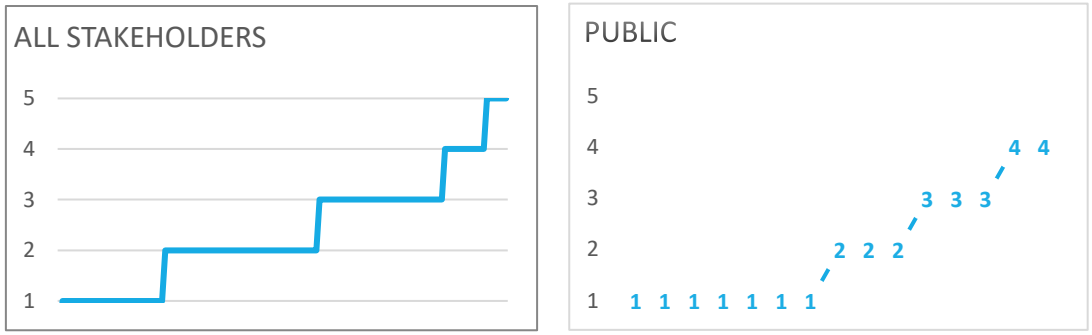


Figure 19 SURVEY No. 1: Question 4.3 – All Stakeholders' and Public' responses

Question No. 4.4: Improve access to financing (more accessible access to loans)

In general, there is a neutral view in terms of the access to financing improvement, more straightforward access to loans because of the transition to autonomous shipping (Table 13). The Public figures depict the lowest mean value in marks, while the Regulators/Flag States/Port Authorities present the highest one. The Owners/Operators mean value is close to the last and show an almost uniform distribution (Figure 20).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	2.9	2.9	2.8	3.2	3.1	3.2	2.5	3.5	2.8	2.6
Median	3	3	3	3	3	3	3	3	3	3
Standard Deviation	1.13	0.33	1.03	1.08	1.36	1.36	1.06	0.9	1.14	1.19

Table 13 SURVEY No. 1: Question 4.4 - Metrics and Characterisation

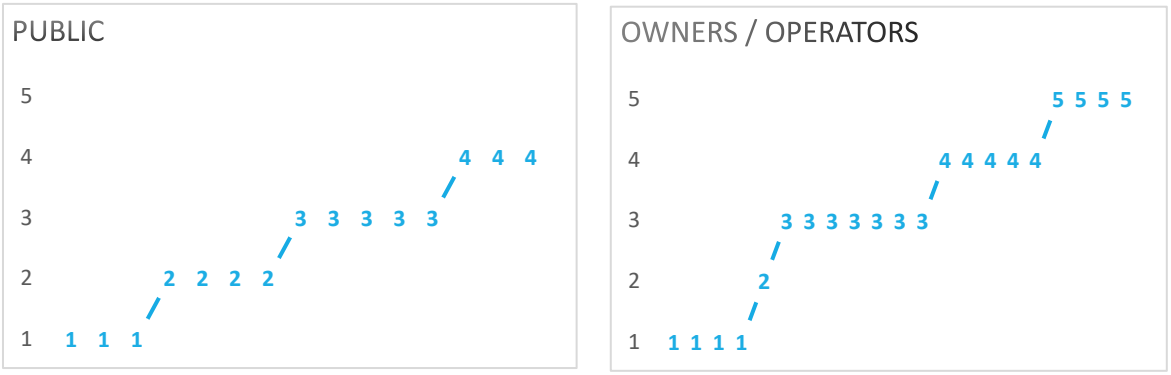


Figure 20 SURVEY No. 1: Question 4.4 – Public' and Owners/Operators' responses

Question No. 4.5: Improve crisis resilience (reduce the risk of company exposure to a disturbance in the market)

The figures present that the stakeholders' mean mark is neutral in terms of the crisis resilience improvement (reduce the risk of company exposure to a disturbance in the market) from the transition to autonomous shipping (Table 14). On the contrary, the Seafarers gave the lowest mark, while the Environmentalists/Professional Societies/International Organisations the maximum. The Owners/Operators are neutral, but with a few contrary opinions (Figure 21).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.2	3.2	2.9	3.7	3.4	3.3	3.2	3.4	2.6	3.1
Median	3	3	3	4	3	3	3	4	3	3
Standard Deviation	1.13	0.34	1.15	1.34	0.84	1.15	1.32	1.38	1.07	0.99

Table 14 SURVEY No. 1: Question 4.5 - Metrics and Characterisation

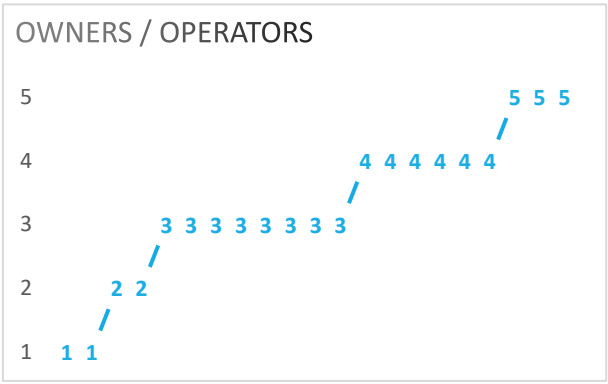


Figure 21 SURVEY No. 1: Question 4.5 – Public' responses

Question No. 5: I expect autonomous shipping will be a viable option for the following shipping sectors: ocean-going vessels, short-sea shipping, inland-shipping, working ships, cruisers

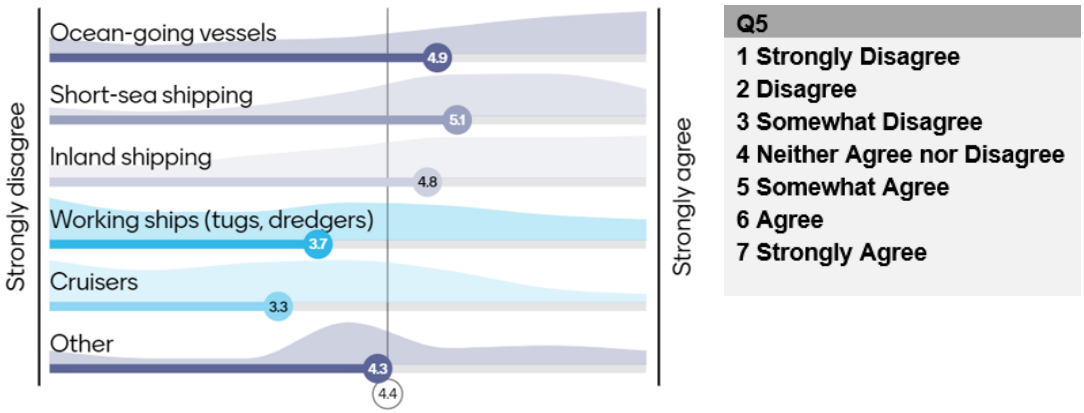


Figure 22 SURVEY No. 1: Question 5 - Mean ranking and ranking characterisations

This question's overall view for Survey No. 1 is neutral to slightly positive (Table 15), while the relevant perspective for Survey No. 2 participants is more favourable to the autonomous shipping viability (Table 16).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	4.4	4.4	4.6	4.7	4.5	4.5	4.5	4.3	3.6	3.5
Median	4.5	5	4.5	5	5	5	4.5	5	4	4
Standard Deviation	0.15	0.29	0.38	0.42	0.46	0.35	0.38	0.24	0.25	0.40

Table 15 SURVEY No. 1: Question 5 - Metrics and Characterisation

METRICS	STAKEHOLDERS								
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators	Flag States		
			Technology Providers	International Organisations			Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Somewhat Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Somewhat Agree
Mean	4.8	4.8	4.7	5.0	5.9	3.0	4.2	4.4	4.9
Median	5.5	5.0	5.0	5.0	6.0	1.0	4.5	5.5	5.0
Standard Deviation	0.19	0.49	0.42	0.89	0.29	-	0.81	0.96	0.20

Table 16 SURVEY No. 2: Question 5 - Metrics and Characterisation

Question No. 5.1: Ocean-going vessels

The results shown in Table 17 demonstrate that the stakeholders' mean mark is neutral in terms of the crisis resilience improvement (reduce the risk of company exposure to a disturbance in the market) from the transition to autonomous shipping. The Seafarers gave the lowest mark, while the Environmentalists/Professional Societies/International Organisations gave the maximum mark. The Owners/Operators are neutral as well, with a few contrary opinions (Figure 23). The diagrams present that the stakeholders' mean mark is neutral in terms of the crisis resilience improvement (reduce the risk of company exposure to a disturbance in the market) from the transition to autonomous shipping.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree
Mean	4.9	4.9	5.4	5.3	5.1	4.5	5.1	5.1	3.9	3.3
Median	6	5	6	6	6	6	5	6	4	4
Standard Deviation	1.98	0.77	1.72	2.05	1.79	2.48	1.51	1.69	2.33	2.19

Table 17 SURVEY No. 1: Question 5.1 - Metrics and Characterisation

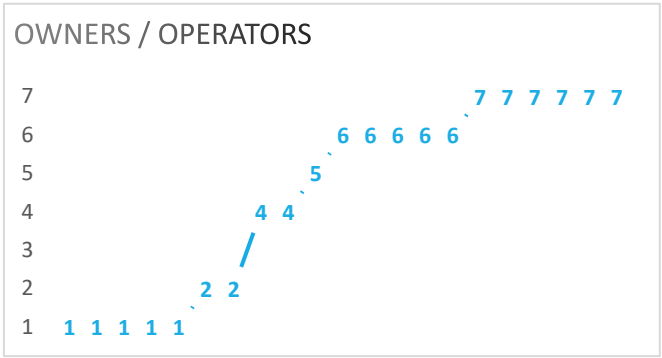


Figure 23 SURVEY No. 1: Question 5.1 – Owners/Operators' responses

Question No. 5.2: Short-sea shipping

According to the results presented in Table 18, there is a positive attitude by the stakeholders regarding autonomous short-sea shipping viability. The Seafarers is the group that is the least keen on autonomy in short-sea shipping and expresses a neutral opinion. On the other hand, the public is the most positive comparing to all the other groups. The Legal Advisors/Technical Advisors and the Environmentalists/Professional Societies/International Organisations results present a positive view with some few neutral responses (Figure 24). All the other groups cover all the range of marks, from 1 to 7.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree
Mean	5.1	5.1	5.3	5.0	5.4	5.1	5.4	4.9	4.3	4.6
Median	5	5	5	5	5	6	6	5	5	4
Standard Deviation	1.58	0.39	1.13	1.26	0.97	1.81	1.64	1.61	2.00	1.6

Table 18 SURVEY No. 1: Question 5.2 - Metrics and Characterisation

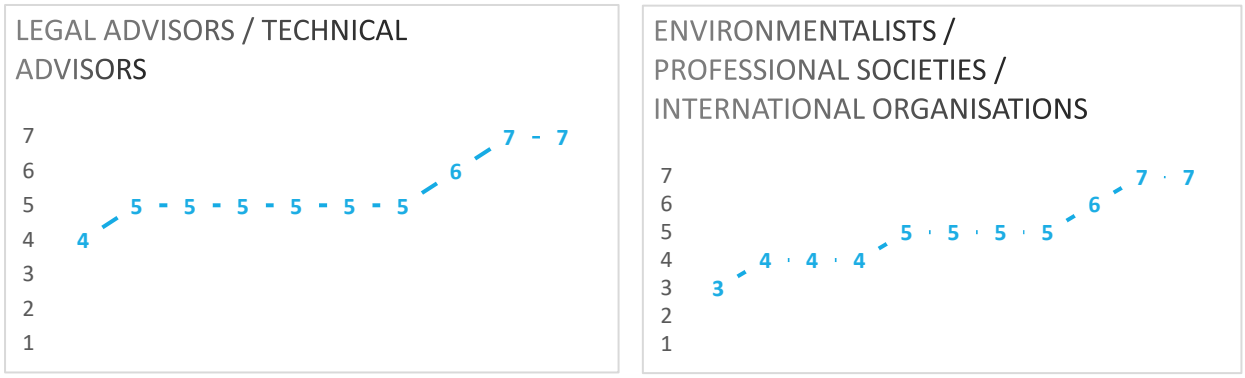


Figure 24 SURVEY No. 1: Question 5.2 – Legal Advisors' and Environmentalists' responses

Comparing the two surveys (Figure 25) clearly defined that the Autonomy stakeholders' perspective is slightly more optimistic. Remarkably, the Owners/Operators group in Survey No. 2 gave the highest ranking. Generally, in Survey No. 2, the participating groups agree that the short-sea shipping will be a viable solution, whereas the groups in Survey No. 1 present to be more conservative but therefore primarily agree to the short-sea shipping viability.

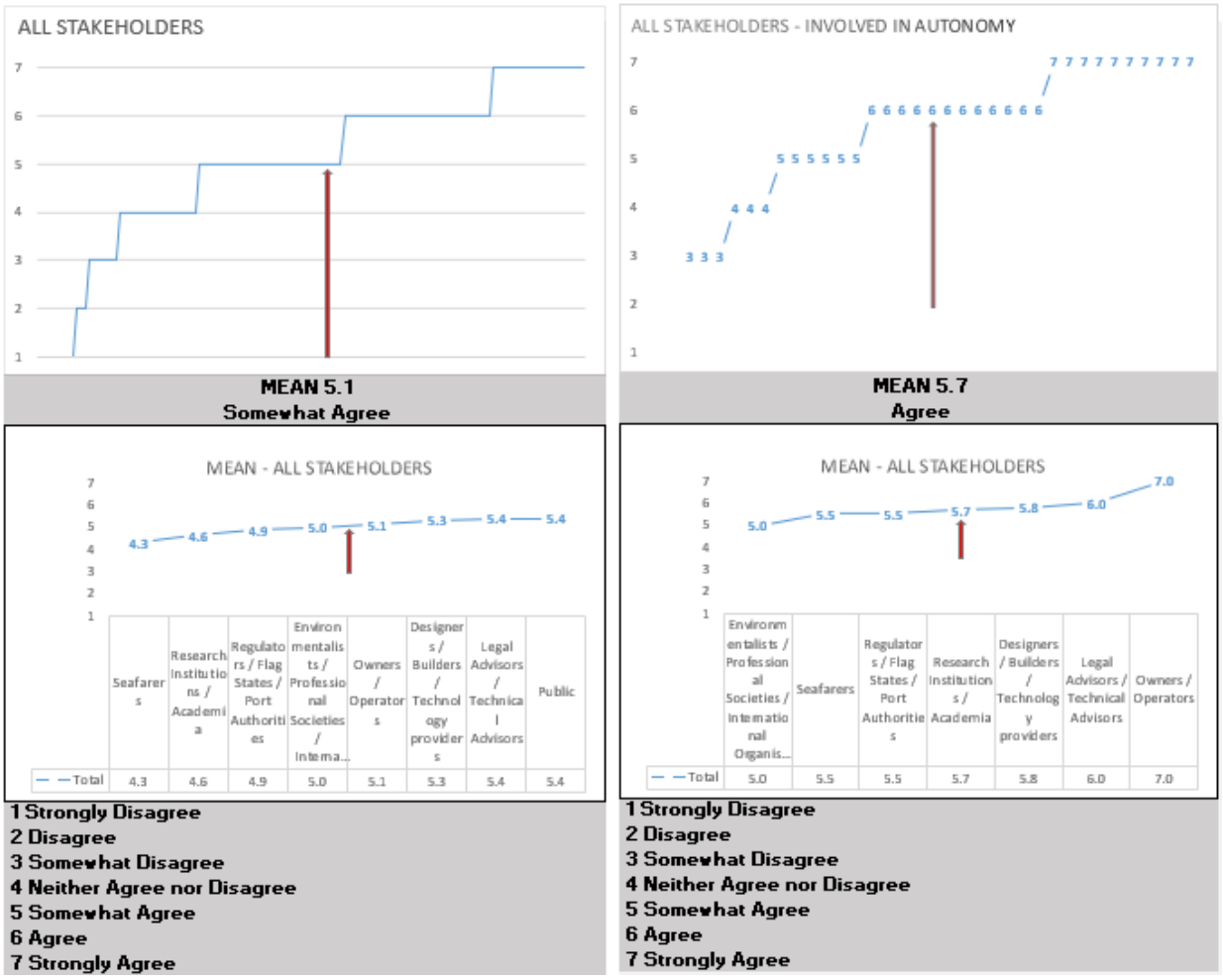


Figure 25 SURVEYS No. 1 and 2: Question 5.2 - Overview

Question No. 5.3: Inland shipping

The mean value of all the stakeholders' answers represents an agreement to some degree regarding the autonomous shipping viability in inland shipping (Table 19). There are limited low-grade answers in this sub-question, while most of them are at least neutral. The Seafarers are those with the lowest mean mark (Figure 26), whereas the Designers/Builders/Technology Providers present the highest mean score. The Owners/Operators as well present almost the same mark. Their diagram shows a significant number of "Strongly Agree" answers, while some few are negative (Figure 26).

METRICS	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree
Mean	4.8	4.8	5.1	5.0	4.5	5.0	4.4	5.0	3.7	5.0
Median	5	5	5	5	5	5	4	5	4	6
Standard Deviation	1.81	0.49	1.78	1.73	1.35	2.01	1.8	1.24	1.89	2.2

Table 19 SURVEY No. 1: Question 5.3 - Metrics and Characterisation

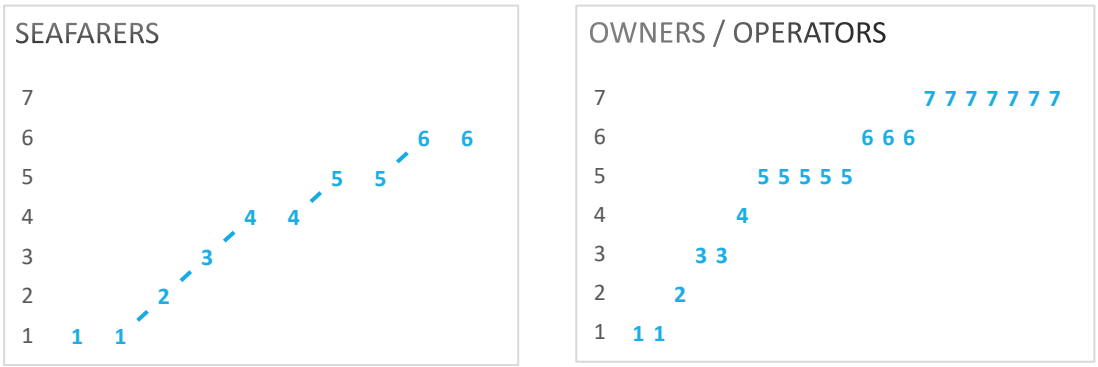


Figure 26 SURVEY No. 1: Question 5.3 – Seafarers' and Owners/Operators' responses

Comparing the two surveys (Figure 27), it is clearly defined that the perspective of the involved in Autonomy stakeholders is slightly more optimistic with No. negative responses. Remarkably, the Owners/Operators group in Survey No. 2 gave the highest ranking. Generally, in Survey No. 2, the participating groups agree that inland shipping will be a viable solution. In contrast, the groups in Survey No. 1 are more conservative but partly agreeable with a few negative responses.

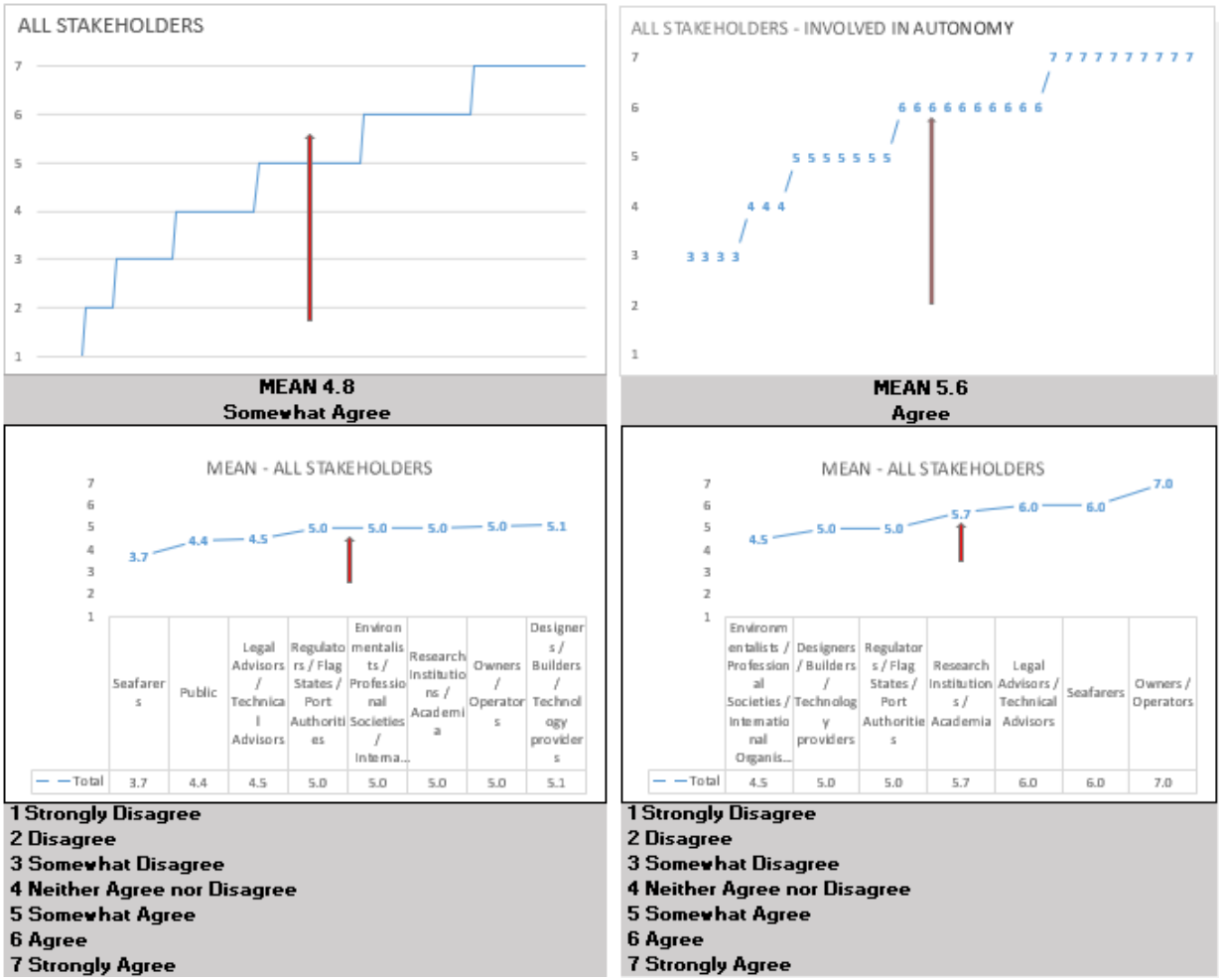


Figure 27 SURVEYS No. 1 and 2: Question 5.3 - Overview

Question No. 5.4: Working ships (tugs, dredgers)

The stakeholders maintain a neutral view of the working ships' viability (tugs, dredgers) if they adopt automation. There are many complete disagreement answers gathered by all the stakeholder groups (Table 20). The Research Institutions/Academia present the lowest mean mark by far, which depicts their Disagreement (Figure 28). On the contrary, the Environmentalists/Professional Societies/International Organisations show the highest mean mark with some very few firm disagreement answers. The Owners/Operators express a partial disagreement, with a significant number of responses opposing this shipping sector's viability, while the remaining number of votes is positive.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Somewhat Disagree	Disagree
Mean	3.7	3.7	3.6	4.4	3.5	3.6	3.7	4.0	3.4	2.4
Median	4	4	3	5	4	3	4	4	4	2
Standard Deviation	1.96	0.57	2.12	2.20	1.84	2.23	1.33	1.80	2.12	1.69

Table 20 SURVEY No. 1: Question 5.4 - Metrics and Characterisation

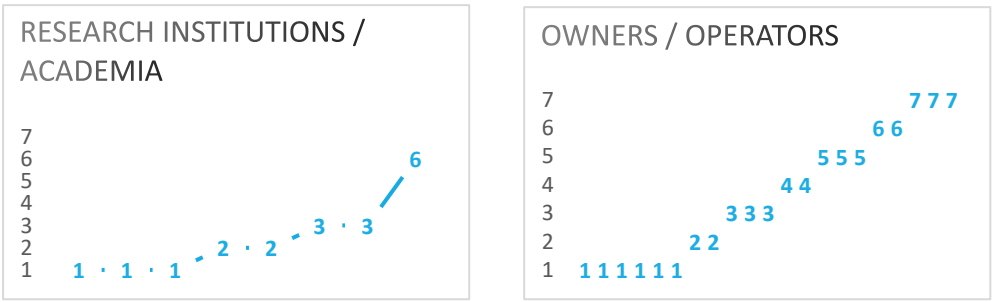


Figure 28 SURVEY No.1: Question 5.4 – Academia's and Owners/Operators' responses

Comparing the two surveys (Figure 29) clearly defined that the perspective of Autonomy stakeholders' perspective is slightly more optimistic with some very few negative responses. Remarkably, the Owners/Operators group in Survey No. 2 gave the highest ranking. Generally, in Survey No. 2, the participating groups agree that the working ships will be a viable solution, whereas Survey No. 1 presents a more conservative, neutral view with a large dispersion.

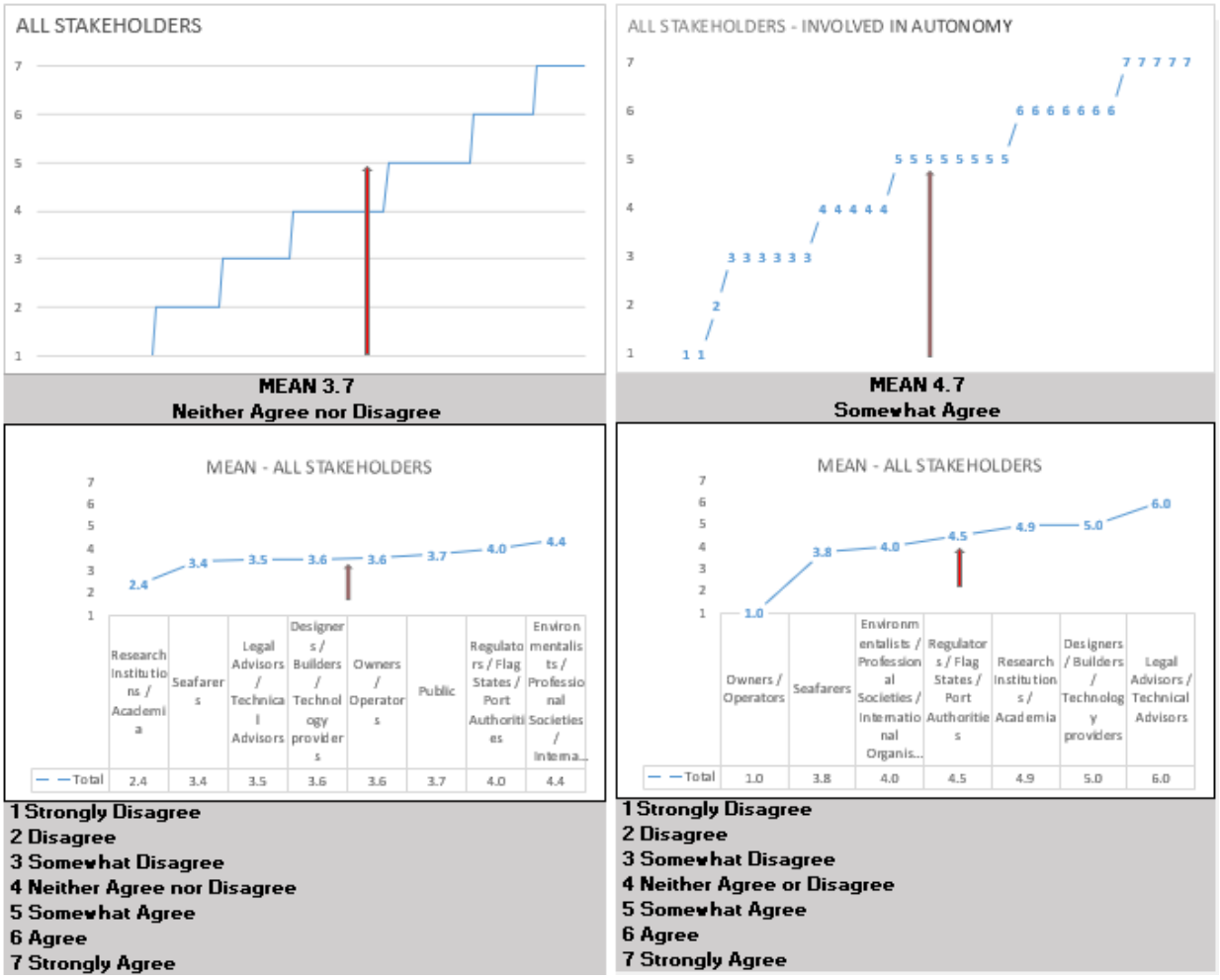


Figure 29 SURVEYS No. 1 and 2: Question 5.4 - Overview

Question No. 5.5: Cruisers

The various stakeholders' results showed that the mean mark is neutral, with some disagreement regarding the viability in autonomous cruiser shipping (Table 21). Low voting numbers express absolute agreement, while there are significant numbers in substantial disagreement and neutral selection. In general, the distribution presents uniformity (Figure 30). Those who disagree with this sub-question are Regulators/Flag States/Port Authorities and the Research Institutions/Academia groups. On the contrary, the Environmentalists/Professional Societies/International Organisations have the highest mean mark. Regarding the Owners/Operators group, it presents somewhat opposing views than neutral (Figure 30).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Neither Agree nor Disagree	Neither Agree Nor Disagree	Somewhat Disagree	Neither Agree nor Disagree	Disagree	Somewhat Disagree	Disagree
Mean	3.3	3.3	3.4	4.0	3.6	3.4	3.7	2.5	3.1	2.5
Median	3	3	3	4	4	4	4	3	3	3
Standard Deviation	1.70	0.54	1.94	1.61	1.84	1.78	1.76	1.29	1.66	1.51

Table 21 SURVEY No. 1: Question 5.5 - Metrics and Characterisation

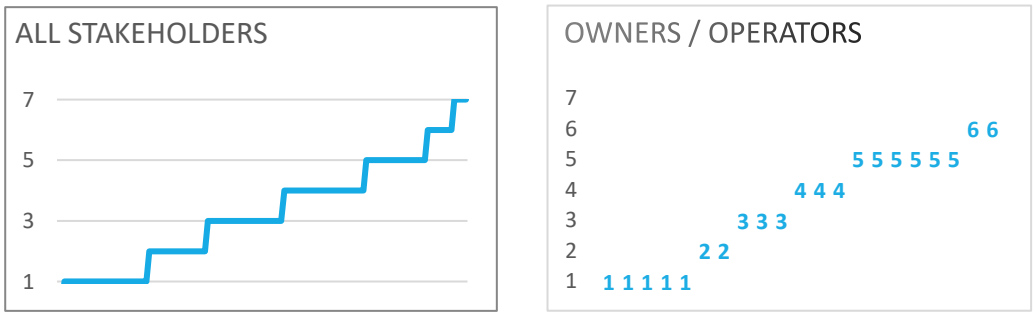


Figure 30 SURVEY No. 1: Question 5.5 – All Stakeholders' and Owners' responses

Question No. 6: The transition to autonomous shipping will: solve the deficit of seafarers, improve the quality of life for the employees in the shipping sector, require the modification of the current training framework for seafarers, result in the loss of existing knowledge, skills and experience of seafarers, contribute to the transportation modal shift and render the use of smaller ships more attractive

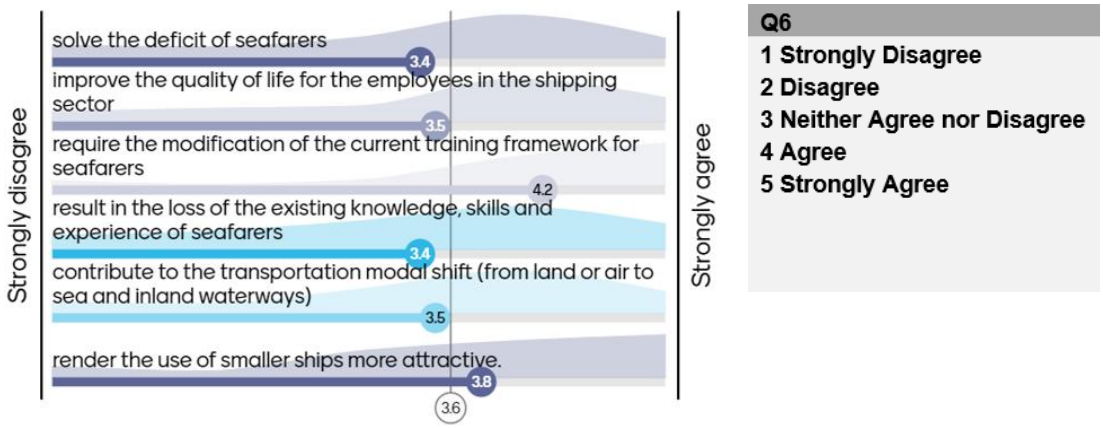


Figure 31 SURVEY No. 1: Question 6 - Mean ranking and ranking characterisations

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Agree
Mean	3.6	3.6	3.6	3.5	3.6	3.8	3.7	3.9	2.9	3.7
Median	4	4	4	4	4	4	4	4	3	4
Standard Deviation	0.07	0.08	0.14	0.22	0.34	0.17	0.15	0.26	0.19	0.16

Table 22 SURVEY No. 1: Question 6 - Metrics and Characterisation

The general perspective of the stakeholders for this question is neutral to slightly positive in terms of the required changes for the working sector that the transition to autonomous shipping is expected to bring (Table 22). It is observed that the standard deviation for all the stakeholder groups is very low, which depicts that the sub-questions mean markings are very close to each other and similar to the overall mean marking. The Seafarers group made the difference that gave the most negative feedback but in general neutral. The standard deviation denotes that this perspective is approaching for all the sub-questions.

Question No. 6.1: Solve the shortage of Seafarers

The stakeholders' figures show general neutrality concerning the deficit of Seafarers' solution from the transition to autonomous shipping (Table 23). Those who opposed were the Seafarers, presenting rather extreme answers than neutral (Figure 32). On the other hand, the Owners/Operators replied that they mainly agree with very few answers to be negative or neutral (Figure 32). The Designers/Builders/Technology Providers view is almost similar to that of the last group. The Regulators/Flag States/Port Authorities group figures show a uniformity, having replied to the majority of the answers positively.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Agree	Disagree	Neither Agree nor Disagree
Mean	3.4	3.4	3.5	3.3	3.6	3.8	3.5	3.7	2.5	3.4
Median	4	4	4	4	4	4	4	4	3	4
Standard Deviation	1.26	0.39	1.26	1.34	1.59	1.07	1.30	0.91	1.43	1.30

Table 23 SURVEY No. 1: Question 6.1 - Metrics and Characterisation

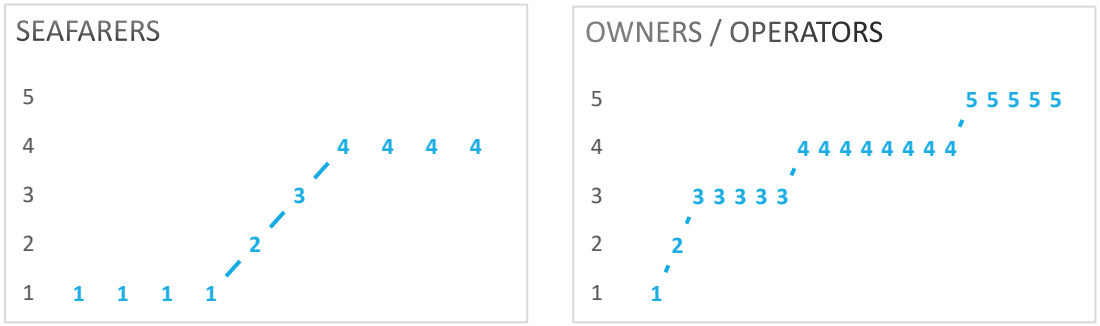


Figure 32 SURVEY No. 1: Question 6.1 – Seafarers' and Owners/Operators' responses

Comparing the two surveys (Figure 33), it is observed that the mean rankings, as well as the general mean, appear to be almost the same. Nevertheless, the Owners/Operators group in Survey No. 1 is the group with the highest-ranking while Survey No. 2 is that with the lowest grade. Also, it is clearly defined in Survey No. 2 that the most responses are gathered in grade 4, which is equivalent to the characterisation "Agree".

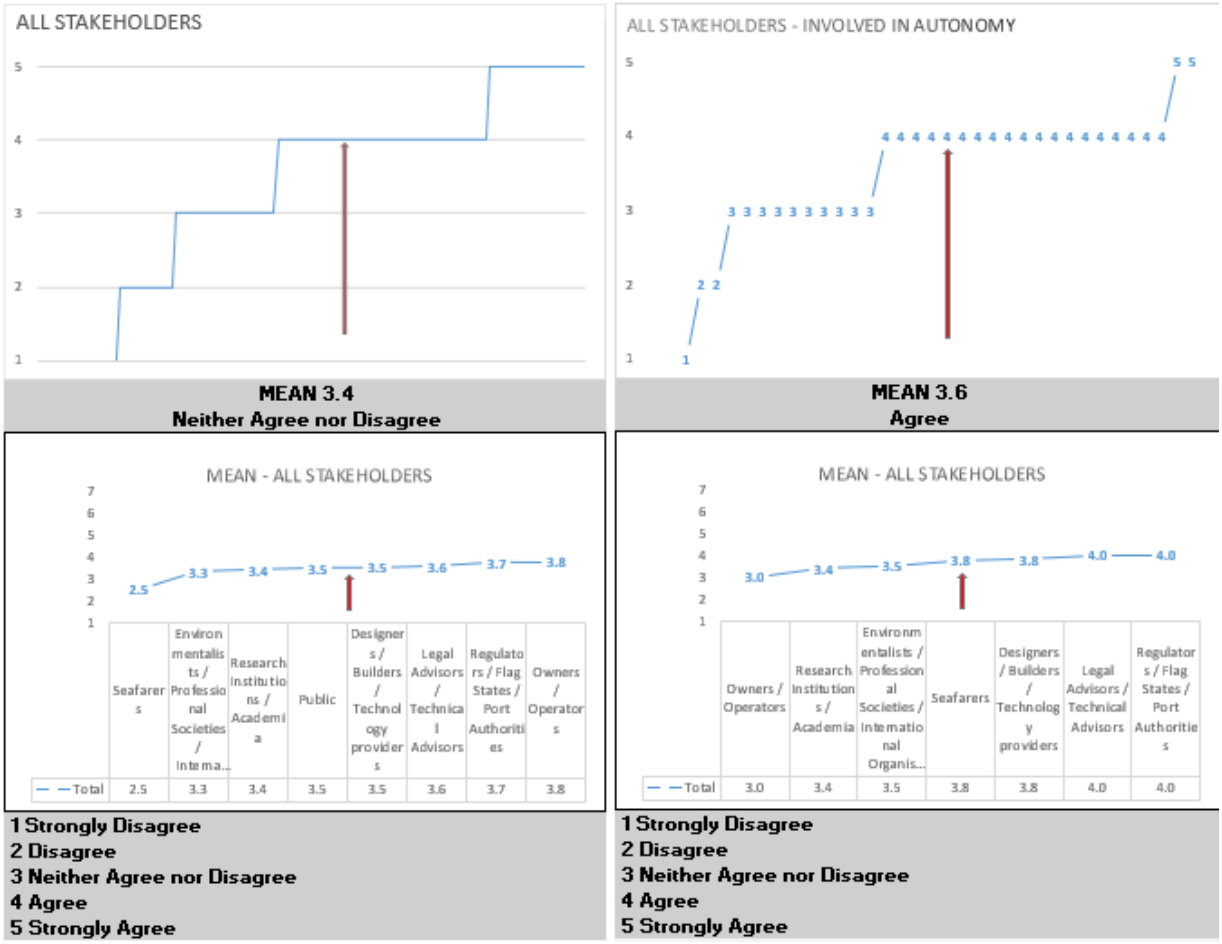


Figure 33 SURVEY No. 1 and 2: Question 6.1 - Overview

Question No. 6.2: Improve the quality of life for the employees in the shipping sector

In the sub-question, if the transition to autonomous shipping will improve the quality of life for the employees in the shipping sector, the mean mark of the stakeholders' answers is favourable (Table 24). The Seafarers' answers are entirely similar to the responses of the previous question and present the lowest mean value. In contrast, the Legal Advisors/Technical Advisors group is the one that has the highest figures approaching the "Agree" characterisation. The Owners/Operators group approaches the same state, but the distribution of its answers is different while the majority is agreeable, and a smaller number is negative or neutral (Figure 34).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Agree	Agree	Disagree	Agree
Mean	3.5	3.5	3.3	3.5	3.8	3.7	3.6	3.6	2.5	3.6
Median	4	4	4	4	4	4	4	4	3	4
Standard Deviation	1.26	0.41	1.41	1.27	0.67	1.27	1.45	1.28	1.43	1.19

Table 24 SURVEY No. 1: Question 6.2 - Metrics and Characterisation

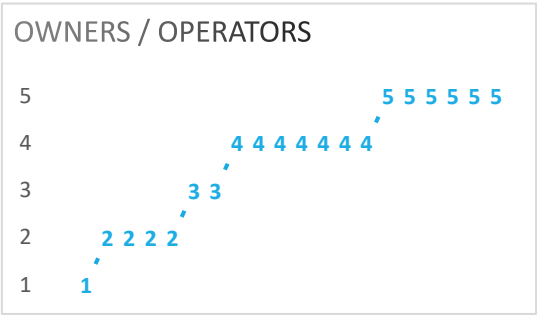


Figure 34 SURVEY No. 1: Question 6.2 – Owners/Operators' responses

Question No. 6.3: Require the modification of the current training framework for Seafarers

This sub-question refers to the requirement to modify Seafarers' current training framework as a prerequisite for the transition to autonomous shipping (Table 25). The Seafarers mark is the lowest but almost positive, with some few negative answers (Figure 35). On the other hand, the Owners/Operators and the Regulators/Flag States/Port Authorities figures are the highest.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Neutral	Agree
Mean	4.2	4.2	4.3	4.2	4.0	4.4	4.3	4.4	3.5	4.3
Median	5	4	4	5	4	5	5	4	4	5
Standard Deviation	1.09	0.29	0.99	1.03	1.32	0.99	1.10	0.63	1.78	0.89

Table 25 SURVEY No. 1: Question 6.3 - Metrics and Characterisation

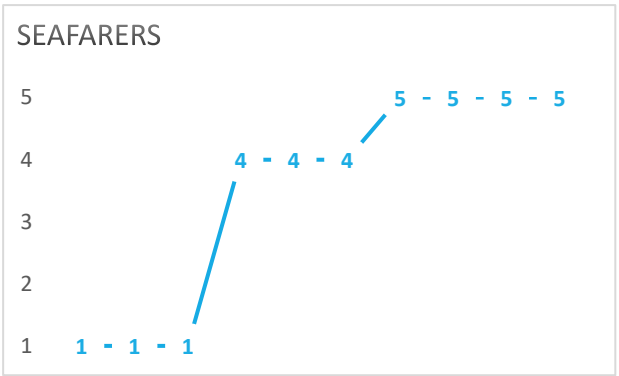


Figure 35 SURVEY No. 1: Question 6.3 – Seafarers' responses

Comparing the two surveys (Figure 36), it is observed that the mean rankings, as well as the general mean, appear to be almost the same with a slightly more positive perspective of the Stakeholders that participated in Survey No. 2. The Seafarers appear neutral and with the lowest ranking in Survey No. 1, while in Survey No. 2 are positive. The Designers/Builders/Technology Providers group takes the lowest ranking in Survey No. 2, whereas on the top of the marking are the Regulators/Flag States/Port Authorities, Legal Advisors/Technical Advisors Owners/Operators.

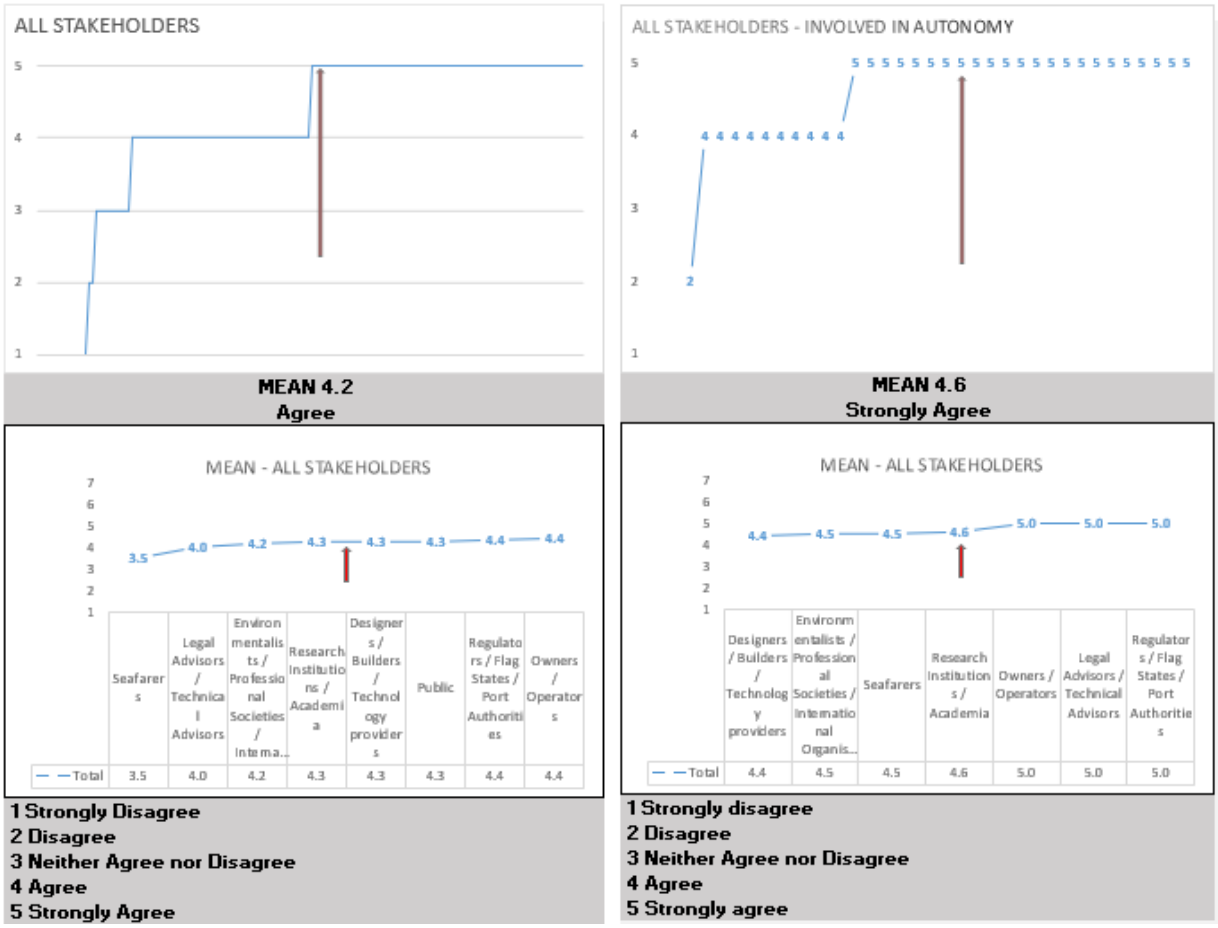


Figure 36 SURVEY No. 1 and 2: Question 6.3 - Overview

Question No. 6.4: Result in the loss of the existing knowledge, skills and experience of Seafarers

The mean value of the stakeholders presents that they neither agree nor disagree (Table 26). The diagrams illustrate that there is a dispersion in answers (Figure 37). The group that is less keen on this result is the Legal Advisors/Technical Advisors group, whereas the group that is fond of it is the Research Institutions/Academia.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
Mean	3.3	3.3	3.6	3.7	3.0	3.3	3.3	3.2	3.2	3.9
Median	4	3	4	4	3	3	4	3	4	4
Standard Deviation	1.27	0.30	1.30	1.34	1.12	1.12	1.40	1.25	1.48	1.25

Table 26 SURVEY No. 1: Question 6.4 - Metrics and Characterisation

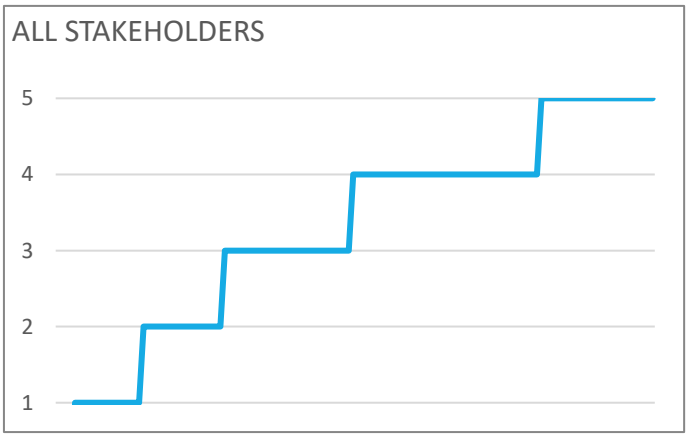


Figure 37 SURVEY No. 1: Question 6.4 – All Stakeholders' responses

Question No. 6.5: Contribute to the modal transportation shift (from land or air to sea and inland waterways)

All the stakeholders are either neutral or positive. Those who are most keen on this state are the Regulators/Flag States/Port Authorities group (Table 27). The Owners/Operators and the Designers/Builders/Technology Providers and the Public present diagram similarities (Figure 38), but with variations in their answers that cover all the range of marks with the majority of them positive or at least neutral.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.5	3.5	3.6	3.0	3.3	3.6	3.5	3.9	2.7	3.5
Median	4	4	4	4	4	4	4	4	3	4
Standard Deviation	1.22	0.39	1.26	1.63	1.22	1.27	1.25	0.83	1.34	1.31

Table 27 SURVEY No. 1: Question 6.5 - Metrics and Characterisation

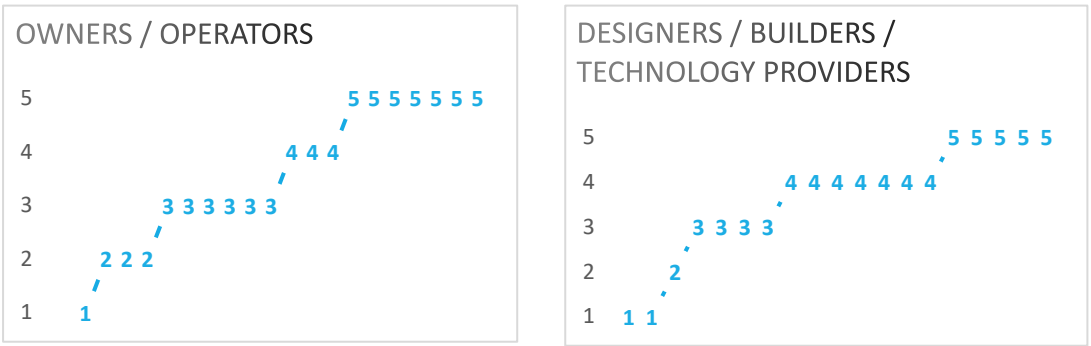


Figure 38 SURVEY No. 1: Question 6.5 – Owners' and Designers' responses

Question No. 6.6: Render the use of smaller ships more attractive

In general, most stakeholders agree that the transition to autonomous shipping will render the use of smaller ships more attractive (Table 28). The Seafarers group figures present the lowest mark and relatively neutral. On the other hand, the Regulators/Flag States/Port Authorities group figures show the highest mean value, which agrees with the question. The selection "Strongly Agree" is that with the most answers which are mainly gathered from the groups of Owners/Operators, Public and Regulators/Flag States/Port Authorities (Figure 39).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.7	3.7	3.2	3.5	4.1	3.7	4.2	4.4	2.9	3.5
Median	4	4	4	4	4	4	4	5	3	4
Standard Deviation	1.26	0.52	1.17	1.58	0.78	1.45	1.08	0.84	1.20	1.20

Table 28 SURVEY No. 1: Question 6.6 - Metrics and Characterisation

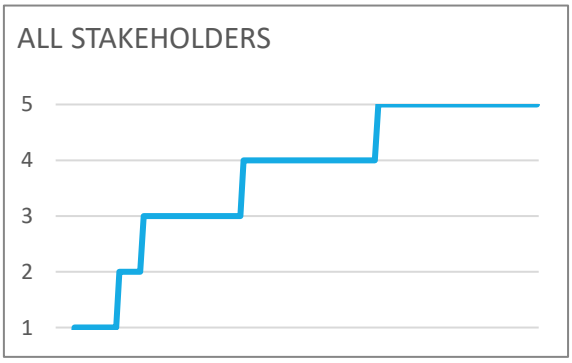


Figure 39 SURVEY No. 1: Question 6.5 – All Stakeholders' responses

Question No. 7: Please assess the impact of the following barriers to the transition to autonomous shipping; regulatory and economic barriers, technological and social limitations, safety and security issues

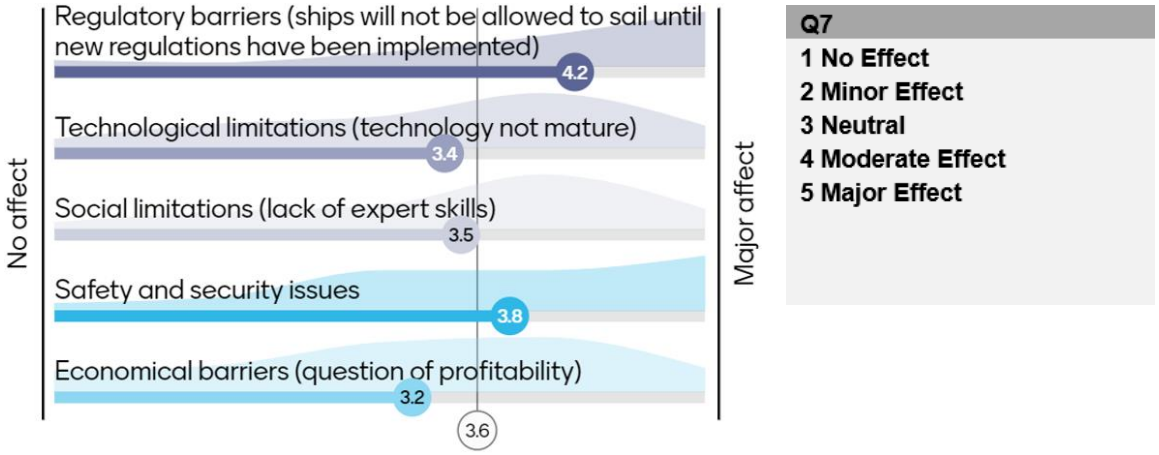


Figure 40 SURVEY No. 1: Question 7 - Mean ranking and ranking characterisations

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Neutral	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect
Mean	3.6	3.6	3.6	3.6	3.4	3.5	3.7	3.7	3.7	3.9
Median	4	4	4	4	3	4	4	4	4	4
Standard Deviation	0.04	0.05	0.14	0.23	0.23	0.14	0.09	0.24	0.18	0.26

Table 29 SURVEY No. 1: Question 7 - Metrics and Characterisation

The general perspective of the stakeholders for this question is neutral to slightly positive (Table 29). It is observed that the standard deviation for all the stakeholder groups is low, which depicts that the sub-questions mean markings are very close to each other and similar to the overall mean marking. Stakeholders mean values assimilate, and the standard deviation denotes that this perspective is identical for all the sub-questions.

Question No. 7.1: Regulatory barriers (ships will not be allowed to sail until new regulations have been implemented)

This sub-question depicts the stakeholders' view that the regulatory barriers will moderate affect the transition to autonomous shipping (Table 30). The only group to be neutral in this state is the Seafarers group, while others are positive. The group with the highest marks is the Regulators/Flag States/Port Authorities. There is a great majority of "major effect" answers, and the second category to follow is that of "Moderate Effect". Almost non-existent are the responses of "No Effect" or "Minor Effect", while there are some few "Neutral" (Figure 41).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Major Effect	Neutral	Major Effect
Mean	4.1	4.1	4.2	3.9	4.4	4.2	4.1	4.6	3.3	4.5
Median	5	4	4	5	5	4	5	5	4	5
Standard Deviation	1.13	0.40	1.01	1.52	0.73	0.99	1.19	0.76	1.58	0.76

Table 30 SURVEY No. 1: Question 7.1 - Metrics and Characterisation

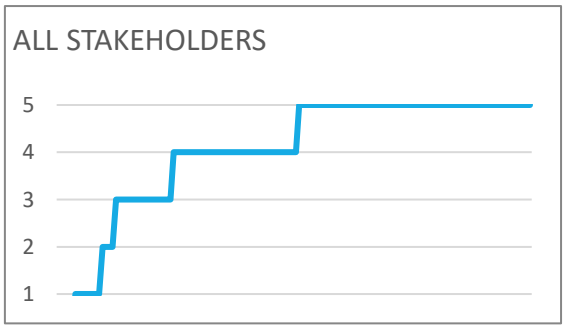


Figure 41 SURVEY No. 1: Question 7.1 – All Stakeholders' responses

Question No. 7.2: Technological limitations (Technology not mature)

The stakeholders' figures present they are neutral in terms of technological limitations, such as Technology immaturity is (Table 31). In general, the mark that gathers the most answers is that of "Moderate Effect" (Figure 42). The lowest mean mark is presented by the Legal Advisors/Technical Advisors group, whereas the highest from the public. The Designers/Builders/Technology Providers group gathers a significant number of "Minor Effect" answers.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neutral	Neutral	Neutral	Moderate Effect	Neutral	Moderate Effect	Moderate Effect	Neutral	Moderate Effect	Moderate Effect
Mean	3.4	3.4	3.3	3.7	2.8	3.6	3.8	3.1	3.7	3.8
Median	4	4	3	4	3	4	4	4	4	4
Standard Deviation	1.14	0.36	1.15	1.06	1.20	1.32	1.01	1.03	1.22	1.28

Table 31 SURVEY No. 1: Question 7.2 - Metrics and Characterisation

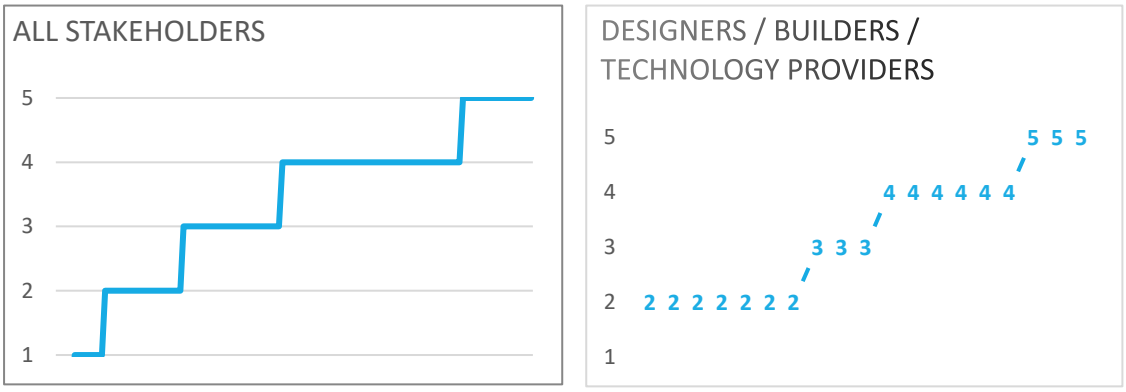


Figure 42 SURVEY No. 1: Question 7.2 – All Stakeholders' and Designers' responses

Question No. 7.3: Social limitations (lack of expert skills)

The stakeholders' figures present that the social limitations barrier, such as the lack of expert skills, affects the transition to autonomous shipping in a moderate degree (Table 32). In general, the mark that gathers the most answers is that of "Moderate Effect", while almost non-existent are the responses of "No Effect" (Figure 43). The lowest mean mark is presented by the Legal Advisors/Technical Advisors group, whereas the highest from the Regulators/Flag States/Port Authorities. The Designers/Builders/Technology Providers group gathers a significant number of "Moderate Effect" answers.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Neutral	Neutral	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect
Mean	3.5	3.5	3.6	3.6	2.9	3.3	3.5	3.9	3.9	3.8
Median	4	4	4	4	3	4	4	4	4	4
Standard Deviation	1.11	0.34	0.77	1.17	1.17	1.17	1.25	0.83	1.17	1.28

Table 32 SURVEY No. 1: Question 7.3 - Metrics and Characterisation

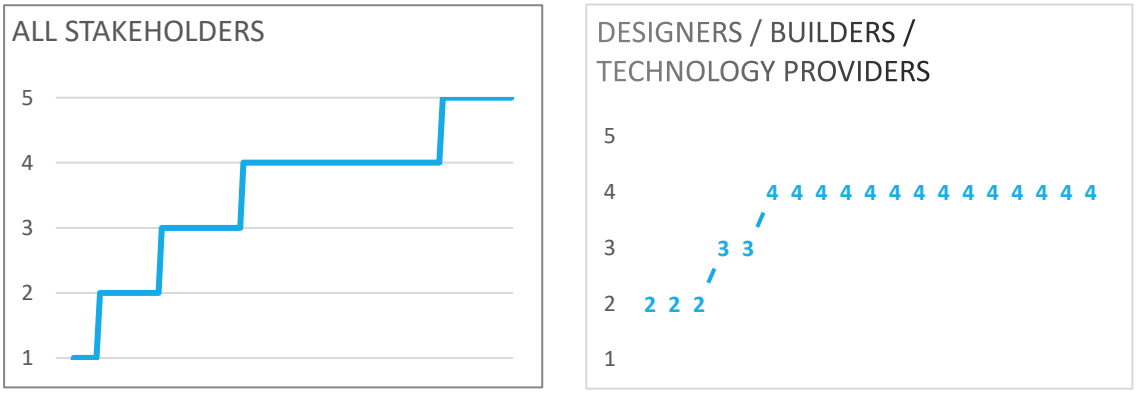


Figure 43 SURVEY No. 1: Question 7.3 – All Stakeholders' and Designers' responses

Comparing the two surveys (Figure 39), it is observed that the mean rankings, as well as the general mean, appear to be almost the same with a slightly more positive perspective of the Stakeholders that participated in Survey No. 1. In Survey No. 1, the mark that gathered the most responses is number 4, equivalent to the characterisation "Moderate Effect", whereas in Survey No. 2 is the number 3 that depicts the "Neutral" characterisation. In both surveys, the Seafarers opinion remain stable. Nevertheless, in Survey No. 2, Legal Advisors/Technical Advisors gave more positive feedback than in Survey No. 1. At the same time, all the other groups are less optimistic and consider the social limitations as neutral or of minor effect.

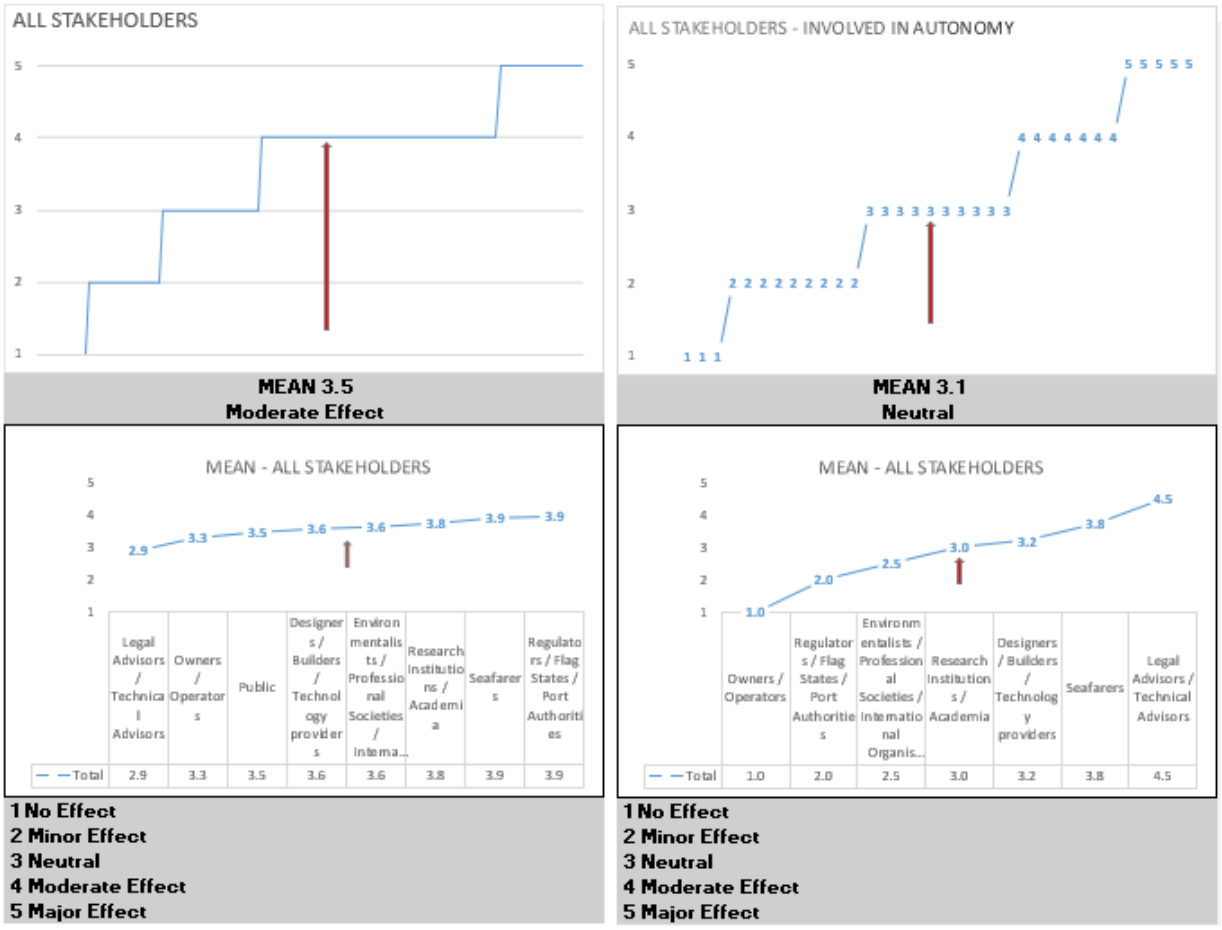


Figure 44 SURVEY No. 1 and 2: Question 7.3 - Overview

Question No. 7.4: Safety and security issues

The stakeholders' figures present that the safety and security issues barrier affects the transition to autonomous shipping in a moderate degree (Table 33). In general, the mark that gathers the most answers is that of "Major Effect", while almost non-existent are the responses of "No Effect" and "Minor Effect" (Figure 45). The Owners/Operators group presents the lowest mean mark, having a significant number of "Neutral" answers (Figure 45), whereas the Research Institutions/Academia gather the highest score.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Neutral	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect
Mean	3.8	3.8	3.8	3.7	4.1	3.4	3.7	4.1	3.8	4.1
Median	4	4	4	4	5	3	4	4	4	4
Standard Deviation	1.17	0.26	1.08	1.06	1.17	1.31	1.22	0.92	1.30	0.99

Table 33 SURVEY No. 1: Question 7.4 - Metrics and Characterisation

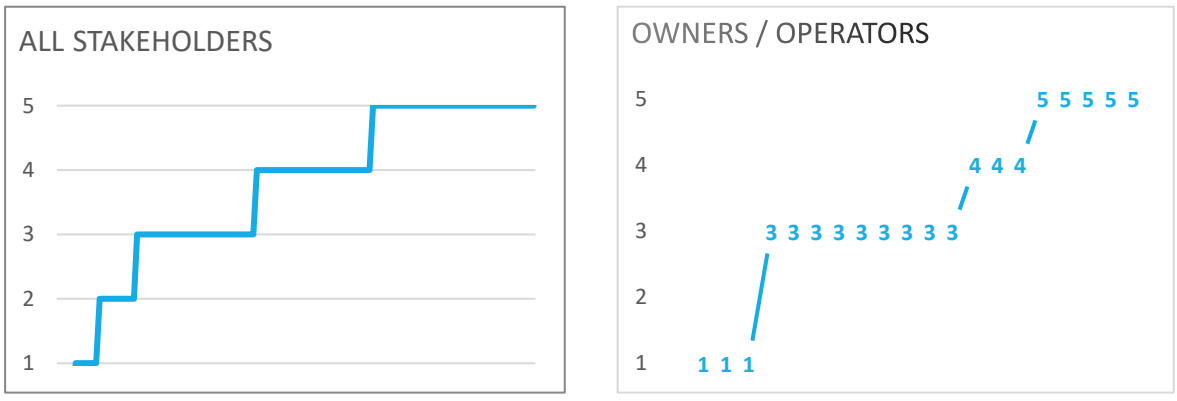


Figure 45 SURVEY No. 1: Question 7.4 – All Stakeholders' and Owners/Operators' responses

Question No. 7.5: Economic barriers (a question of profitability)

The stakeholders' figures present that the economic barriers will not affect the transition to autonomous shipping, as the received answers' mean value is "Neutral" (Table 34). The Legal Advisors/Technical Advisors group present the lowest mean mark, whereas the Seafarers gather the highest score. The Owners/Operators and the Designers/Builders/Technology Providers show many "Neutral" answers. The Research Institutions/Academia, Public and Seafarers, gather the most responses in the mark of "Moderate Effect" (Figure 46).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Moderate Effect	Moderate Effect
Mean	3.2	3.2	3.1	3.0	2.7	3.1	3.5	3.0	3.6	3.5
Median	3	3	3	3	3	3	4	3	4	4
Standard Deviation	1.21	0.32	1.05	1.49	1.32	1.10	1.19	1.36	1.13	0.76

Table 34 SURVEY No. 1: Question 7.5 - Metrics and Characterisation

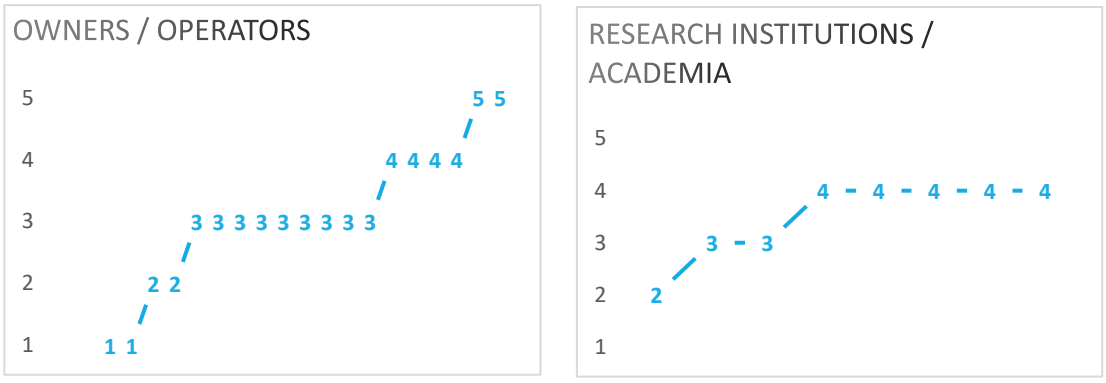


Figure 46 SURVEY No. 1: Question 7.5 –Owners/Operators' and Academia's responses

Comparing the two surveys (Figure 47), it is observed that the mean rankings, as well as the general mean, appear to be almost the same with a slightly more positive perspective of the Stakeholders that participated in Survey No. 2. In Survey No. 1, the most responses are gathered between "Neutral" and "Moderate Effect", whereas in Survey No. 2, between "Moderate Effect" and "Major Effect". The Legal Advisors/Technical Advisors involved in Autonomy figures present that economic barriers have a significant effect, while Survey No. 1 express neutrality.

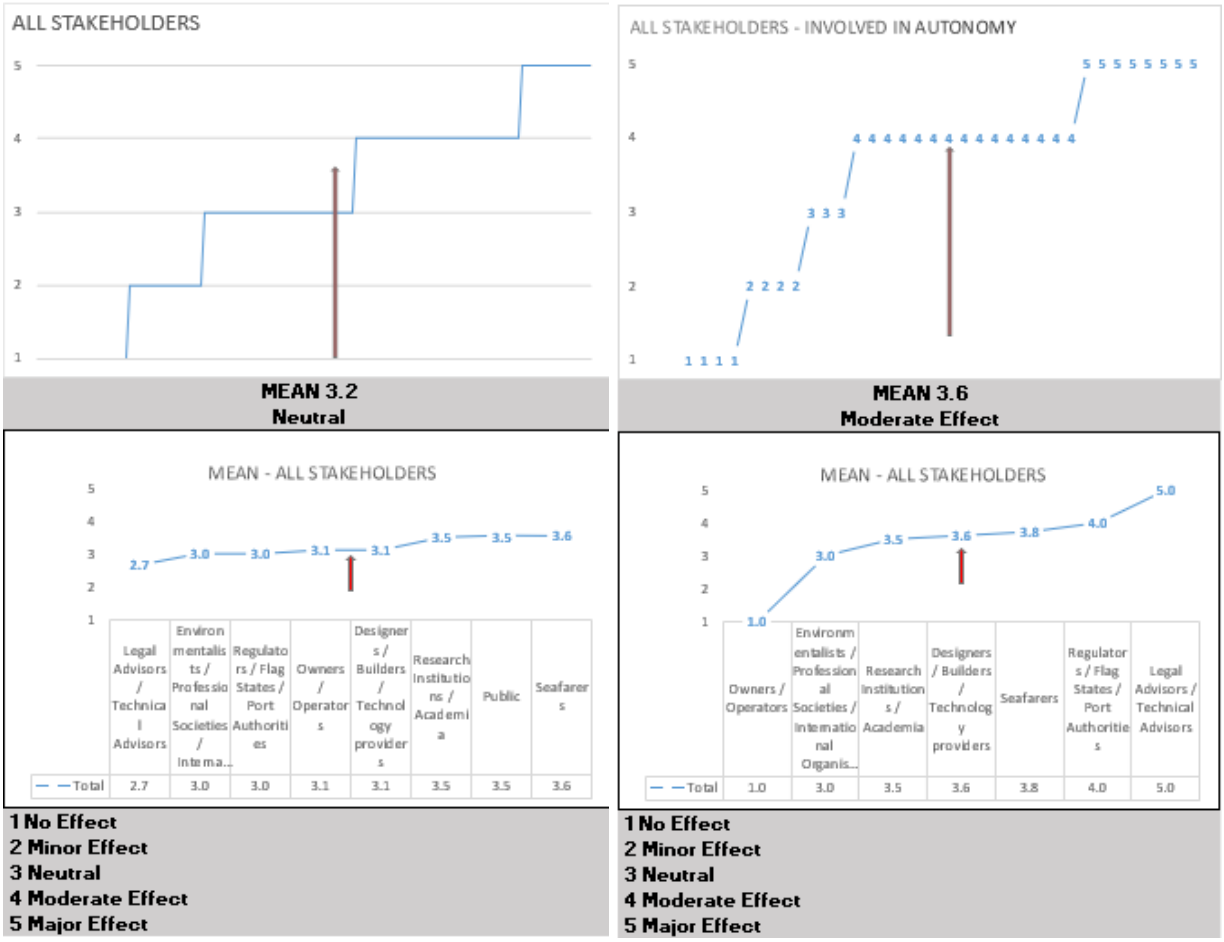


Figure 47 SURVEYS No. 1 and 2: Question 7.5 - Overview

Question No. 8: What do you think are the biggest challenges for the development of autonomous shipping; provide financial incentives to support the transition process to autonomous shipping, guarantee the safety of autonomous ships, cover the infrastructure costs in port adaptation for autonomous ships and cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships

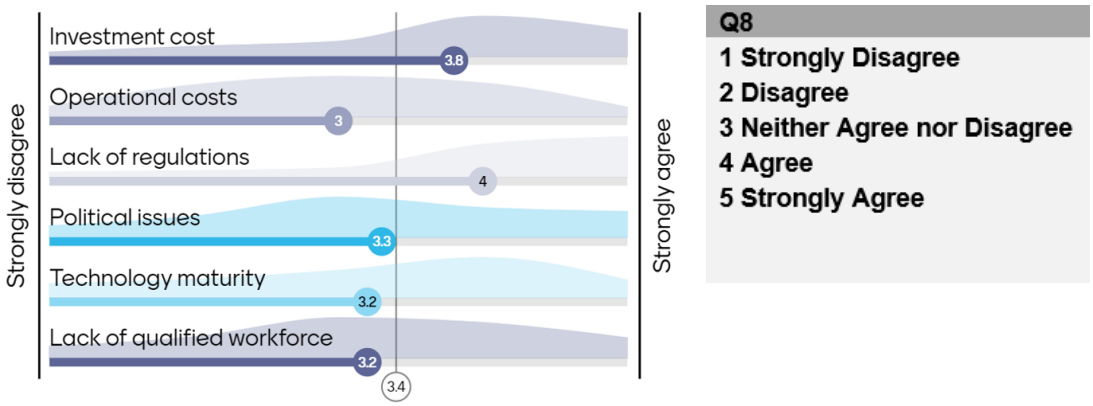


Figure 48 SURVEY No. 1: Question 8 - Mean ranking and ranking characterisations

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.4	3.4	3.6	3.7	2.9	3.5	3.2	3.7	3.3	3.5
Median	3	3	4	4	3	3.5	3.5	4	4	4
Standard Deviation	0.06	0.09	0.24	0.09	0.26	0.16	0.24	0.12	0.14	0.31

Table 35 SURVEY No. 1: Question 8 - Metrics and Characterisation

The general perspective of the stakeholders for this question is neutral (Table 35). It is observed that the standard deviation for all the stakeholder groups is low, which depicts that the sub-questions mean markings are very close to each other and similar to the overall mean marking. Stakeholders mean values assimilate, and the standard deviation denotes that this perspective is identical for all the sub-questions.

Question No. 8.1: Investment cost

The stakeholders' results illustrate that the investment cost is one of the biggest challenges for the development of autonomous shipping, considering that the mean value of the received answers is "Agree" (Table 36), as well as the most answers gathered in a mark (Figure 49). The Research Institutions/Academia group figures show the lowest mean mark, whereas the Environmentalists/Professional Societies/International Organisations gather the highest score. The Designers/Builders/Technology Providers present a significant number of "Agree" answers, and the Regulators/Flag States/Port Authorities, as well as the Owners/Operators "Strongly Agree", respectively.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree
Mean	3.8	3.8	3.9	4.2	3.4	4.1	3.3	4.1	3.6	2.6
Median	4	4	4	4	3	5	4	4	4	2
Standard Deviation	1.13	0.53	0.71	0.79	0.88	1.17	1.29	1.12	1.51	1.30

Table 36 SURVEY No. 1: Question 8.1 - Metrics and Characterisation

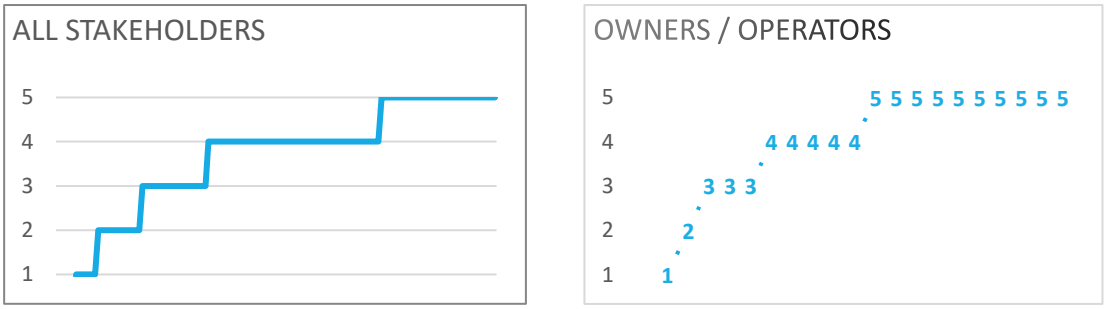


Figure 49 SURVEY No. 1: Question 8.1 – All Stakeholders' and Owners'/Operators' responses

Question No. 8.2: Operational costs

The stakeholders' figures show that the operational costs are not considered one of the biggest challenges for developing autonomous shipping, as the mean value of the received answers is neutral (Table 37). The Legal Advisors/Technical Advisors group presents the lowest mean mark, expressing its disagreement, whereas the Environmentalists/Professional Societies/International Organisations gather the highest score. The Designers/Builders/Technology Providers and the Public present a significant number of "Agree" answers (Figure 50), as well as the Owners/Operators "Neither Agree nor Disagree" respectively.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers / Builders / Technology Providers	Environmentalists / Professional Societies / International Organisations	Legal Advisors / Technical Advisors	Owners / Operators	Public	Regulators / Flag States / Port Authorities	Seafarers	Research Institutions / Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.0	3.0	3.2	3.5	2.1	3.2	2.9	3.3	3.3	2.6
Median	3	3	3	4	2	3	3	3	4	2
Standard Deviation	1.09	0.45	0.96	0.85	0.93	1.09	1.10	1.03	1.16	1.19

Table 37 SURVEY No. 1: Question 8.2 - Metrics and Characterisation

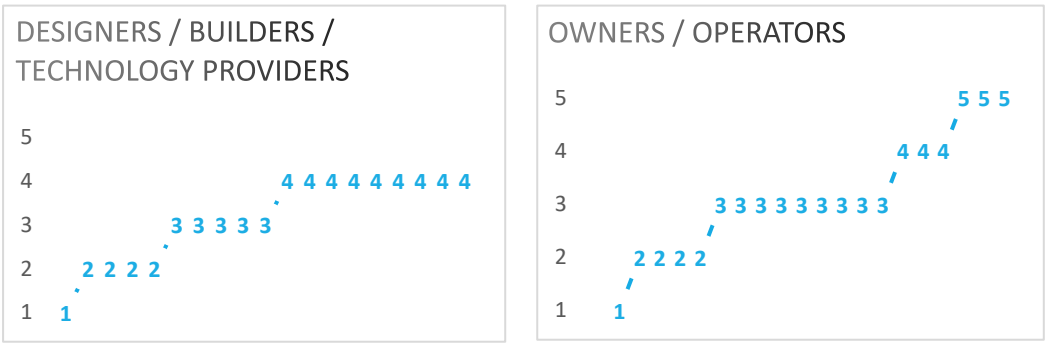


Figure 50 SURVEY No. 1: Question 8.2 – Designers' and Owners' responses

Question No. 8.3: Lack of regulations

The stakeholders consider that the lack of regulations is one of the biggest challenges for developing autonomous shipping, as the mean value of the received answers is "Agree" (Table 38). The most answers gathered are in the marks of "Agree" and "Strongly Agree" (Figure 51). The Regulators/Flag States/Port Authorities group presents the lowest mean mark expressing neutrality, while the Legal Advisors/Technical Advisors gather the highest score.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree
Mean	4.0	4.0	4.2	4.2	4.3	4.1	3.4	4.1	3.5	4.0
Median	4	4	4	5	5	5	4	4	4	5
Standard Deviation	1.16	0.34	0.90	1.03	1.00	1.29	1.59	0.95	1.27	1.41

Table 38 SURVEY No. 1: Question 8.3 - Metrics and Characterisation

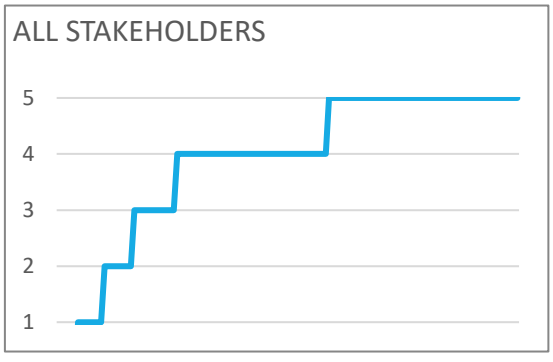


Figure 51 SURVEY No. 1: Question 8.3 – All Stakeholders' responses

Question No. 8.4: Political issues

The stakeholders' figures show that the political issues are not considered one of the biggest challenges for the development of autonomous shipping, as the mean value (Table 39), and most of the received answers in a mark are "Neither Agree nor Disagree" (Figure 52). The Public presents the lowest mean mark expressing neutrality, while the Research Institutions/Academia, which agrees with the challenge's importance, gathers the highest score.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
Mean	3.3	3.3	3.7	3.4	3.0	3.3	2.8	3.4	2.8	4.0
Median	3	3	4	4	3	3	3	3	3	5
Standard Deviation	1.22	0.42	1.29	0.97	1.41	1.48	0.94	1.12	1.23	1.41

Table 39 SURVEY No. 1: Question 8.4 - Metrics and Characterisation

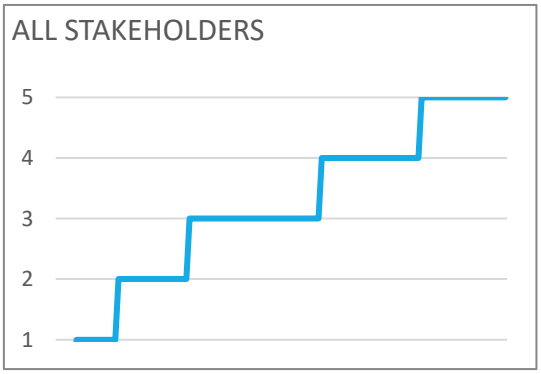


Figure 52 SURVEY No. 1: Question 8.4 – All Stakeholders' responses

Question No. 8.5: Technology maturity

The stakeholders' figures show that technological maturity is not considered one of the biggest challenges for developing autonomous shipping, as the mean value is "Neither Agree nor Disagree" (Table 40). Therefore, most of the received answers are in the mark "Agree" (Figure 53). The Legal Advisors/Technical Advisors group presents the lowest mean mark expressing neutrality, while the Research Institutions/Academia agrees with the importance of the challenge and gathers the highest score.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
Mean	3.2	3.2	3.0	3.2	2.7	3.3	3.5	3.3	3.1	3.9
Median	3	3	3	3	3	4	4	4	4	4
Standard Deviation	1.25	0.35	1.29	0.92	1.50	1.49	1.41	1.25	1.37	0.64

Table 40 SURVEY No. 1: Question 8.5 - Metrics and Characterisation

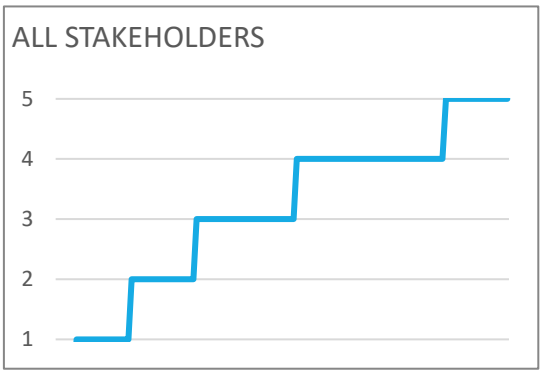


Figure 53 SURVEY No. 1: Question 8.5 – All Stakeholders' responses

Question No. 8.6: Lack of qualified workforce

The stakeholders' figures illustrate that the lack of a qualified workforce does not seem to be one of the biggest challenges for developing autonomous shipping, as the mean value is "Neither Agree nor Disagree" (Table 41). Therefore, most of the received answers in a mark are neutral and "Agree" (Figure 54). The Legal Advisors/Technical Advisors group presents the lowest mean mark expressing a disagreement. In contrast, the Regulators/Flag States/Port Authorities group that agrees with the challenge's importance gathers the highest score. Those collecting a significant number of neutral answers are the groups of Owners/Operators and the Environmentalists/Professional Societies/International Organisations. Besides, a substantial number of "Agree" responses gave the groups of Seafarers, Designers/Builders/Technology Providers, Research Institutions/Academia and Regulators/Flag States/Port Authorities.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree
Mean	3.2	3.2	3.4	3.5	2.0	3.2	3.3	3.8	3.3	3.6
Median	3	3	4	3	2	3	3	4	4	4
Standard Deviation	1.19	0.54	1.22	0.97	1.00	1.32	1.11	0.93	1.16	0.92

Table 41 SURVEY No. 1: Question 8.6 - Metrics and Characterisation

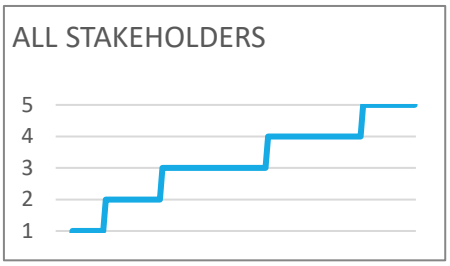


Figure 54 SURVEY No. 1: Question 8.6 – All Stakeholders' responses

Question No. 9: Which technical limitations do you consider the most significant challenge when designing and operating autonomous ships; autonomous navigation, communication with the ship, remote control centres, there are no procedures for testing, verification and validation, ship reliability and maintenance/repair requirements

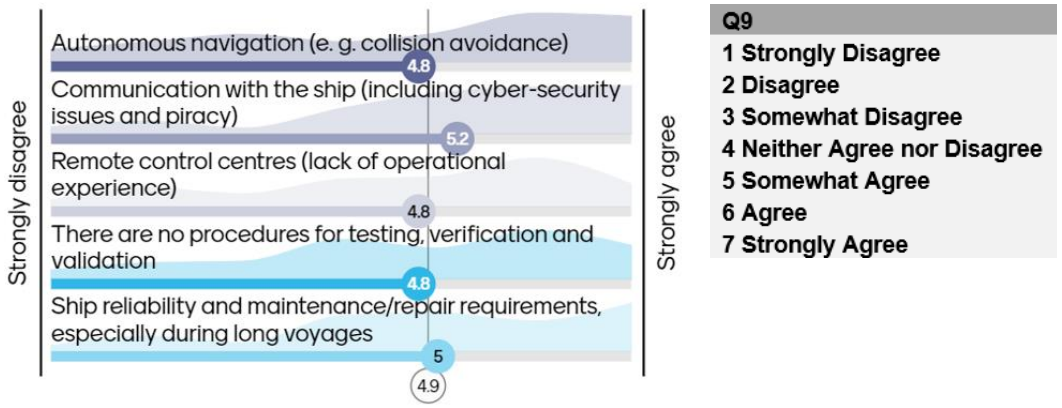


Figure 55 SURVEY No. 1: Question 9 - Mean ranking and ranking characterisations

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree
Mean	4.9	4.9	5.1	4.9	4.8	4.7	4.7	5.5	5.3	5.2
Median	5	5	5	5	5	5	5	6	5	6
Standard Deviation	0.09	0.14	0.28	0.33	0.33	0.19	0.13	0.38	0.34	0.19

Table 42 SURVEY No. 1: Question 9 - Metrics and Characterisation

The general perspective of the stakeholders for this question is "Somewhat Agree" (Table 42). It is observed that the standard deviation for all the stakeholder groups is low, which depicts that the sub-questions mean markings are very close to each other and similar to the overall mean marking. Stakeholders mean values assimilate, and the standard deviation denotes that this perspective is identical for all the sub-questions.

Question No. 9.1: Autonomous navigation (e.g. collision avoidance)

The majority of the stakeholders replied that they agree to some degree that autonomous navigation is the most significant challenge when designing and operating autonomous ships (Table 43). The marks of "Agree" and "Strongly Agree" gather the most polls comparing to other marks (Figure 56). The Owners/Operators and the Legal Advisors/Technical Advisors groups present the lowest mean mark. Both express mainly opposing views, and there is an indicative number of voters that is neutral. The highest score is gathered by the Environmentalists/Professional Societies/International Organisations, which appears to have only one "Strongly Disagree" voting, and the mean value leads to "Agree".

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree
Mean	4.8	4.8	5.1	5.6	4.1	4.1	5.3	5.1	4.7	5.0
Median	5	5	5	6	4	4	6	5	4	6
Standard Deviation	1.92	0.54	1.59	1.90	2.26	2.34	1.79	1.66	1.22	2.27

Table 43 SURVEY No. 1: Question 9.1 - Metrics and Characterisation

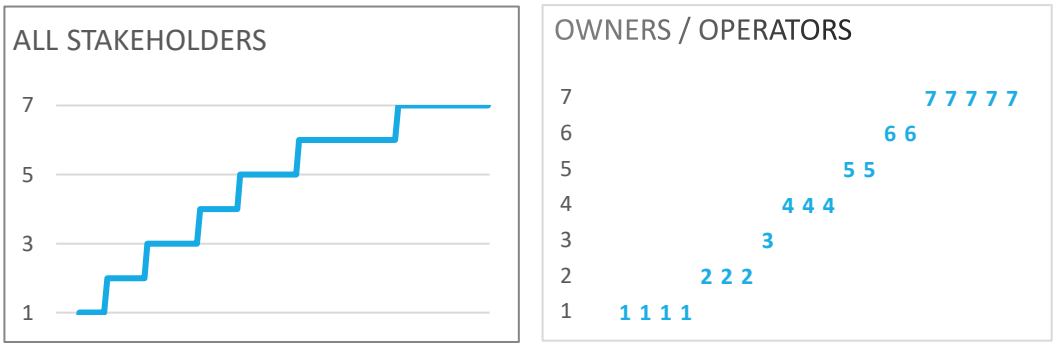


Figure 56 SURVEY No. 1: Question 9.1 – All Stakeholders' and Owners' responses

Question No. 9.2: Communication with the ship (including cyber-security issues and piracy)

The majority of the stakeholders replied that they agree to some degree that the communication with the ship, including cyber-security issues and piracy, will be a big challenge when designing and operating autonomous ships (Table 44). The marks of "Somewhat Agree", "Agree", and "Strongly Agree" gather the most votes comparing to other marks (Figure 57). The Public presents the lowest mean mark, which is neutral. On the contrary, the Designers/Builders/Technology Providers and the Regulators/Flag States/Port Authorities figures show the highest score regarding characterisation "Agree".

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Agree	Somewhat Agree	Somewhat Agree
Mean	5.2	5.2	5.9	4.9	5.2	5.2	4.4	6.0	5.1	5.1
Median	6	5	6	5	5	6	5	6	5	6
Standard Deviation	1.68	0.52	1.15	1.90	1.72	2.01	1.99	0.91	1.05	2.03

Table 44 SURVEY No. 1: Question 9.2 - Metrics and Characterisation

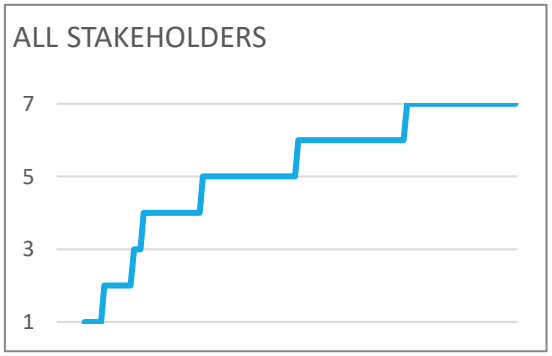


Figure 57 SURVEY No. 1: Question 9.2 – All Stakeholders' responses

Question No. 9.3: Remote control centres (lack of operational experience)

In the sub-question, whether the remote-control centres will be a big challenge when designing and operating autonomous ships, for example, because of the lack of operational experience, most stakeholders replied that they agree to some degree with this state (Table 45). The mark of "Agree" gathers the most votes comparing to other marks. The Legal Advisors/Technical Advisors group presents the lowest mean grade, which is neutral. On the contrary, the Seafarers figures show the highest score equivalent to the characterisation "Agree". The Environmentalists/Professional Societies/International Organisations, Owners/Operators and the Designers/Builders/Technology Providers have the same mean values which correspond to the characterisation "Somewhat Agree". The Regulators/Flag States/Port Authorities diagram illustrates many "Agree" votes (Figure 58).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree
Mean	4.7	4.7	5.0	4.9	3.9	5.0	4.3	5.7	5.9	4.4
Median	5	5	5	5	4	6	5	6	6	5
Standard Deviation	1.73	0.69	1.41	1.66	1.62	2.04	1.79	1.11	0.78	2.13

Table 45 SURVEY No. 1: Question 9.3 - Metrics and Characterisation

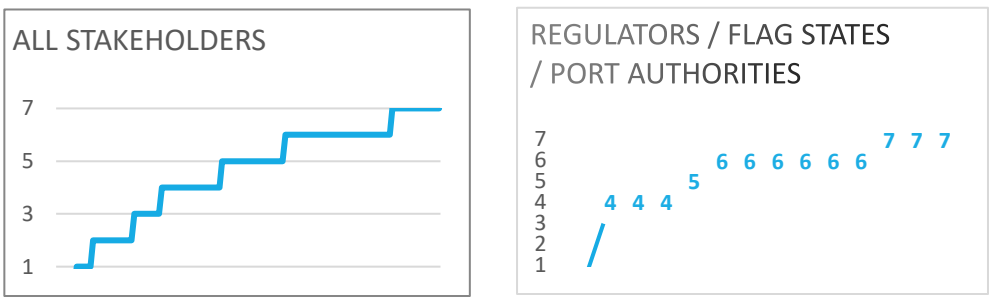


Figure 58 SURVEY No. 1: Question 9.3 – All Stakeholders' and Regulators' responses

Question No. 9.4: There are no procedures for testing, verification and validation

In the sub-question, whether there are no procedures for testing, verification and validation will be a big challenge when designing and operating autonomous ships. The majority of the stakeholders replied that they agree to some degree with this state (Table 46). Two marks gather a significant number of votes; the "Neither Agree nor Disagree" and the "Agree" marks (Figure 59). The Environmentalists/Professional Societies/International Organisations group presents the lowest mean mark, which is neutral. On the contrary, the Regulators/Flag States/Port Authorities figures show the highest score, which corresponds to the "Somewhat Agree" characterisation. The Owners/Operators agree to a degree, and they gather the most votes in two different marks; "Neither Agree nor Disagree" and "Strongly Agree" (Figure 59).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree
Mean	4.7	4.7	5.0	4.5	4.7	4.8	4.6	5.4	5.2	5.3
Median	5	5	6	4	5	5	5	6	5	6
Standard Deviation	1.74	0.33	1.91	1.35	1.80	1.82	1.68	1.56	1.64	1.91

Table 46 SURVEY No. 1: Question 9.4 - Metrics and Characterisation

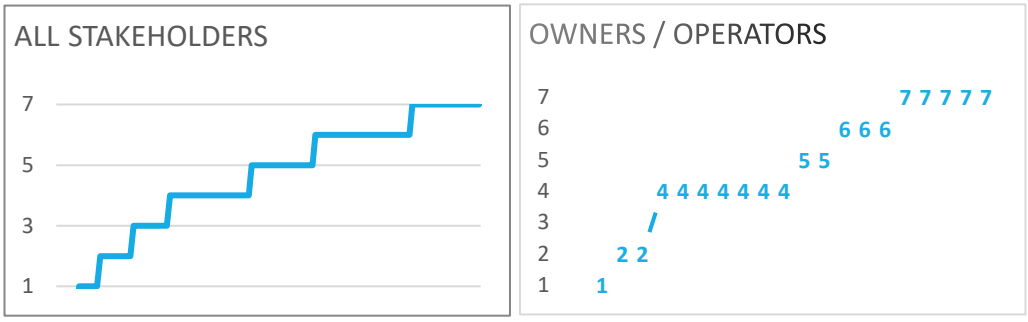


Figure 59 SURVEY No. 1: Question 9.4 – All Stakeholders' and Owners' responses

Question No. 9.5: Ship reliability and maintenance/repair requirements, especially during long voyages

The majority of the stakeholders replied that they agree that the ship stability and maintenance/repair requirements, especially during long voyages, will be a big challenge when designing and operating autonomous ships (Table 47). The mark that gathers a significant number of votes is the "Strongly Agree", and after that, in smaller numbers follow the marks of "Neither Agree nor Disagree" and "Somewhat Agree" (Figure 60). The Environmentalists/Professional Societies/International Organisations group presents the lowest mean mark, which is neutral. On the contrary, the Legal Advisors/Technical Advisors figures demonstrate the highest score that corresponds to the characterisation "Agree". The Owners/Operators are very close to the lowest mean mark, so are the Designers/Builders/Technology Providers.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Agree
Mean	5.0	5.0	4.7	4.4	6.1	4.6	4.9	5.2	5.8	6.0
Median	5	5	5	4	7	5	5	6	7	7
Standard Deviation	1.73	0.67	1.53	1.17	1.36	2.01	1.67	1.79	1.48	1.77

Table 47 SURVEY No. 1: Question 9.5 - Metrics and Characterisation

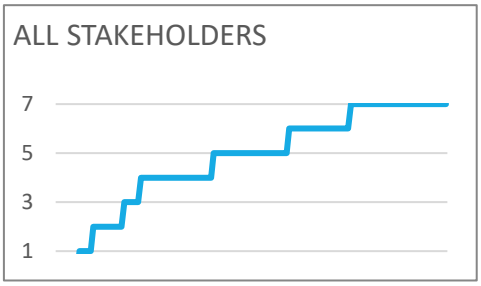


Figure 60 SURVEY No. 1: Question 9.5 – All Stakeholders' responses

Question No. 10: The role of governments; provide financial incentives to support the transition process to autonomous shipping, guarantee the safety of autonomous ships, cover the infrastructure costs in port adaptation for autonomous ships and cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships

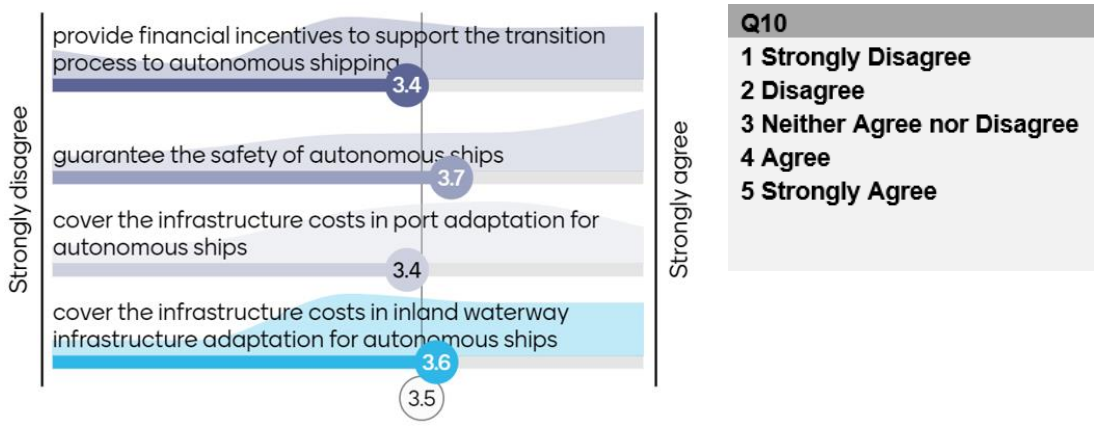


Figure 61 SURVEY No. 1: Question 10 - Mean ranking and ranking characterisations

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.5	3.5	3.4	3.5	3.3	4.0	3.7	3.4	2.8	3.5
Median	4	3	3	3.5	3.5	4	4	3	3	3.5
Standard Deviation	0.07	0.11	0.15	0.11	0.21	0.10	0.08	0.23	0.16	0.13

Table 48 SURVEY No. 1: Question 10 - Metrics and Characterisation

The general perspective of the stakeholders for this question is that they "Agree" that the governments should have a fundamental role in providing financial and safety guarantees of autonomous ships support (Table 48). It is observed that the standard deviation for all the stakeholder groups is low, which depicts that the sub-questions mean markings are very close to each other and similar to the overall mean marking. Stakeholders mean values assimilate, and the standard deviation denotes that this perspective is identical for all the sub-questions.

Question No. 10.1: Provide financial incentives to support the transition process to autonomous shipping

This sub-question asks the stakeholders whether the governments' role is to provide financial incentives to support the transition process to autonomous shipping (Table 49). The most answers were "Neither Agree nor Disagree", and the second choice was that of "Strongly Agree" (Figure 62). The Seafarers gave the lowest mark expressing their disagreement, whereas the Owners/Operators figures present their agreement. Most of the answers of the last group are in the "Strongly Agree" mark.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Disagree	Neither Agree nor Disagree
Mean	3.4	3.4	3.0	3.8	3.3	3.9	3.7	3.3	2.4	3.5
Median	3	3	3	4	3	5	4	3	3	4
Standard Deviation	1.33	0.47	1.24	1.32	1.32	1.37	1.35	1.18	1.24	1.31

Table 49 SURVEY No. 1: Question 10.1 - Metrics and Characterisation

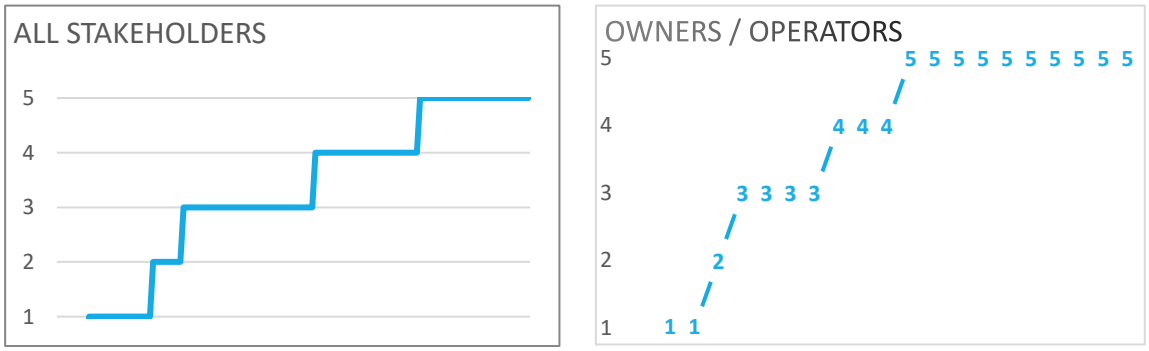


Figure 62 SURVEY No. 1: Question 10.1 – All Stakeholders' and Owners' responses

Comparing the two surveys (Figure 63), it is observed that the mean rankings, as well as the general mean, appear to be almost the same with a slightly more positive perspective of the Stakeholders that participated in Survey 2. In Survey No. 1, the mark that gathered the most responses is number 3, equivalent to the characterisation "Neither Agree nor Disagree". In contrast, in Survey No. 2 is the number 4 that depicts the "Agree" characterisation. In both surveys, the Owners/Operators group opinion is positive and the same. Designers/Builders/Technology Providers view in Survey No. 2 is positive, while Survey No. 1 is neutral.

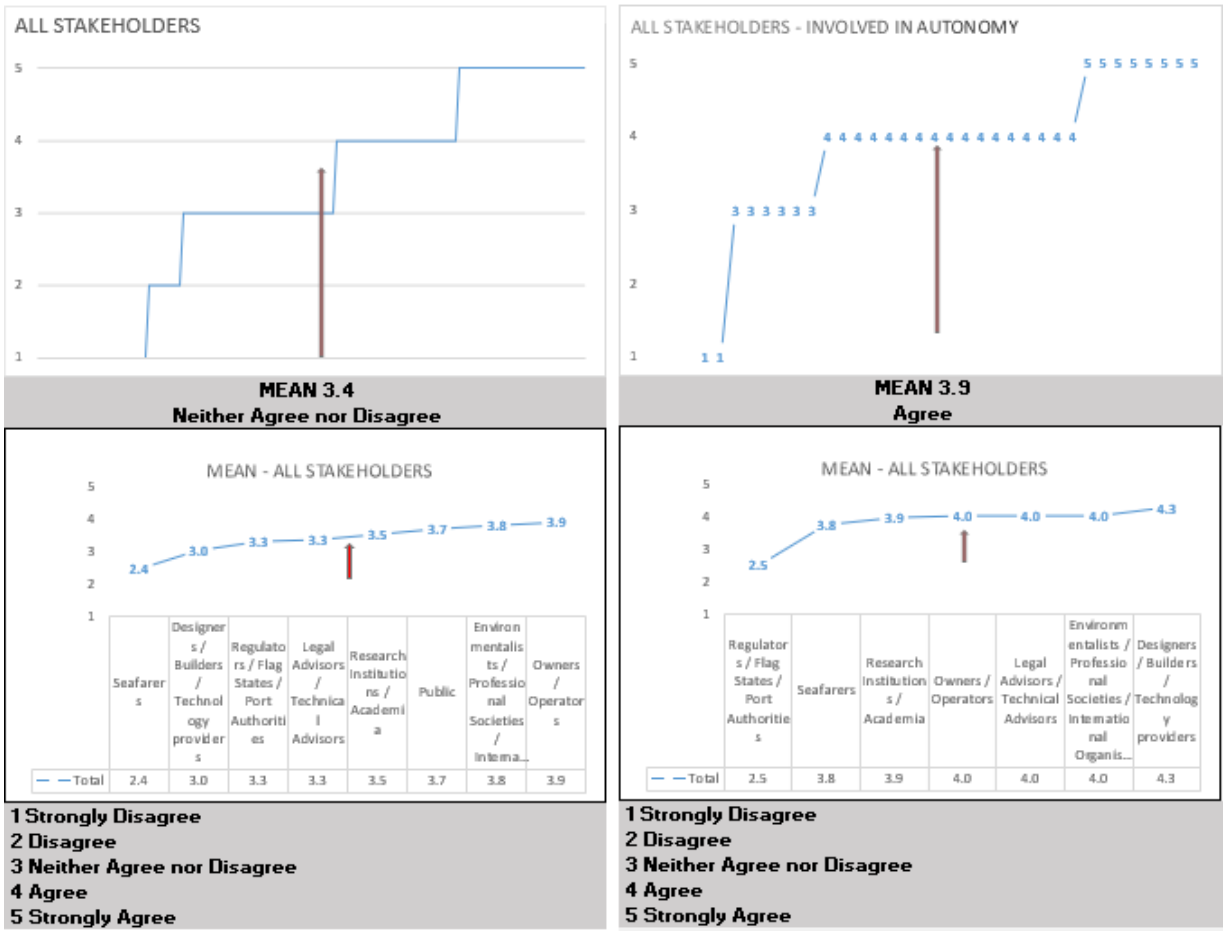


Figure 63 SURVEYS No. 1 and 2: Question 10.1 - Overview

Question No. 10.2: Guarantee the safety of autonomous ships

The mark with the most votes is that of "Strongly Agree" (Figure 64). The Seafarers gave the lowest mark expressing a neutral state, whereas the Public figures present their agreement (Table 50). Most of the last group's answers are in the "Agree" or "Strongly Agree" marks. The Designers/Builders/Technology Providers most votes are in the marks of "Neither Agree nor Disagree" and "Strongly Agree". The Owners/Operators votes are similar to the last group's, with the difference that there are some additional "Agree" votes (Figure 64).

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
Mean	3.6	3.6	3.7	3.8	3.7	3.9	3.9	3.5	3.2	3.6
Median	4	4	4	4	4	4	4	3	4	4
Standard Deviation	1.31	0.21	1.32	1.23	1.50	1.18	1.19	1.33	1.56	1.19

Table 50 SURVEY No. 1: Question 10.2 - Metrics and Characterisation

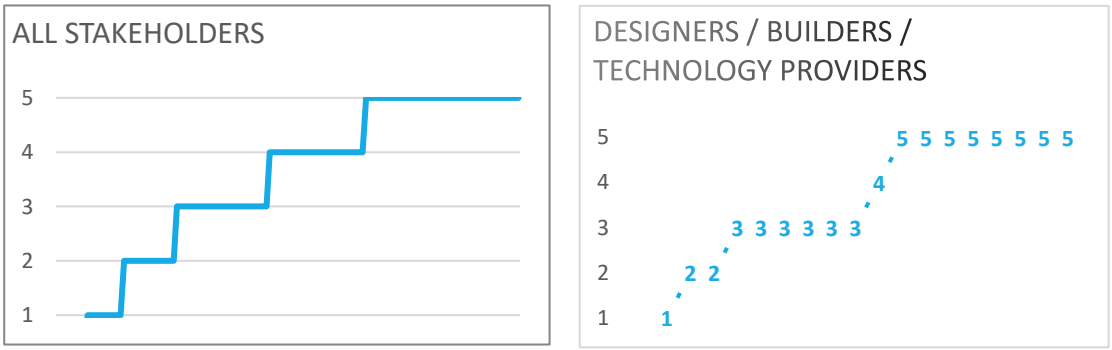


Figure 64 SURVEY No. 1: Question 10.2 – All Stakeholders' and Designers' responses

Question No. 10.3: Cover the infrastructure costs in port adaptation for autonomous ships

The grade with the most votes is that of "Agree" and after that follows the "Neither Agree nor Disagree" (Figure 65). The Seafarers gave the lowest mark expressing a neutral state, whereas the Owners/Operators group figures present its agreement (Table 51). Most of the answers of the last group are given in the "Agree" or "Strongly Agree" marks (Figure 65). The Public' most votes are in the mark of "Agree", while the Regulators/Flag States/Port Authorities majority of votes are in the mark of "Neither Agree nor Disagree".

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.4	3.4	3.3	3.2	2.9	4.0	3.3	3.3	2.8	3.3
Median	4	3	3	3	3	4	4	3	3	3
Standard Deviation	1.20	0.35	0.97	1.40	1.17	1.15	1.28	0.85	1.30	1.39

Table 51 SURVEY No. 1: Question 10.3 - Metrics and Characterisation

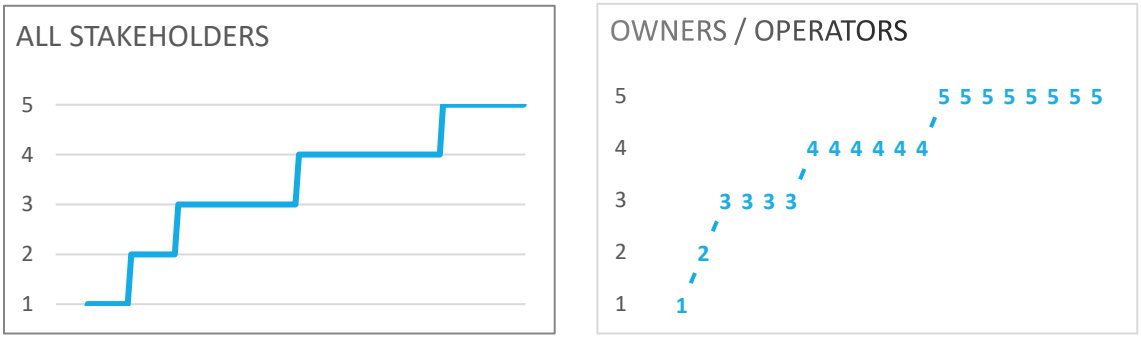


Figure 65 SURVEY No. 1: Question 10.3 – All Stakeholders' and Owners' responses

Question No. 10.4: Cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships

The mark with the most votes is that of "Neither Agree nor Disagree", while the selections "Agree" and "Strongly Agree" gather some fewer votes (Figure 66). The mean value of the votes is "Agree" (Table 52). The Seafarers gave the lowest mark expressing a neutral state, whereas the Owners/Operators group figures present its agreement (Figure 66). Most of the answers of the last group are in the "Strongly Agree" mark. The Regulators/Flag States/Port Authorities and Designers/Builders/Technology Providers most votes are in the mark of "Neither Agree nor Disagree". The last group also presents many answers in the "Strongly Agree" mark.

METRICS	STAKEHOLDERS									
	ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Public	Regulators	Seafarers	Research Institutions
			Builders	Professional Societies	Technical Advisors	Operators		Flag States		
			Technology Providers	International Organisations				Port Authorities		Academia
Characterisation	Agree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
Mean	3.6	3.6	3.6	3.3	3.3	4.0	3.7	3.5	2.8	3.4
Median	4	3	3	3	4	4	4	3	3	3
Standard Deviation	1.20	0.35	1.25	1.49	1.00	1.17	1.18	0.88	1.20	1.51

Table 52 SURVEY No. 1: Question 10.4 - Metrics and Characterisation

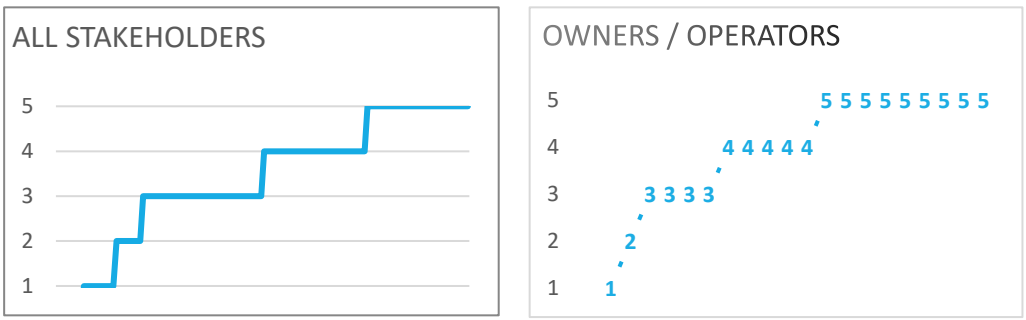


Figure 66 SURVEY No. 1: Question 10.4 – All Stakeholders' and Owners' responses

3. CONCLUSIONS AND PROPOSAL FOR FURTHER INVESTIGATIONS

This chapter contains a summary and discussion of the most significant findings based on the analysis of the stakeholders' responses in Section 2, and there are some suggestions per question for further investigation. Along with the key findings, the current study could pose the base for creating some additional and more specified investigations to discover the weak points of autonomous shipping. Some of the findings appear to assimilate with the conclusions of the MUNIN survey (MUNIN, 2016), which was conducted some years ago, and a relevant reference is made accordingly. The MUNIN survey was part of the Maritime Unmanned Navigation through Intelligence in Networks collaborative project, which was co-funded by the European Commission and aimed to develop and verify an autonomous ship concept controlled by an operator based ashore guided by automated on-board decision systems. Generally, in some questions of the AUTOSHIP report, it can be noticed that the Research Institutions/Academia might have a much more optimistic view than the Shipowners/Operators group.

QUESTION NO. 3: WHICH WOULD BE THE BENEFITS FROM THE TRANSITION TO AUTONOMOUS SHIPPING; FINANCIAL, ENVIRONMENTAL AND SOCIAL BENEFITS, INCREASED SAFETY, ADDED RESILIENCE IN CASE OF MAJOR WORLDWIDE DISRUPTIONS

There is a general view of the stakeholders that the transition to autonomous shipping will be beneficial to some degree in all the aspects we examined, however, noticeable differences among categories can be found. For example, the Seafarers do not expect that autonomous ships will improve safety, differently from designers.

On the other hand, in terms of the environmental benefits acknowledgment, the professionals are keener on noticing them, compared to the Public. Also, the Environmentalists, as well as Owners/Operators to some extent, seem to be more in favour of the environmental benefits than to the increase of income and profitability.

This denotes that a communication plan could perhaps act as a mean to bring the Public closer to the idea the autonomous shipping will be beneficial in environmental terms, that seafarer's position on safety should be explored (and the advantages of improved jobs ashore better analysed and communicated) that cost benefit analyses will be important for operators and owners especially, understanding their criteria for sustainability. All these are parts to be investigated by AUTOSHIP project in the following period.

Comparing to the results that the MUNIN stakeholders survey (MUNIN, 2016) presented some years ago, the feedback received in the AUTOSHIP survey is more conservative. Noteworthy is that in the MUNIN questionnaire, almost one out of two who participated in the qualitative assessment has gained experience onboard a ship expressed a positive view in terms of autonomous ships. At the same time, in the AUTOSHIP survey, the seafarers' feedback, which is the equivalent group, was neutral.

Moreover, it will be necessary to evaluate the weak links of an autonomous ship system in a supply chain context, so that future efforts can be directed to overcome these gaps. In addition to this, it will be necessary to further examine the criteria in which Environmentalists/Professional Societies/International Organisations and Owners/Operators consider as sustainable solutions and use this as criteria for improving the autonomous ship systems and closing the gaps.

Finally, an outcome of the survey analysis is that it will be necessary to investigate whether or not social benefits for seafarers can be matched or improved if their jobs are transferred from the ship to shore.

QUESTION NO. 4: HOW WOULD THE TRANSITION TO AUTONOMOUS SHIPPING IMPACT THE SHIPPING INDUSTRY; INCREASE THE INCOME, PROFITABILITY, NUMBER OF EMPLOYEES, IMPROVE ACCESS TO FINANCING AND CRISIS RESILIENCE

The stakeholders' general perspective is neutral. **In terms of employees, respondents showed a slightly negative view of the increase in the employees' numbers. However, from the responses, the various groups did not consider a value-chain perspective, for example the numbers of employees required to develop the relative systems and technologies (i.e., designers, technology providers, IT, sensor experts). Instead, they might have considered a Seafarers removal from the ships and base some indicative professionals in the remote-control centre.**

In terms of the financial metrics and the crisis resilience, various stakeholders have a slight tendency that the autonomous ships will improve them. As mentioned in the previous paragraph, the **Environmentalists/Professional Societies/International Organisations, as well as Owners/Operators to some extent, seem to be more in favour of the environmental benefits than to the increase of income and profitability**.

It would be good to understand why the Owners/Operators keep a neutral view regarding the improvement in crisis resilience. It would also be interesting to understand why Designers/Builders/Technology providers are neutral on the impact of autonomous shipping.

MUNIN survey participants expressed a positive impact on improving the profitability of shipping companies and the cost of maritime transport (MUNIN, 2016). Generally, to some extent, the transition is driven forward by Technology providers. Thus, there is a need to comprehend whether the survey has reached a mixed group. Some are positive (i.e., interested in autonomous shipping), while others are negative (interested in the status quo).

QUESTION NO. 5: I EXPECT AUTONOMOUS SHIPPING WILL BE A VIABLE OPTION FOR THE FOLLOWING SHIPPING SECTORS: OCEAN-GOING VESSELS, SHORT-SEA SHIPPING, INLAND-SHIPPING, WORKING SHIPS, CRUISERS

There is a general agreement that short-sea, inland water ways and ocean-going vessels can adopt autonomous technology. Interestingly, Research Institutions/Academia and Seafarers disagree with this statement concerning ocean-going ships. On the contrary, the least appropriate ship type is deemed to be the Cruiser, that might be due to the negative media attention that cruiser ships have received in the last years because of fatal accidents that have been occurred (i.e., Costa Concordia sinking in 2021 after hitting a rock, she capsized and sank near Giglio island, Italy).

One of the most fundamental technological barriers to autonomous shipping's effectiveness is establishing communication for exchanging data at a respective speed between the various parties. Regarding Short-sea and Inland shipping, there is a redundancy of communications systems, whereas the Ocean-going shipping requires further investigation in terms of this part and its cost-effectiveness. Another considerable barrier is the regulatory framework: for Ocean-going shipping (International Regulations), Short-sea and Inland shipping (National Authority Regulations).

Concerning the working ships (tugs, dredgers), there is a neutral view, but again the Research Institutions/Academia group is negative, despite several initiatives concern this segment, and the Regulators/Flag States/Port Authorities and the Environmentalists/Professional Societies/International Organisations share a more positive view. The Designers/Builders/Technology Providers have a neutral perspective regarding autonomous working ships' viability (tugs, dredgers).

The Research Institutions/Academia's adverse position to Ocean-going and working tugs requires investigation to understand the obstacles that come into their consideration. The AUTOSHIP project will to some extent provide recommendations to this point through AUTOSHIP Deliverable 8.2 'Roadmap for Autonomous ship adoption and development'.

QUESTION NO. 6: THE TRANSITION TO AUTONOMOUS SHIPPING CAN: SOLVE THE DEFICIT OF SEAFARERS, IMPROVE THE QUALITY OF LIFE FOR THE EMPLOYEES IN THE SHIPPING SECTOR, REQUIRE THE MODIFICATION OF THE CURRENT TRAINING FRAMEWORK FOR SEAFARERS, RESULT IN THE LOSS OF EXISTING KNOWLEDGE, SKILLS AND EXPERIENCE OF SEAFARERS, CONTRIBUTE TO THE TRANSPORTATION MODAL SHIFT AND RENDER THE USE OF SMALLER SHIPS MORE ATTRACTIVE

Most of the responses were positive, while some few were neutral. The Seafarers group is opposed to all the answers. The Owners/Operators group is the one that agrees mostly that the transition will assist in the deficit of the seafarers. The responses present that the Designers/Builders/Technology Providers are neutral. There is a general perspective that the modification of the training framework is essential. The Legal Advisors/Technical Advisors group either seems to be on the lower end or upper end for almost all sub-questions.

The proper answer to this question requires a complete understanding of the supply chain. There is a requirement to investigate the groups' understanding level further to have the most proper answers to this question. It is of importance to define the root cause that the Seafarers are averse to autonomous shipping transition; perhaps they fear that autonomous shipping will be a reason for losing their jobs. Therefore, there is need to establish a dialogue with Seafarers such as to speak about safety, jobs and the true autonomy transition, in order not to have them against. Also, there is a large spread on the transition and barrier questions by the Legal Advisors/Technical Advisors group, which either seems to be on the lower end or upper end for almost all sub-questions with its given answers.

QUESTION NO. 7: PLEASE ASSESS THE IMPACT OF THE FOLLOWING BARRIERS TO THE TRANSITION TO AUTONOMOUS SHIPPING; REGULATORY AND ECONOMIC BARRIERS, TECHNOLOGICAL AND SOCIAL LIMITATIONS, SAFETY AND SECURITY ISSUES

Regulators/Flag States/Port Authorities group gave the most significant mark in terms of the sub-question 'ships will not be allowed to sail until new regulations have been implemented. We can also notice that many individuals from various groups agree with this view. The Owners/Operators and the Legal/Technical Advisors are neutral regarding the social limitations (lack of expert skills). Undoubtedly, the introduction of autonomous ships calls for the adaptation of the maritime legislation respectively, as yet MUNIN respondents concurred; more than the half of respondents stated that they were pretty optimistic about the successful legislation adaptation for autonomous ships (MUNIN, 2016).

It is suggested, an analysis of the Designers/Builders/Technology Providers view of the autonomous safety and security stage by far and which are the future expectations. Another point for more in-depth investigation is that of the National and International Regulations. These are the different National

Authorities that have a more positive perception than others to indicate which countries are closer to implementing autonomous shipping. This will be done extensively in AUTOSHIP Deliverable 7.4 'Proposed regulatory, legal and liabilities frameworks amendments', a public report, and includes an analysis and study to cover the autonomous shipping operations by proposing regulatory, legal, and liabilities frameworks amendments. Part of the regulatory framework is also that of COLREGS. Specifically, it should be examined whether there is a need to develop new versions of COLREGS before the autonomous ships are ready to navigate the seas.

QUESTION NO. 8: WHAT DO YOU THINK ARE THE BIGGEST CHALLENGES FOR THE DEVELOPMENT OF AUTONOMOUS SHIPPING; PROVIDE FINANCIAL INCENTIVES TO SUPPORT THE TRANSITION PROCESS TO AUTONOMOUS SHIPPING, GUARANTEE THE SAFETY OF AUTONOMOUS SHIPS, COVER THE INFRASTRUCTURE COSTS IN PORT ADAPTATION FOR AUTONOMOUS SHIPS AND COVER THE INFRASTRUCTURE COSTS IN INLAND WATERWAY INFRASTRUCTURE ADAPTATION FOR AUTONOMOUS SHIPS

The majority of professionals agree to the lack of regulations as one of the most significant challenges for the transition. On top of that, the consensus is that the investment cost will be higher and that the economic benefit is associated with reduced OPEX. In terms of the different costs' relevance, Owners/Operators figures are neutral, while in contrast, the Designers/Builders/Technology Providers and Research Institutions/Academia expect that investment cost is a higher barrier than operating costs. The fact that the Owners/Operators present a neutral view in terms of investment cost is interesting and the different view among the groups would worth further clarification.

When it comes to safety and workforce, the numbers illustrate that the lack of a qualified workforce is not considered a significant challenge (MUNIN, 2016), which may require further investigation. The groups do not consider the lack of a qualified workforce as a significant challenge requiring further clarification. Also, a mismatch needs clarification regarding the different perspective for the operation and investment costs that the Owners/Operators, Designers/Builders/Technology Providers and Research Institutions/Academia have. Another part that requires further investigation for assurance and approval is that of the software systems and their functionality, as there is no evidence that they are safe.

QUESTION NO. 9: WHICH TECHNICAL LIMITATIONS DO YOU CONSIDER BEING THE MOST SIGNIFICANT CHALLENGE WHEN DESIGNING AND OPERATING AUTONOMOUS SHIPS; AUTONOMOUS NAVIGATION, COMMUNICATION WITH THE SHIP, REMOTE CONTROL CENTRES, THERE ARE NO PROCEDURES FOR TESTING, VERIFICATION AND VALIDATION, SHIP RELIABILITY AND MAINTENANCE/REPAIR REQUIREMENTS

In general, all the groups agree almost at the same level which are the arising challenges; The Remote-Control Centres, the procedures for testing, verification and validation, and the ship reliability and maintenance/repair requirements, especially during long voyages. There is a need for defining the technical limitations the Designers/Builders/Technology Providers still need to confront, regarding:

- Autonomous navigation
- Communication with the shore and among vessels
- Remote control centres
- Testing, verification and validation procedures
- Ship reliability and maintenance/repair

It's also noteworthy to report that the participants in both surveys reflect that one of the most intriguing challenges is the communication field and especially the potential cyber-attacks and piracy. This probably aligns with the current perception that autonomous ships need more data and more extensive data transfer, challenging communication. The previous MUNIN survey (MUNIN, 2016) results agree for this part, recognising the cyber-attacks as the new threat that the evolution of shipping in advanced autonomy needs to face.

QUESTION NO. 10: THE ROLE OF GOVERNMENTS; PROVIDE FINANCIAL INCENTIVES TO SUPPORT THE TRANSITION PROCESS TO AUTONOMOUS SHIPPING, GUARANTEE THE SAFETY OF AUTONOMOUS SHIPS, COVER THE INFRASTRUCTURE COSTS IN PORT ADAPTATION FOR AUTONOMOUS SHIPS AND COVER THE INFRASTRUCTURE COSTS IN INLAND WATERWAY INFRASTRUCTURE ADAPTATION FOR AUTONOMOUS SHIPS

The respondents show neutrality regarding the role of the governments. The Owners/Operators group considers the coverage of any infrastructure costs either in port or in the inland waterway and guarantee the autonomous ship's safety as the essential parts. Thus, support and guidance from the Governments, especially regarding funding and safety assurance, would clarify the scene. **Further investigation could be done for acquiring any additional suggestions in terms of the role that the governments could have.** It would also help clarify the root cause of the neutrality expressed by the stakeholders regarding the governments' role and whether this statement could be attributed to the lack of knowledge of the role of the governments.

A point not to be ignored is that with autonomous ships, as the shipowners are reluctant to additional onboard cost if there is no strong business case on a short perspective, **there is a need for determining**

the incentives, perhaps the political incentives, to drive the process. **There is a suggestion for further examination of both the technology and the infrastructure development.**

Further investigation could be done for acquiring any additional suggestions in terms of the role that the governments could have. It would also help clarify the root cause of the neutrality expressed by the stakeholders regarding the governments' role and whether this state could be attributed to the lack of knowledge of the role of the governments. A point not to be ignored is that with autonomous ships, as the shipowners are reluctant to additional onboard cost, if there is no strong business case on a short perspective, there is a need for determining the incentives, perhaps the political incentives, to drive the process. Finally, there is a suggestion for further examination of both the technology and the infrastructure development too.

GENERAL SURVEY RECOMMENDATIONS

Finally, it was suggested that some questions would be suitable to ask again in a survey but not just related to autonomous ships in general. Instead considering the levels of autonomy in separate. It is noticed in some questions that we have different results when there is a reference to a specific level of autonomy. Thus, there is a need to unify the various autonomous levels a ship can have, letting the individuals understand each case in a more efficient way.

REFERENCES

AUTOSHIP. (2019). Autonomous Shipping Initiative for European Waters. City. Retrieved from https://www.autoship-project.eu/

IMO. (2006). *International Labour Conference, Maritime Labour Convention, 2006.* Retrieved from ilo.org: https://www.ilo.org/wcmsp5/groups/public/---ed_norm/---normes/documents/normativeinstrument/wcms_090250.pdf

Kristin H. Jarman, Jarman. (2013). A practical guide to the art of basic statistics: How to answer almost any question using basic statistics. Wiley-Blackwell.

Mentimeter. (2021). *Create interactive presentations & meetings, wherever you are*. Retrieved from https://www.mentimeter.com/

MUNIN. (2016). *Marine Unmanned Navigation through Intelligence in Networks.* Retrieved from http://www.unmanned-ship.org/munin/survey-results-munin-d9-2-released/

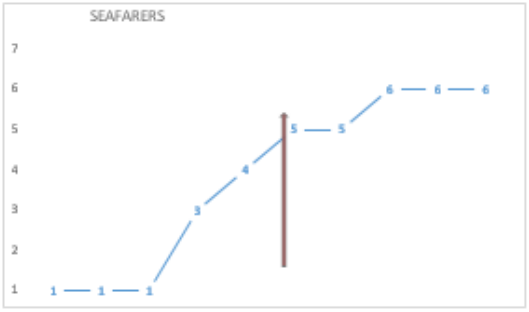
Molica Colella M., Scandale T., Invito A., Panza I., Bolther J. (2021*) AUTOSHIP deliverable D9.6: Stakeholder Analysis Report*.

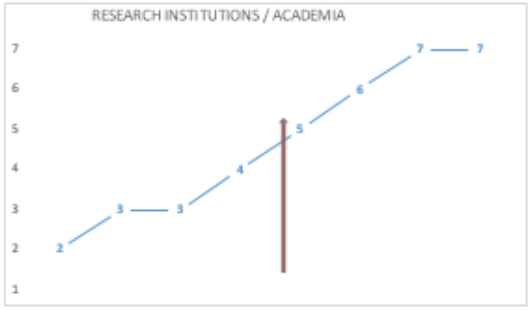
APPENDIX A – (SURVEY NO. 1) GROUP DIAGRAMS PER SUB-QUESTION

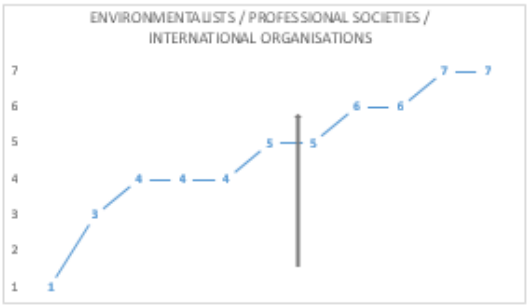
Q2	Q3	Q4
1 Strongly Disagree 2 Disagree 3 Somewhat Disagree 4 Neither Agree nor Disagree 5 Somewhat Agree 6 Agree 7 Strongly Agree	1 Extremely Unlikely 2 Unlikely 3 Neutral 4 Likely 5 Extremely Likely	1 Strongly Disagree 2 Disagree 3 Neither Agree nor Disagree 4 Agree 5 Strongly Agree
Q5	**Q6**	**Q7**
1 Strongly Disagree 2 Disagree 3 Somewhat Disagree 4 Neither Agree nor Disagree 5 Somewhat Agree 6 Agree 7 Strongly Agree	1 Strongly Disagree 2 Disagree 3 Neither Agree nor Disagree 4 Agree 5 Strongly Agree	1 No Effect 2 Minor Effect 3 Neutral 4 Moderate Effect 5 Major Effect
Q8	**Q9**	**Q10**
1 Strongly Disagree 2 Disagree 3 Neither Agree nor Disagree 4 Agree 5 Strongly Agree	1 Strongly Disagree 2 Disagree 3 Somewhat Disagree 4 Neither Agree nor Disagree 5 Somewhat Agree 6 Agree 7 Strongly Agree	1 Strongly Disagree 2 Disagree 3 Neither Agree nor Disagree 4 Agree 5 Strongly Agree

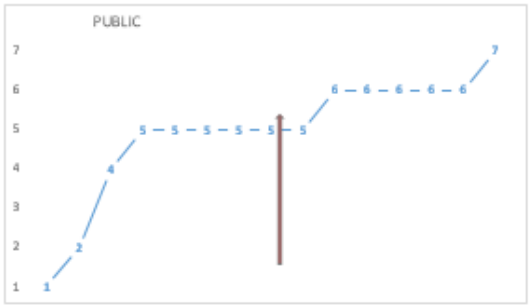
Table 53: SUPPORT TABLE – CHARACTERISATION OF MARKS PER QUESTION

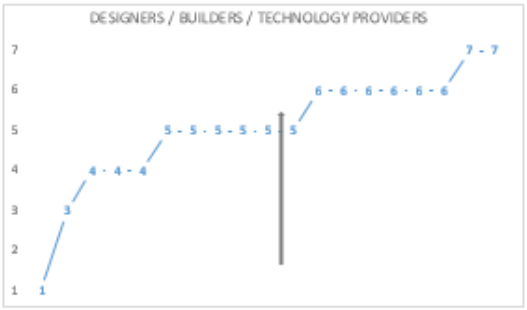
Q2 In my opinion there is a need for the transition from the conventional to the autonomous shipping

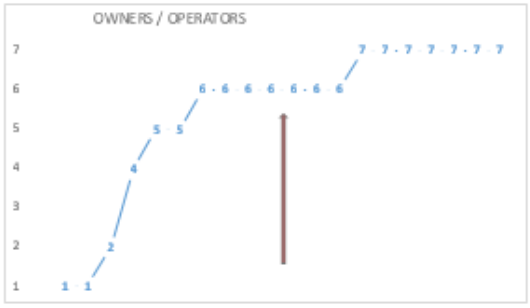




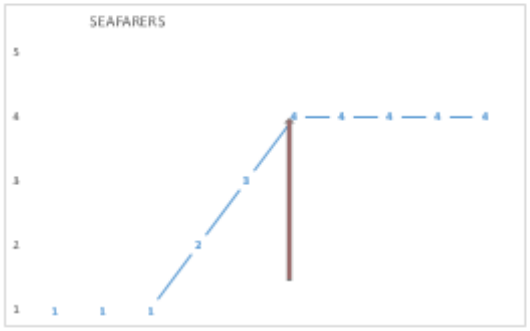


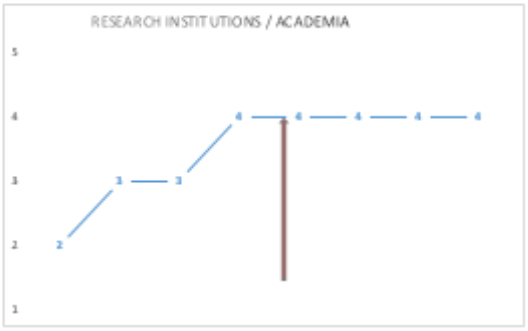


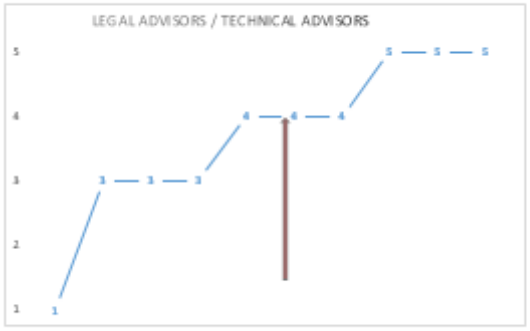


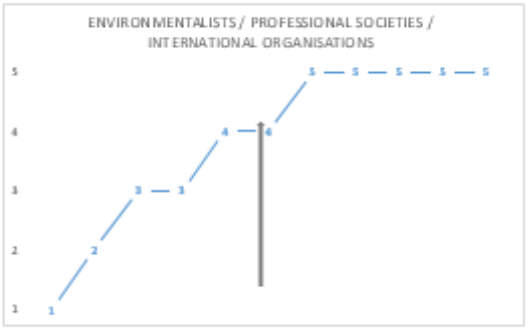


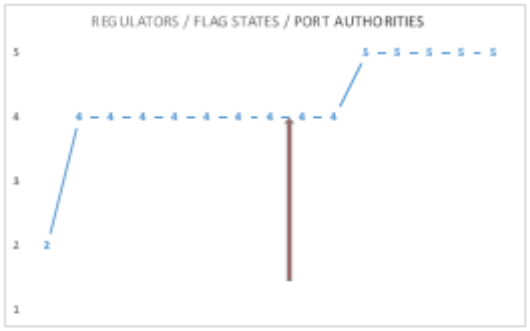
Q3.1 Which would be the benefits from the transition to autonomous shipping?: Financial benefits (reduced fuel consumption, optimized routing, reduced manning cost etc.)

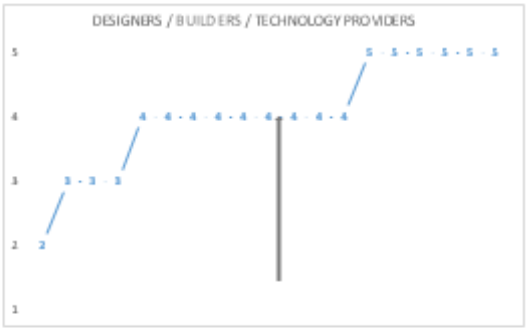


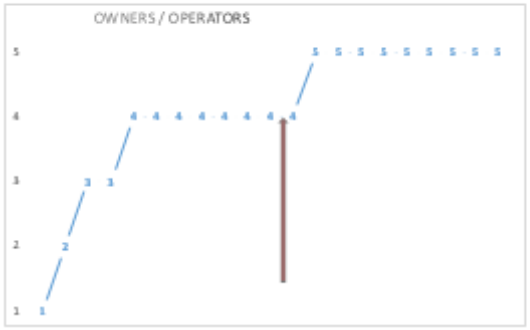




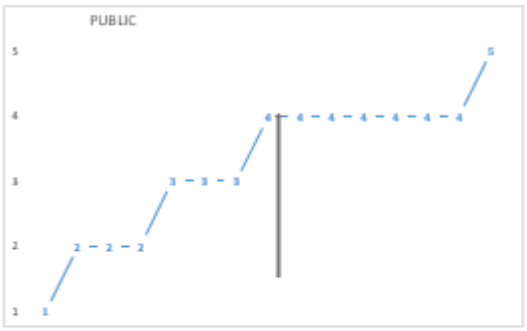


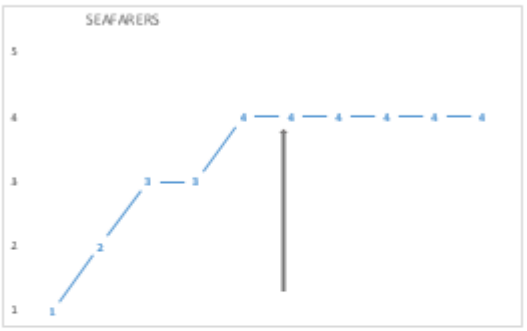


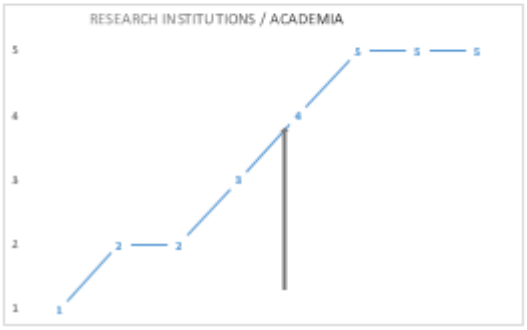


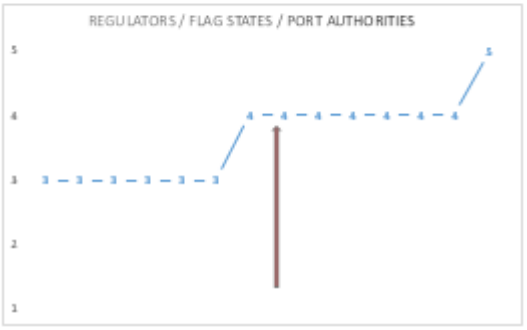


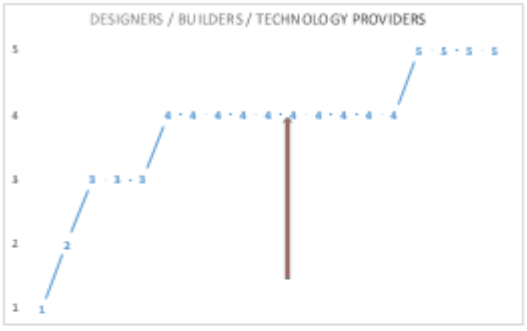
Q3.2 Which would be the benefits from the transition to autonomous shipping?: Environmental benefits (reduced environmental footprint)

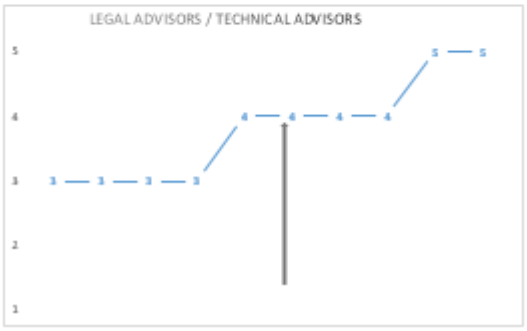




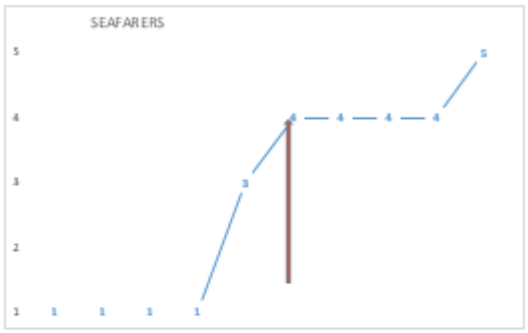


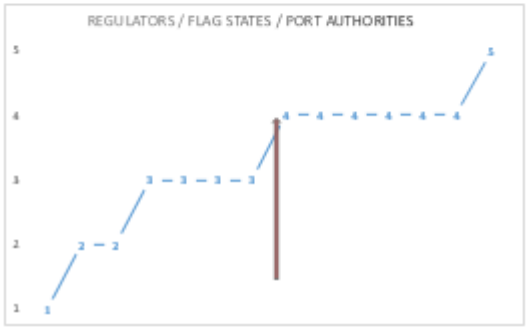


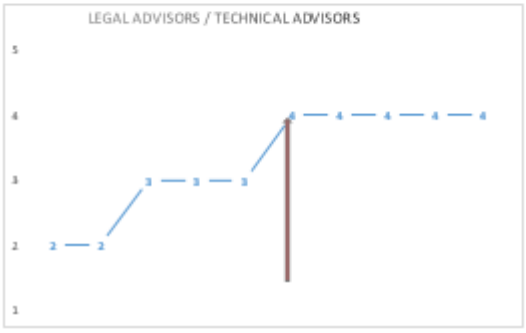


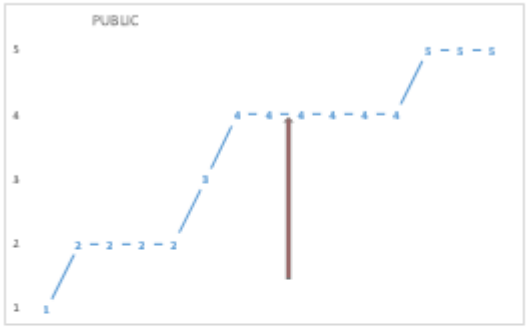


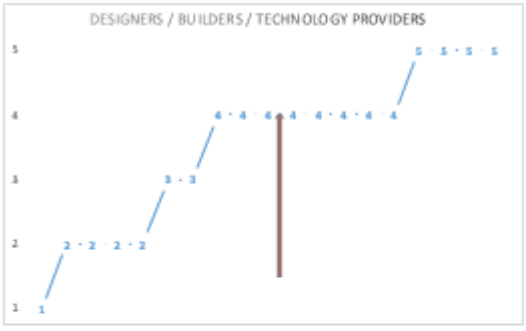
Q3.3 Which would be the benefits from the transition to autonomous shipping?: Social benefits (increased job opportunities onshore – especially for women, better working conditions for seafarers)



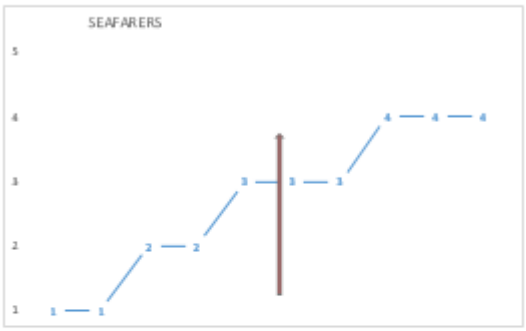


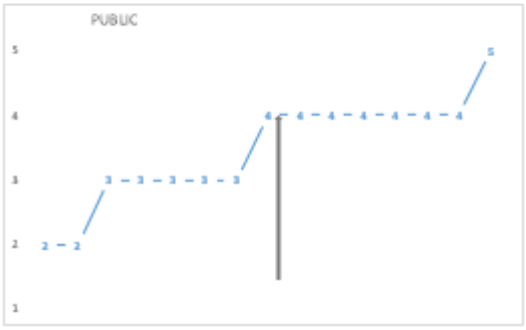


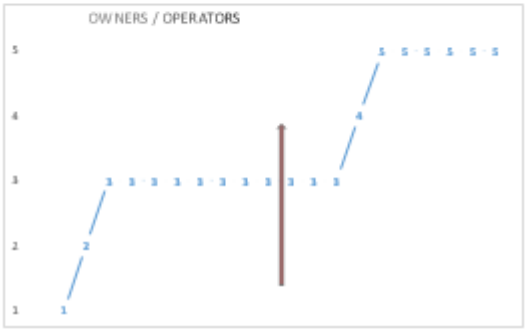


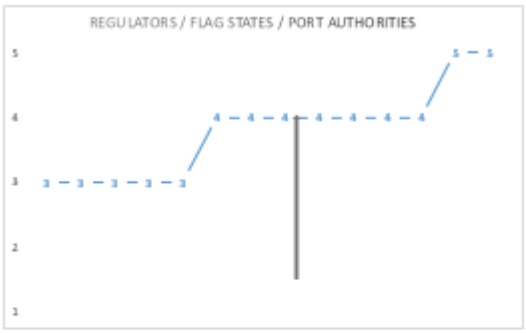


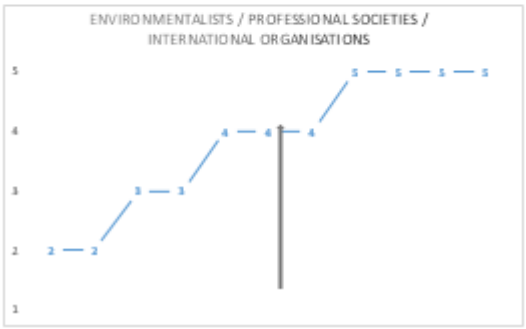
Q3.4 Which would be the benefits from the transition to autonomous shipping?: Increased safety (due to system automation)

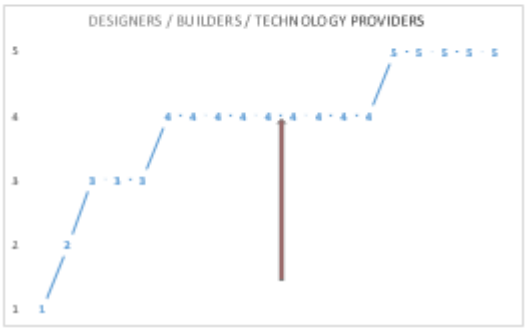




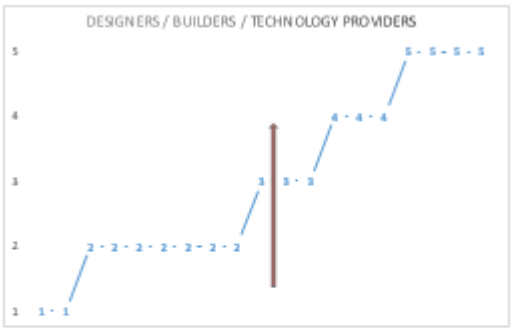


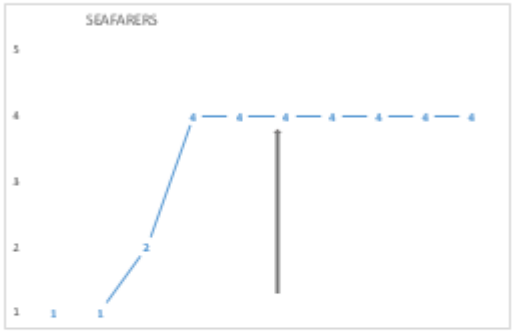


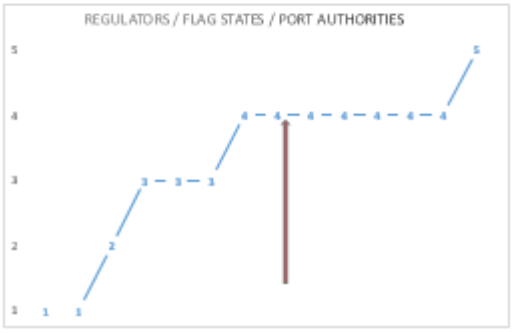


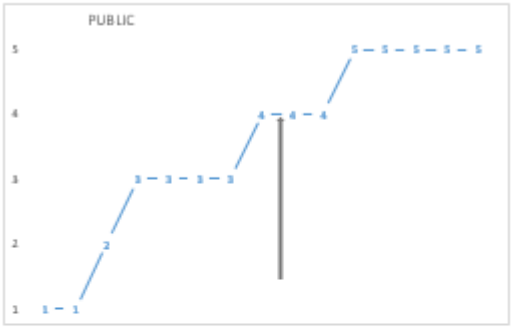


Q3.5 Which would be the benefits from the transition to autonomous shipping?: Added resilience in case of major worldwide disruptions (diseases, wars, piracy...)

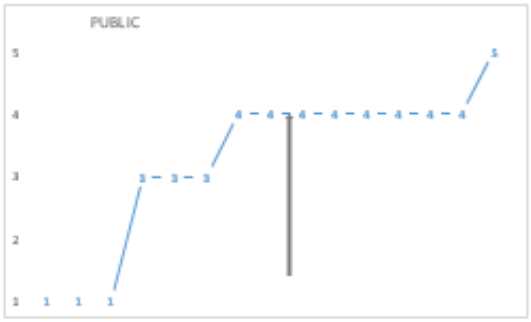


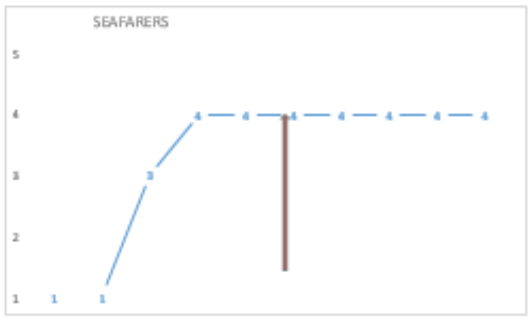


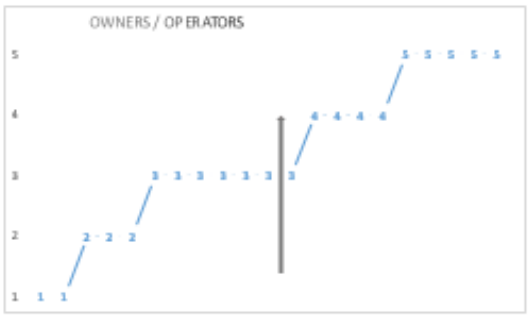


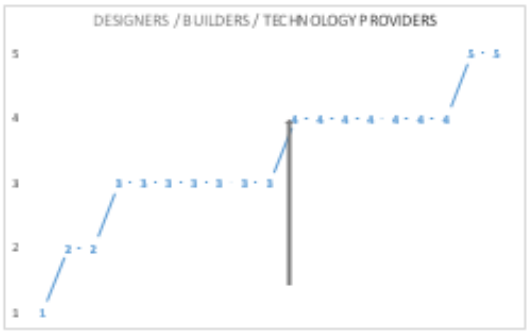


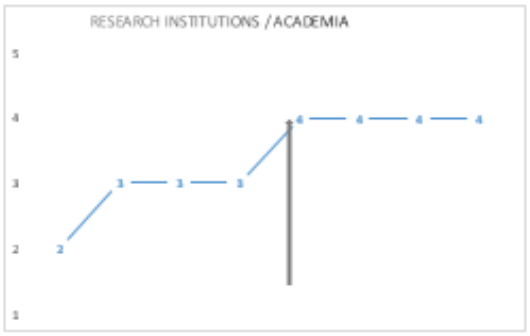
Q4.1 How would the transition to autonomous shipping impact the shipping industry?: Increase the income

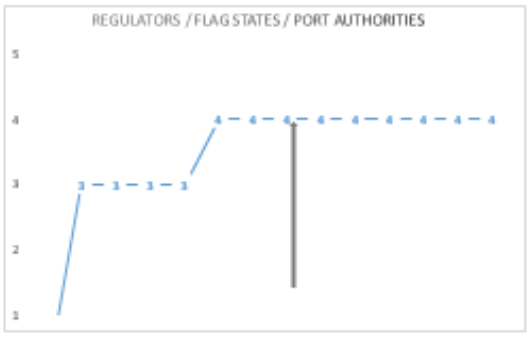




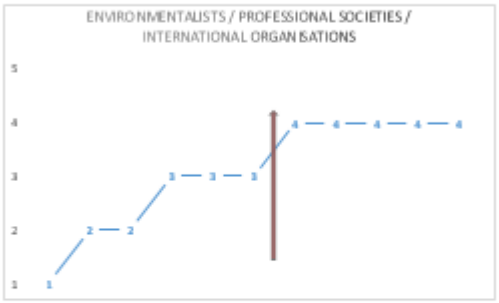


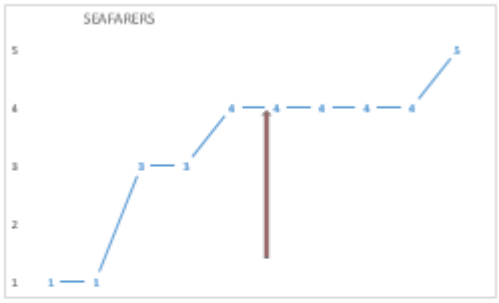


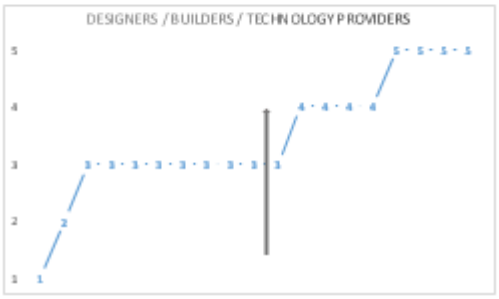


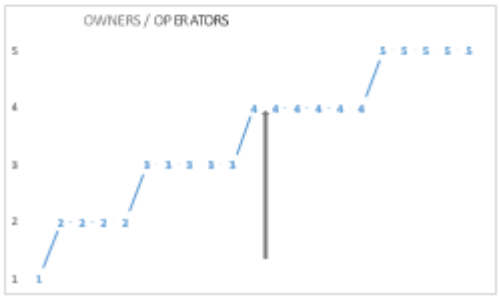


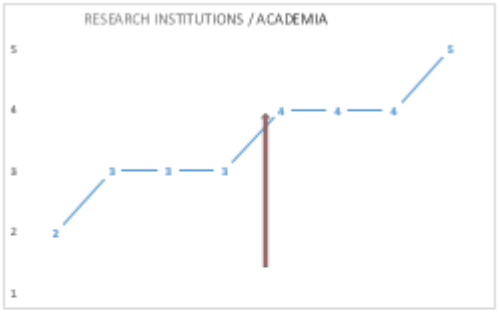
Q4.2 How would the transition to autonomous shipping impact the shipping industry?: Increase the profitability

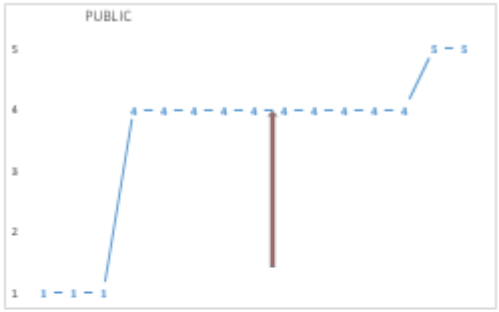


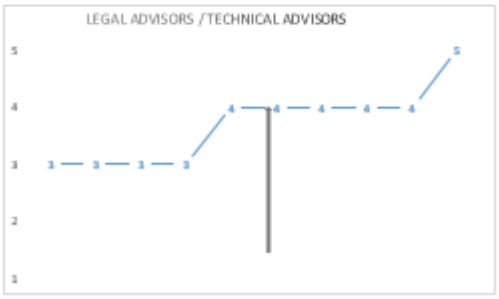


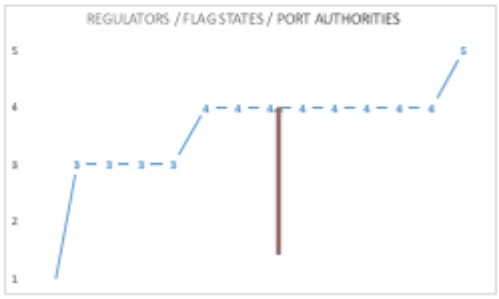




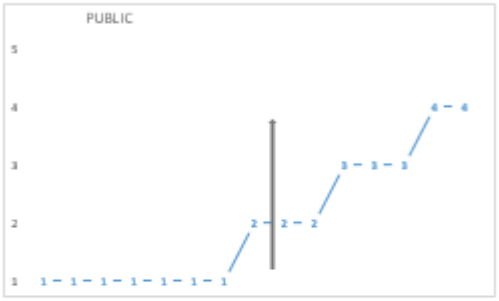


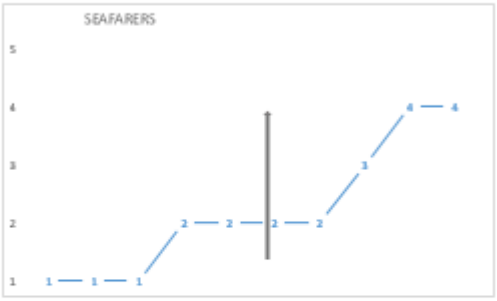


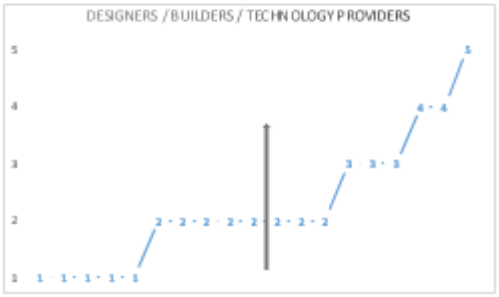


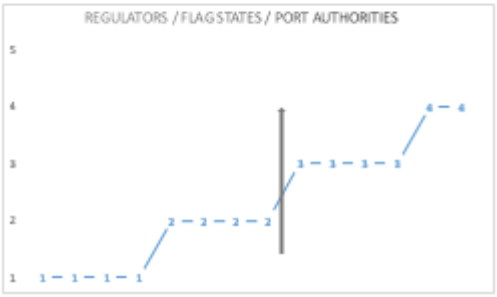


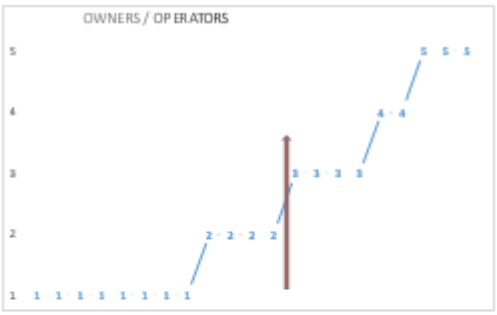
Q4.3 How would the transition to autonomous shipping impact the shipping industry?: Increase the number of employees

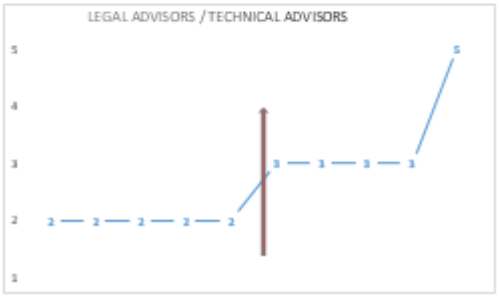




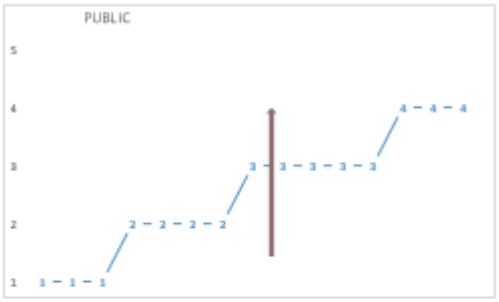


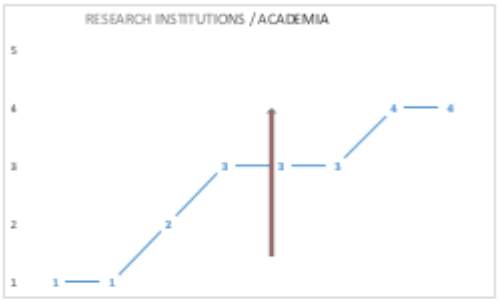


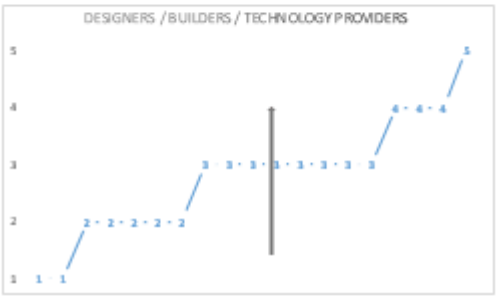


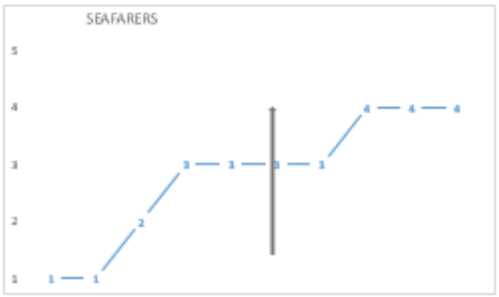


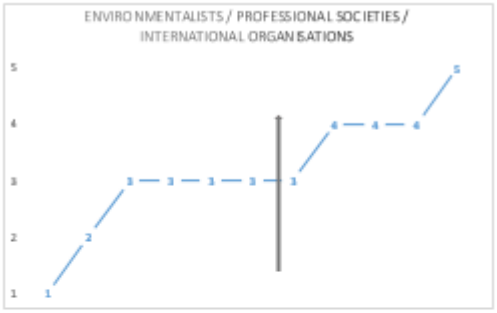
Q4.4 How would the transition to autonomous shipping impact the shipping industry?: Improve the access to financing (easier access to loans)

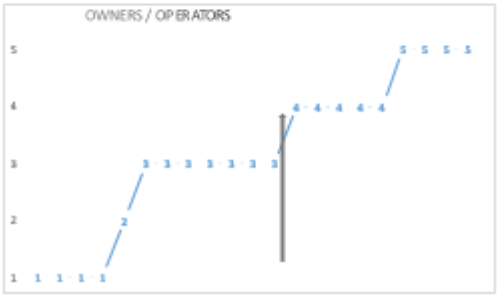


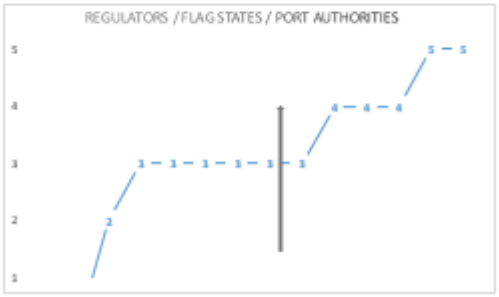




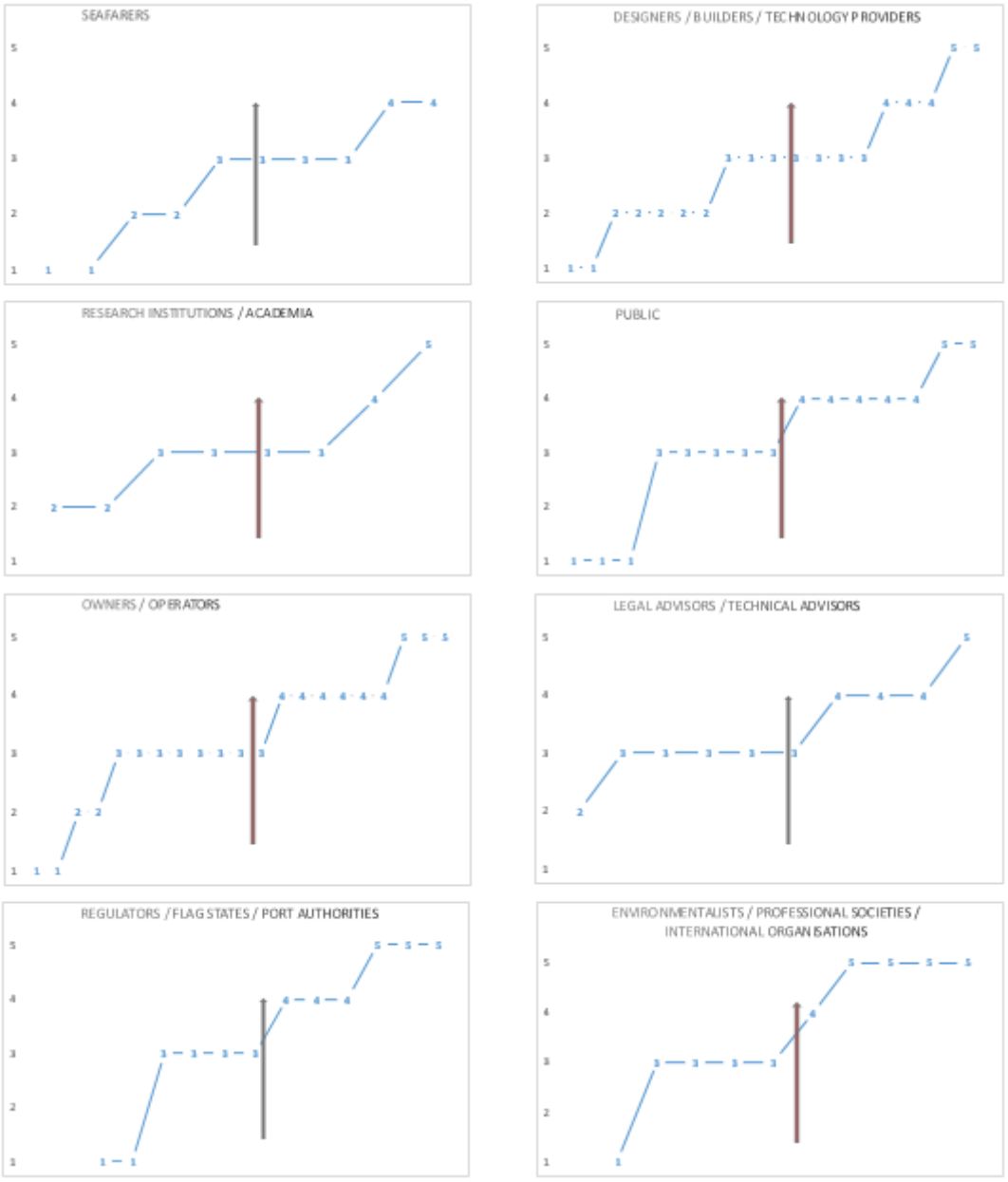




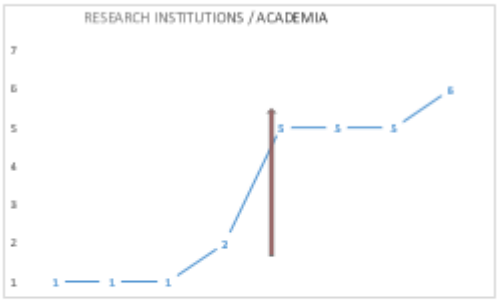


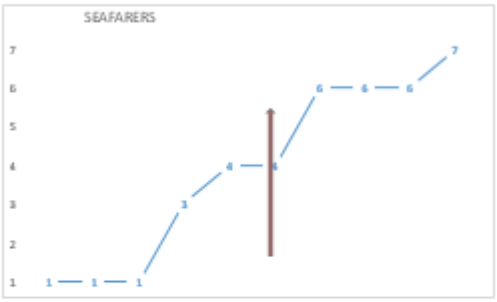


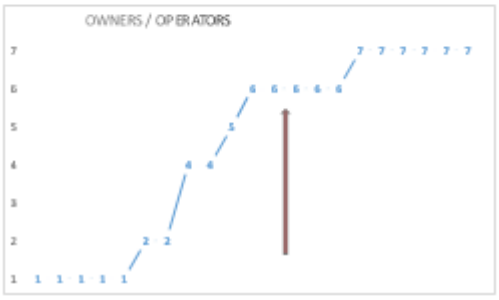
Q4.5 How would the transition to autonomous shipping impact the shipping industry?: Improve crisis resilience (reduce the risk of company exposure to disturbance in the market)

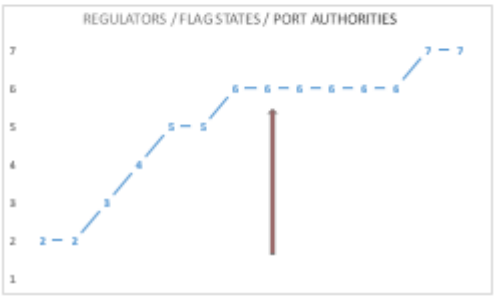


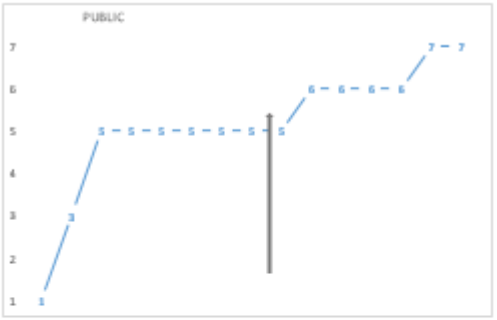
Q5.1 I expect the autonomous shipping will be a viable option for the following shipping sectors: Ocean-going vessels

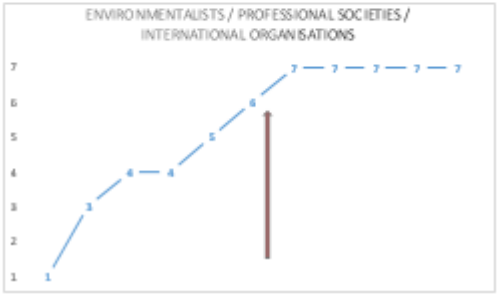


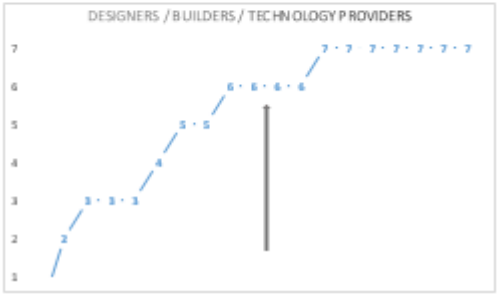




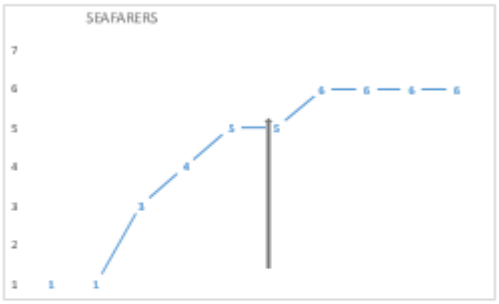


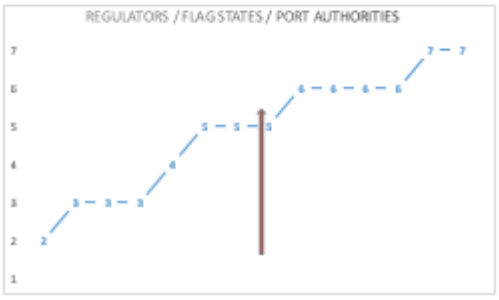


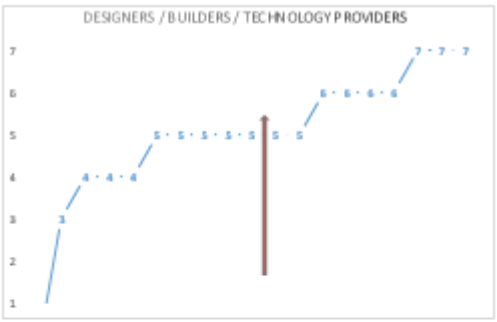


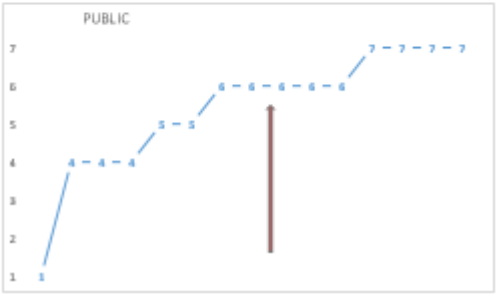


Q5.2 I expect the autonomous shipping will be a viable option for the following shipping sectors: Short-sea shipping

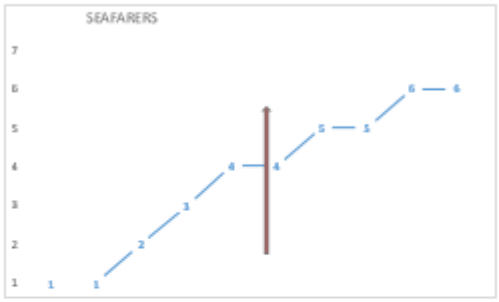


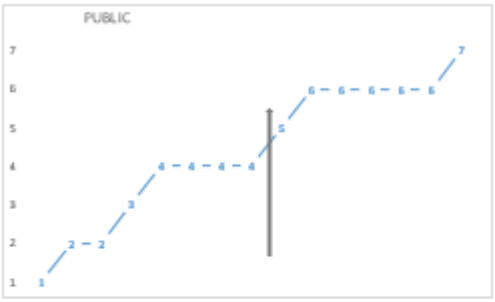


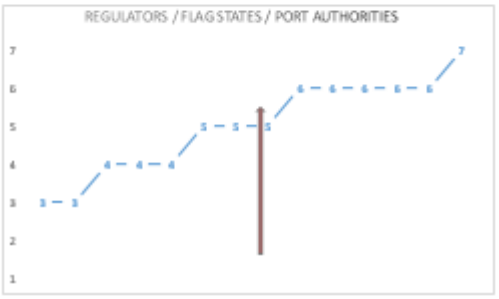


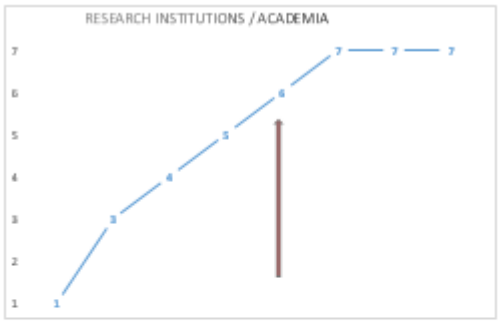


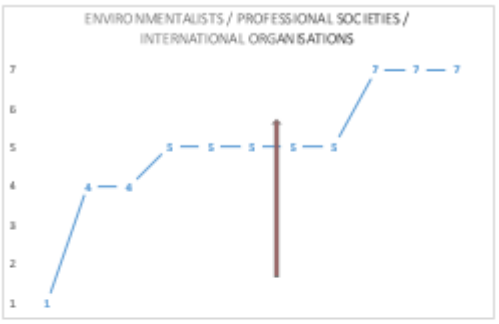
Q5.3 I expect the autonomous shipping will be a viable option for the following shipping sectors: Inland shipping

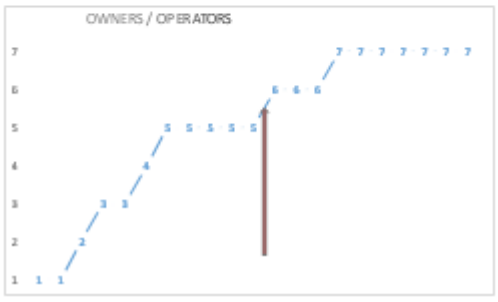


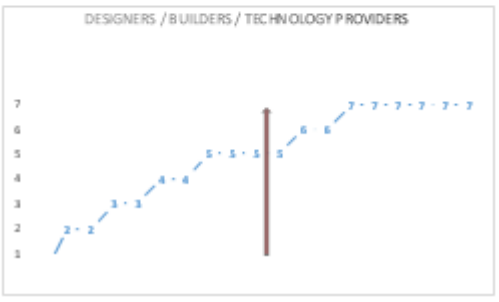




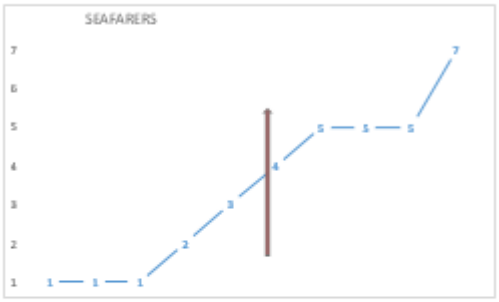


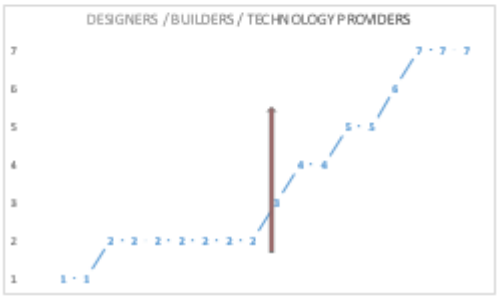


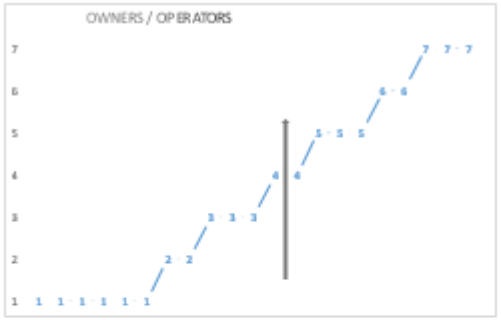


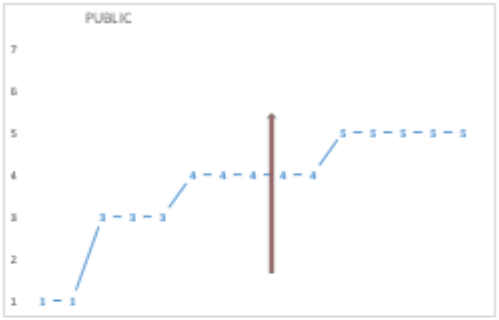


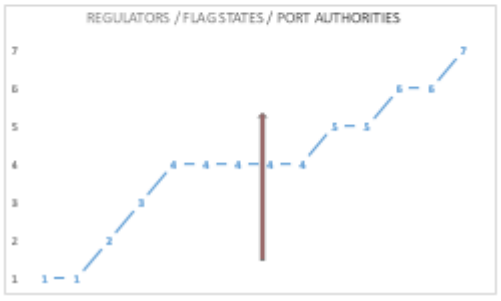
Q5.4 I expect the autonomous shipping will be a viable option for the following shipping sectors: Working ships (tugs, dredgers)



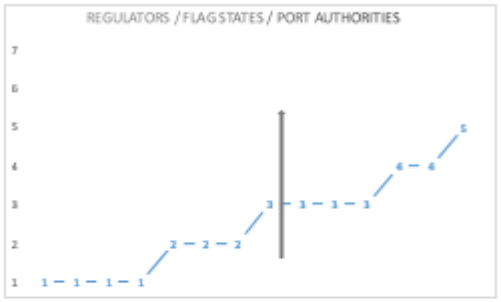


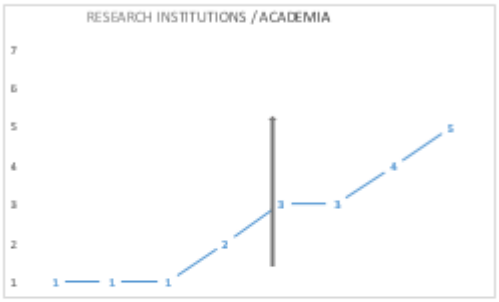


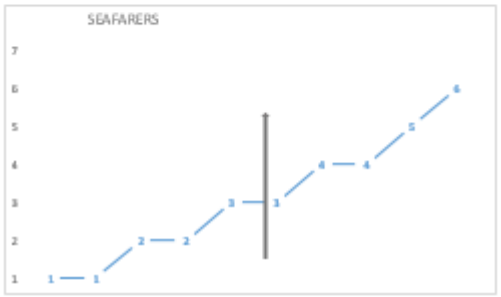


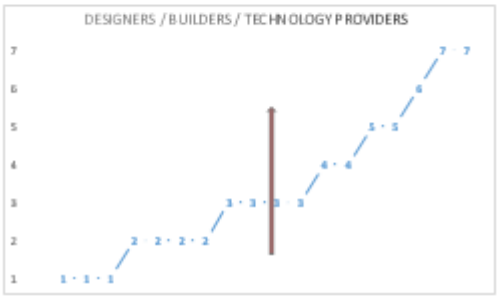


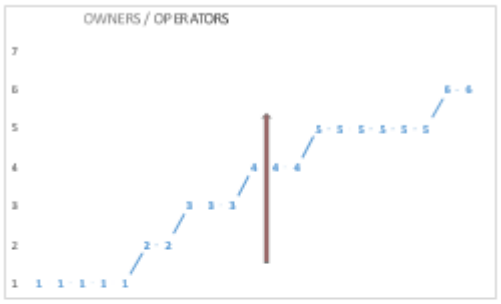
Q5.5 I expect the autonomous shipping will be a viable option for the following shipping sectors: Cruisers

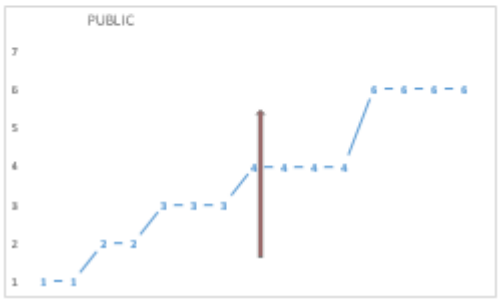




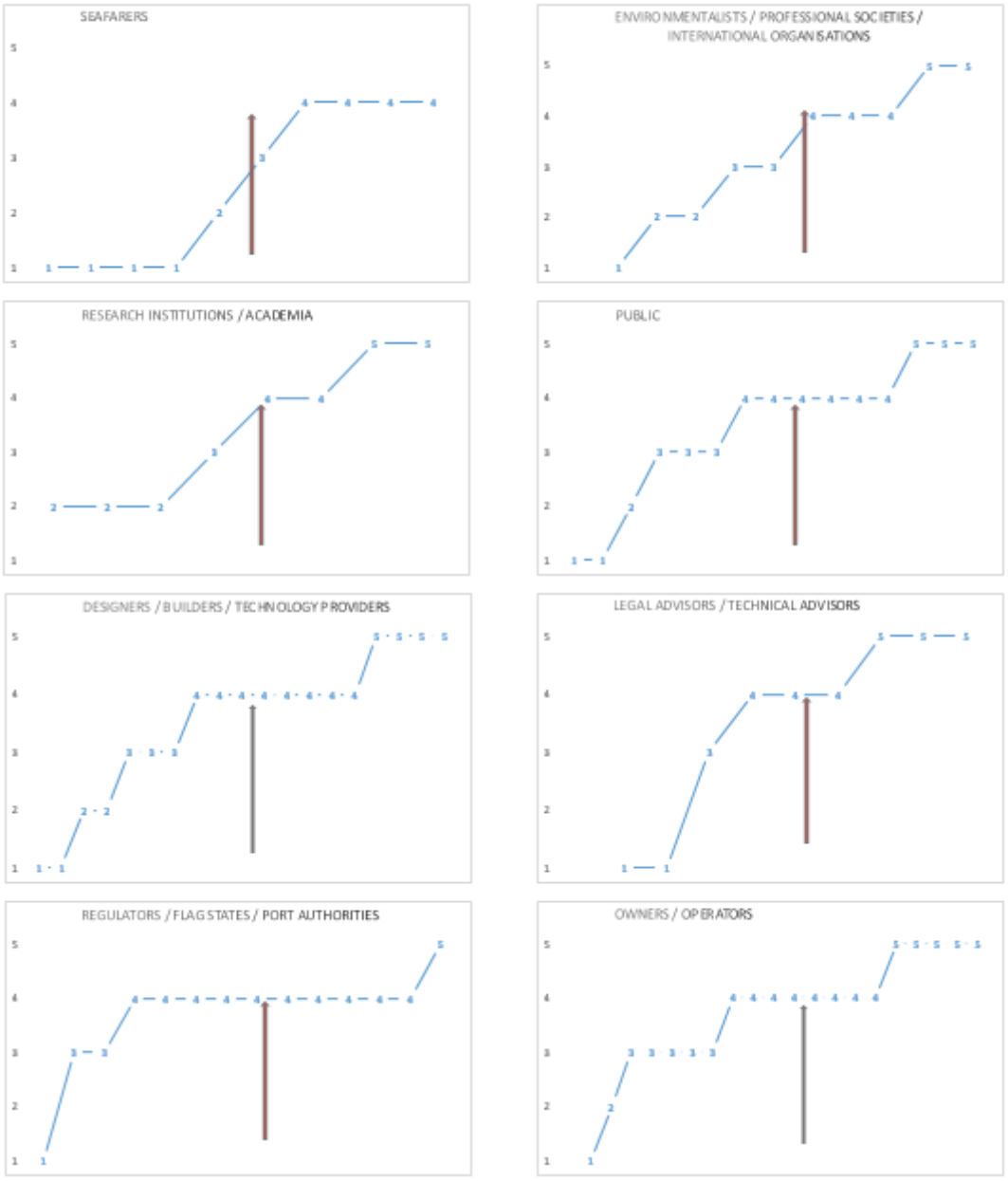




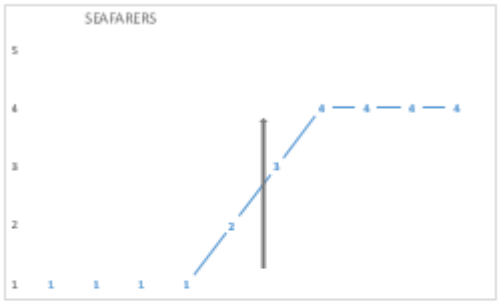


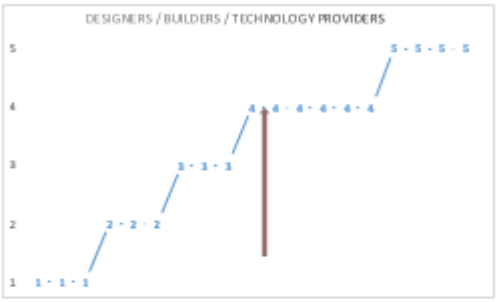


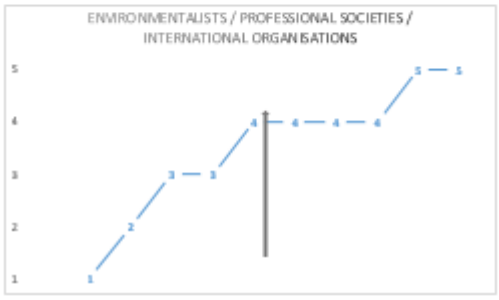
Q6.1 The transition to autonomous shipping will: Solve the deficit of seafarers

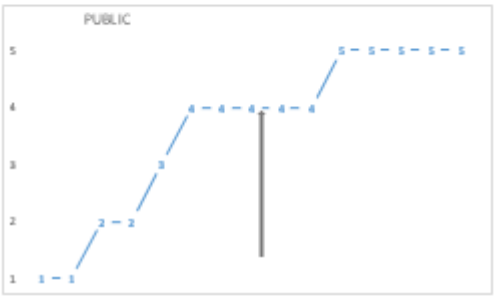


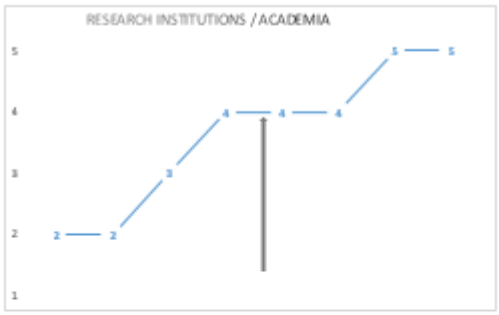
Q6.2 The transition to autonomous shipping will:
Improve the quality of life for the employees in the shipping sector

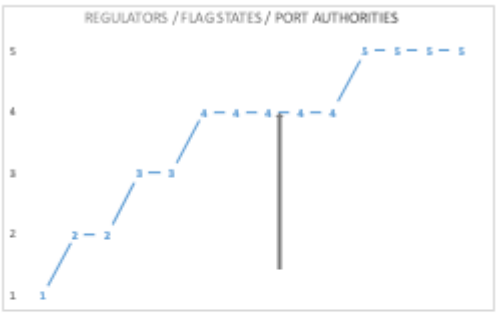


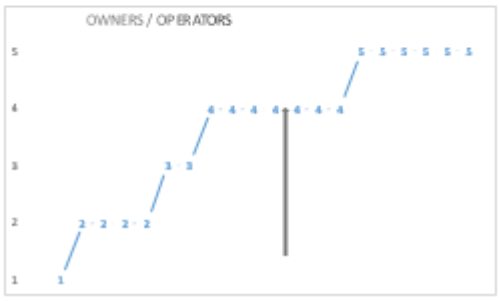




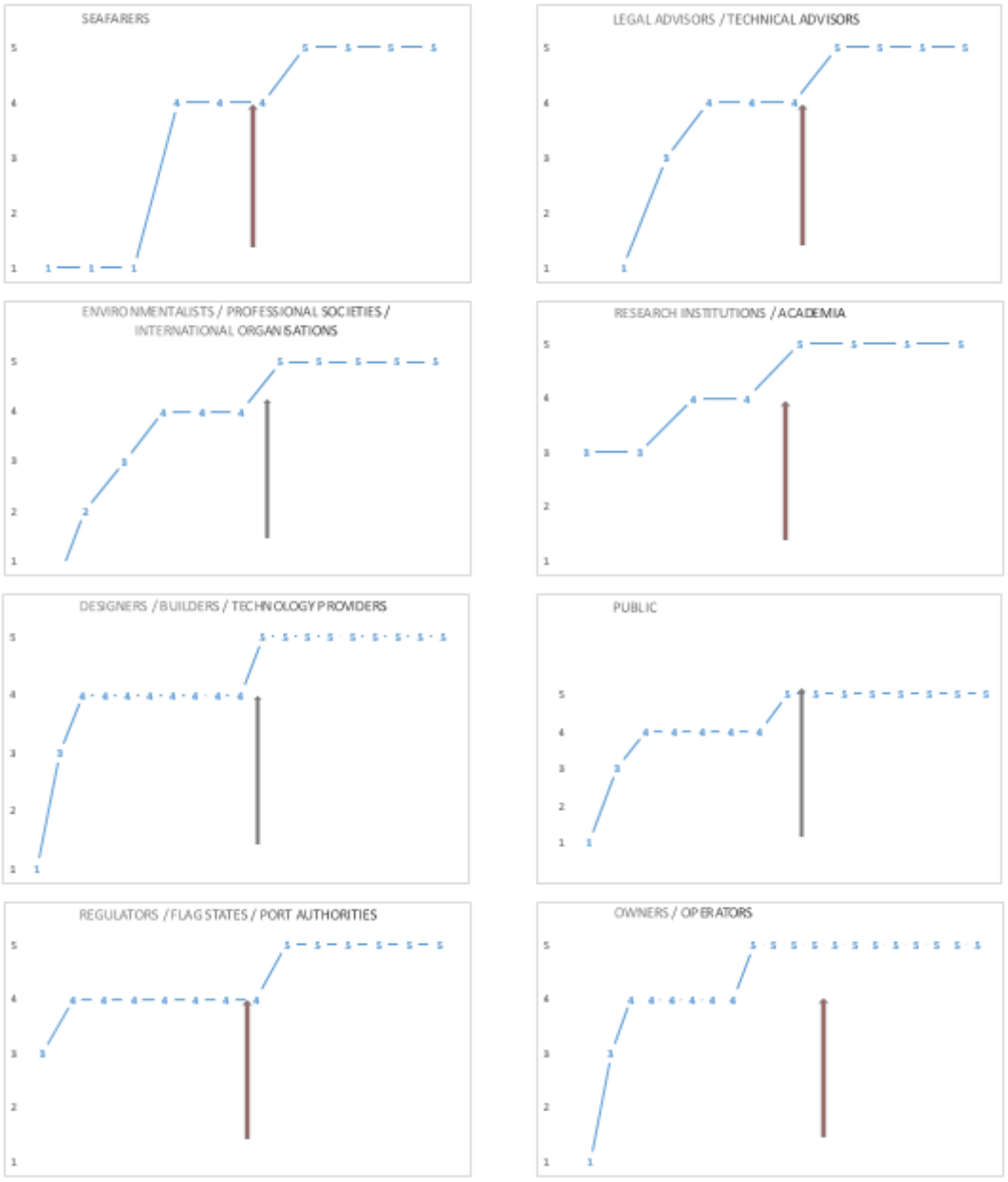




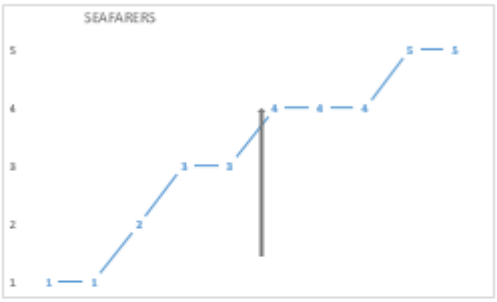


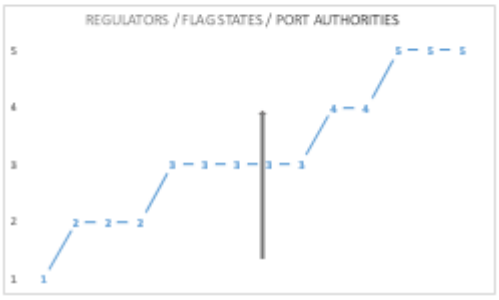


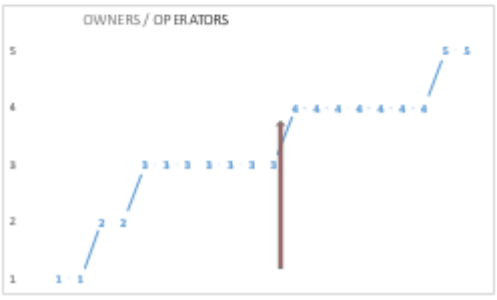
Q6.3 The transition to autonomous shipping will:
Require the modification of the current training framework for seafarers

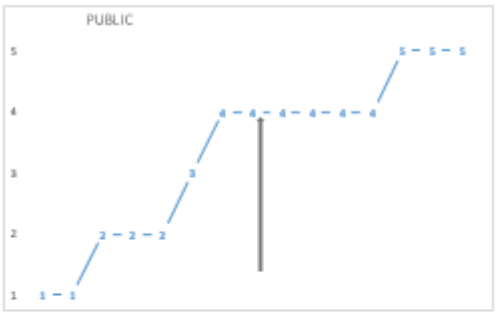


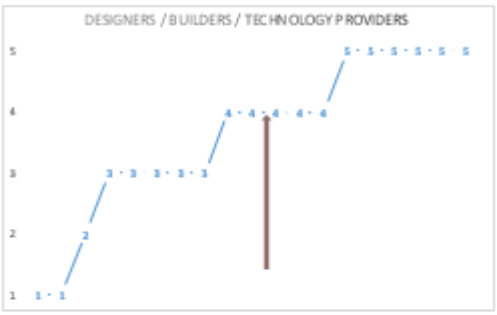
Q6.4 The transition to autonomous shipping will:
Result in the loss of the existing knowledge, skills and experience of seafarers

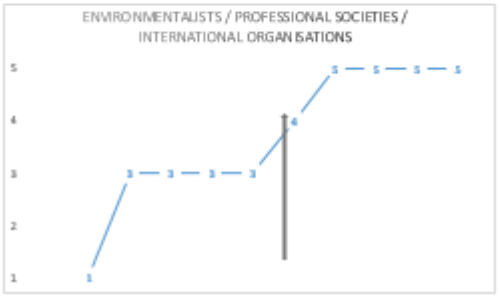




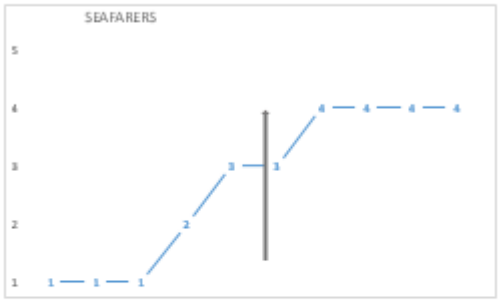


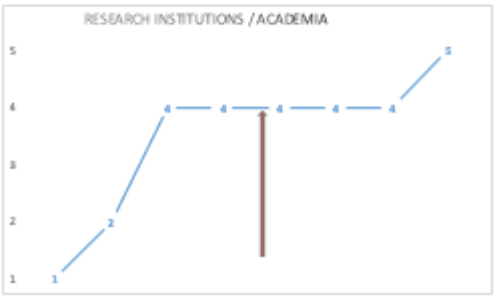


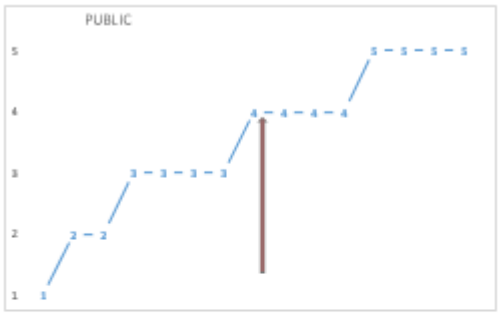


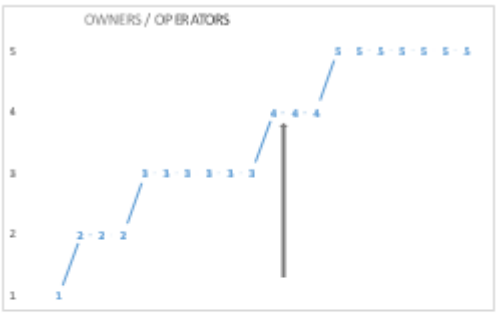


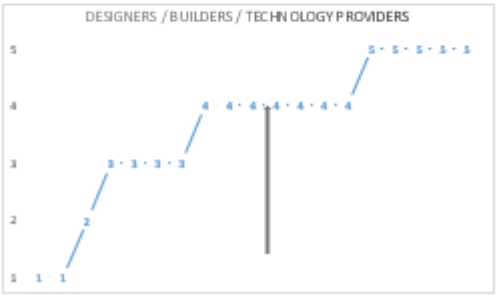
Q6.5 The transition to autonomous shipping will:
Contribute to the transportation modal shift (from land or air to sea and inland waterways)

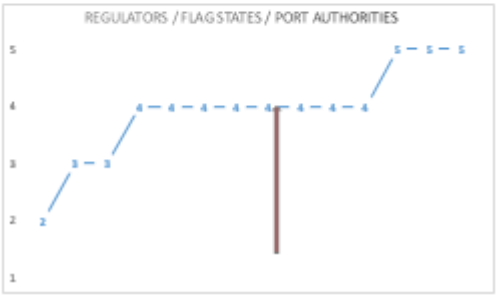




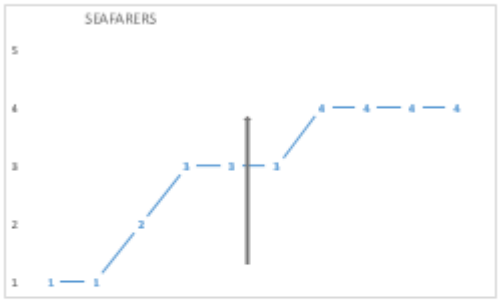


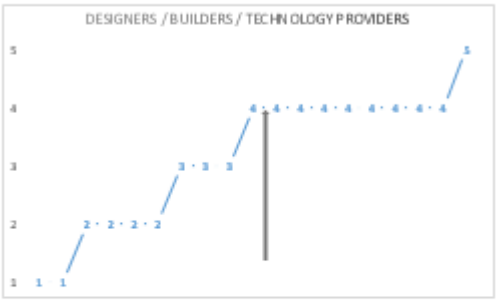


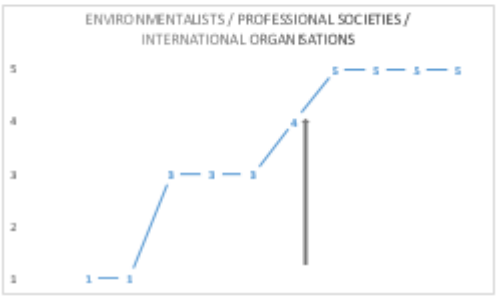


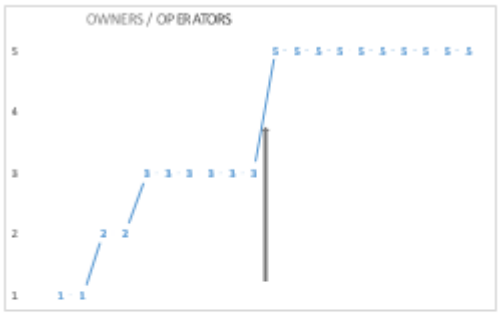


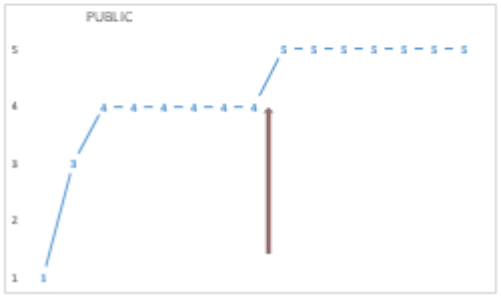
Q6.6 The transition to autonomous shipping will:
Render the use of smaller ships more attractive



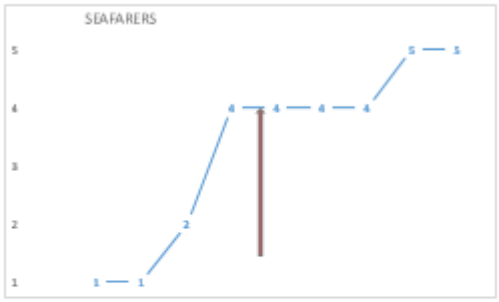


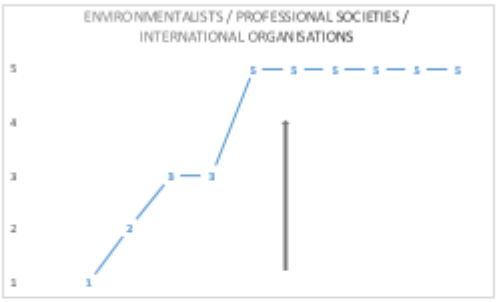


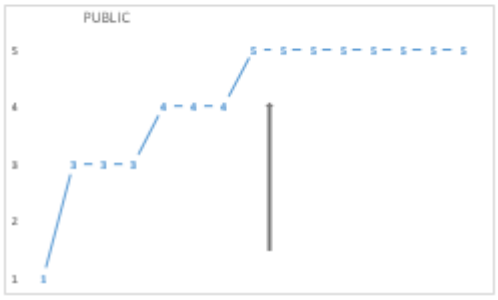


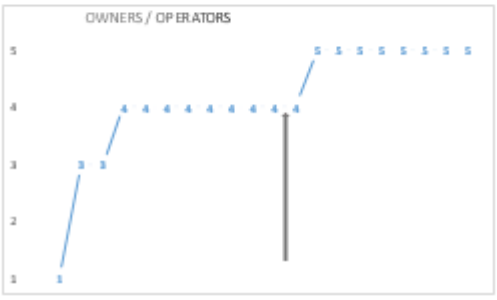


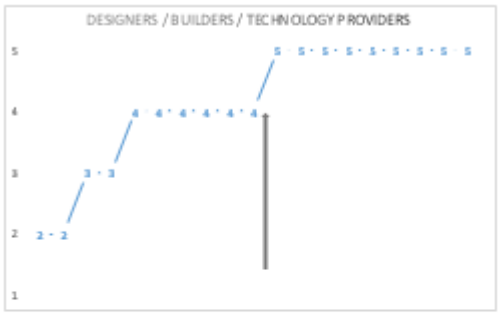
Q7.1 Please assess the impact of the following barriers to the transition to autonomous shipping: Regulatory barriers (ships will not be allowed to sail until new regulations have been implemented)

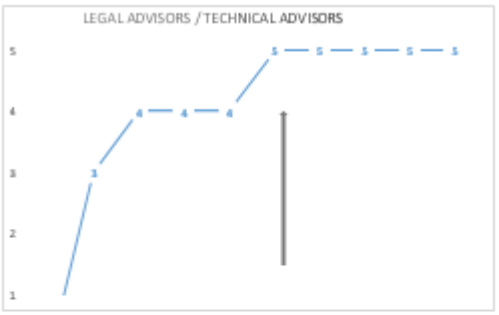


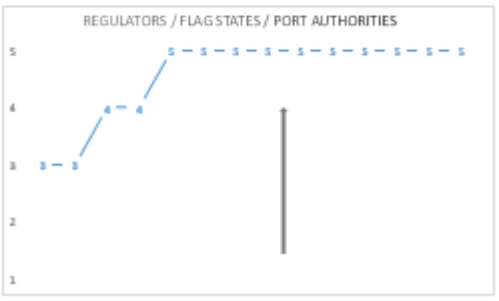




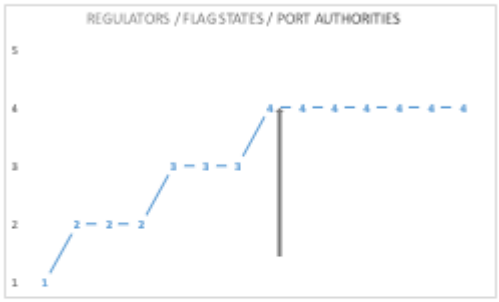


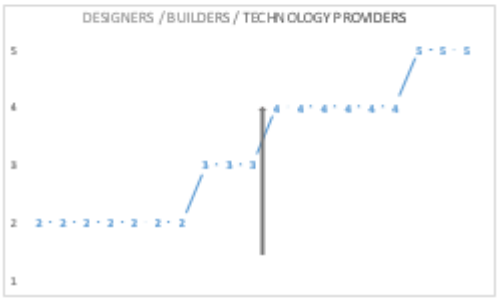


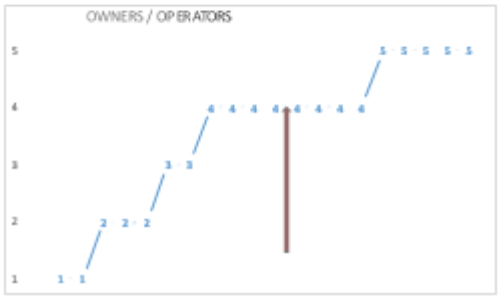


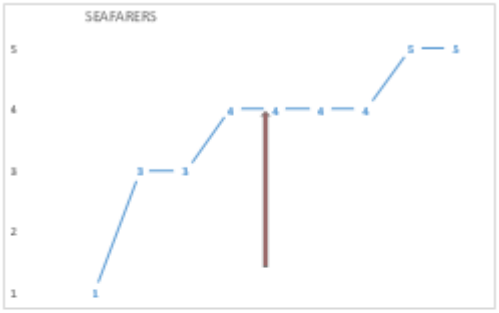


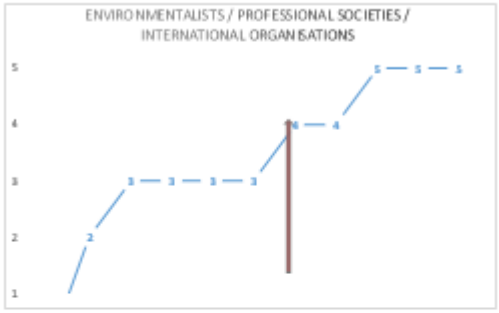
Q7.2 Please assess the impact of the following barriers to the transition to autonomous shipping: Technological limitations (technology not mature)

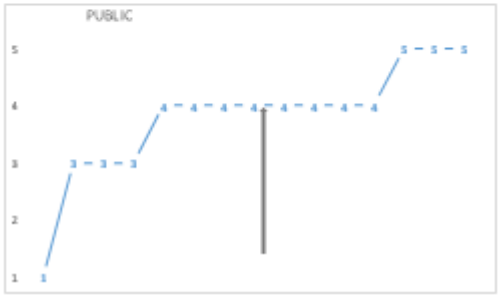




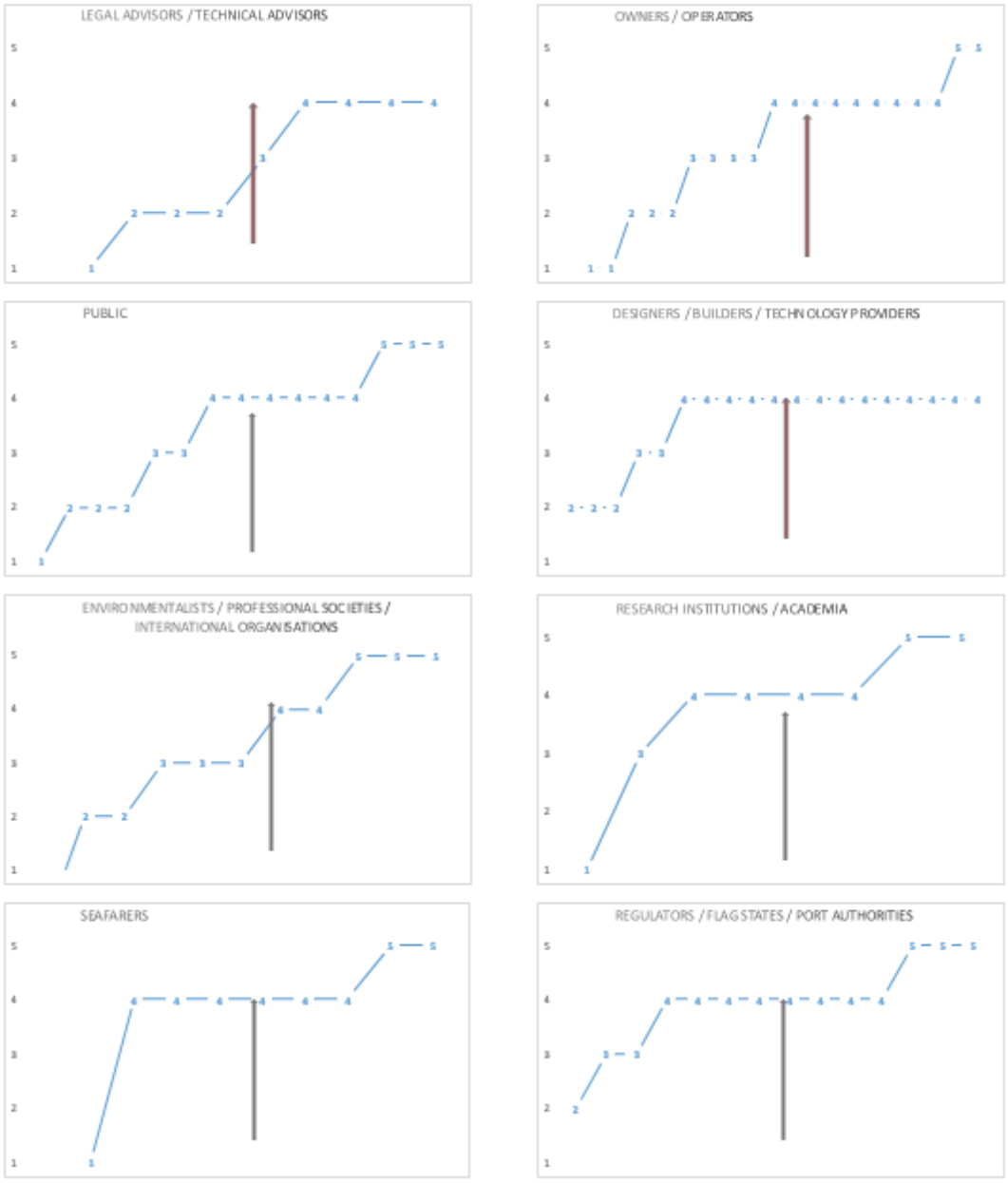




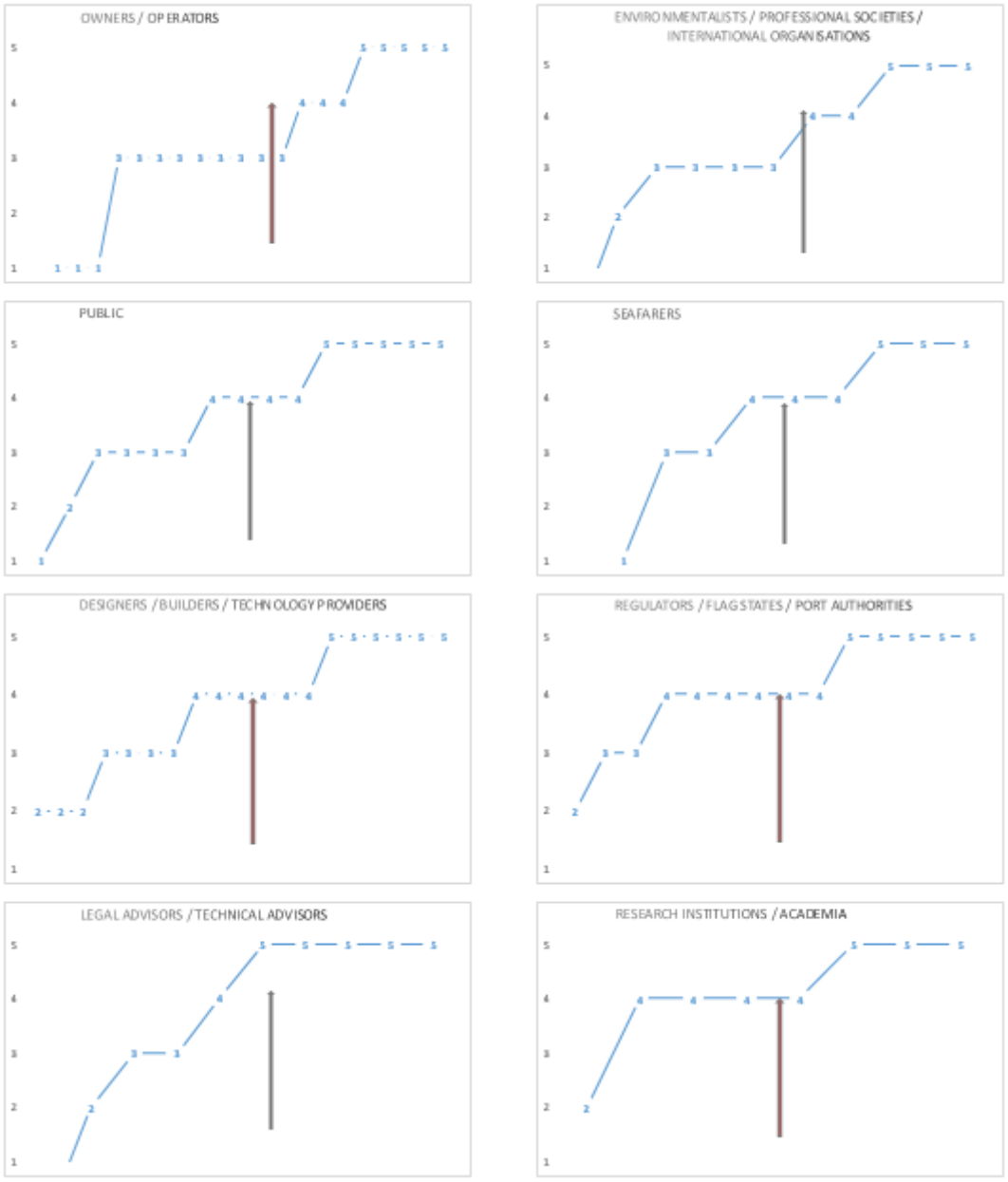




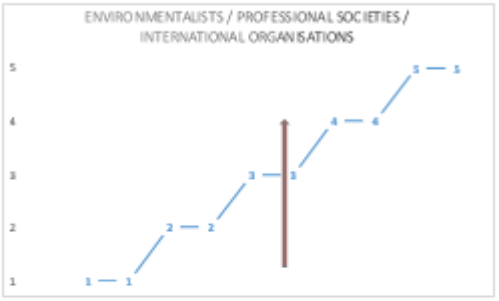
Q7.3 Please assess the impact of the following barriers to the transition to autonomous shipping: Social limitations (lack of expert skills)

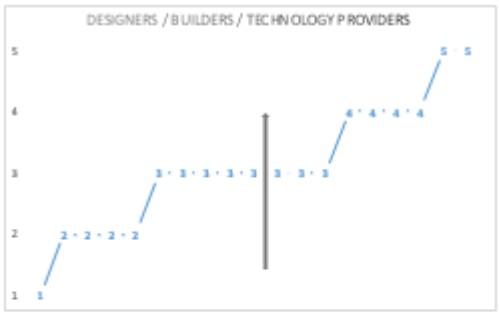


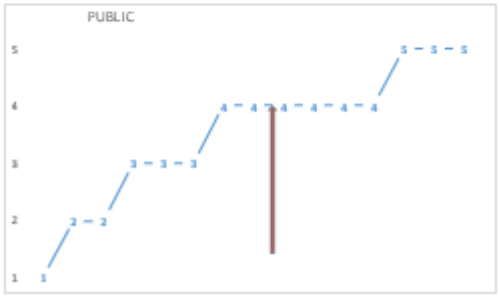
Q7.4 Please assess the impact of the following barriers to the transition to autonomous shipping: Safety and security issues



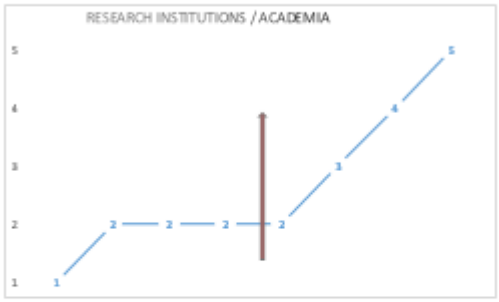
Q7.5 Please assess the impact of the following barriers to the transition to autonomous shipping: Economical barriers (question of profitability)

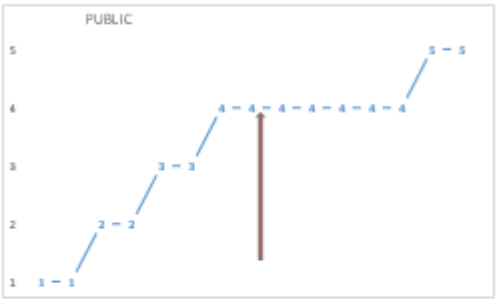


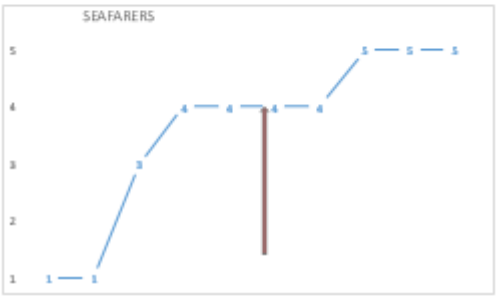


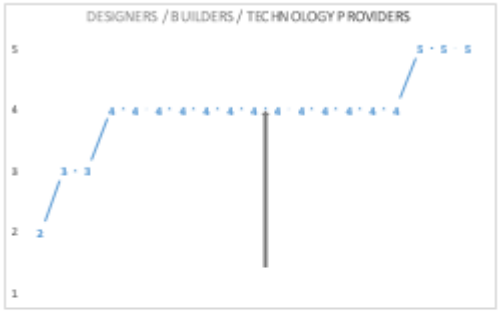


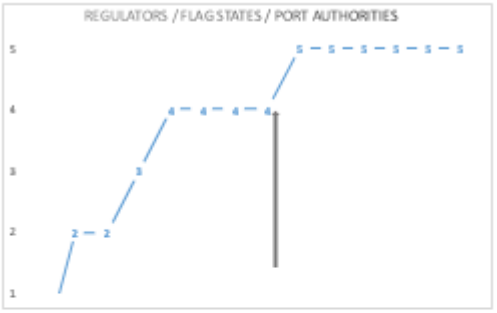
Q8.1 What do you think which are the biggest challenges for the development of autonomous shipping?: Investment cost



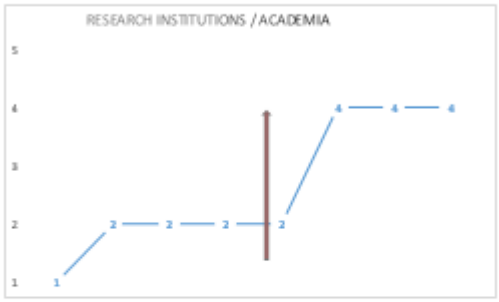


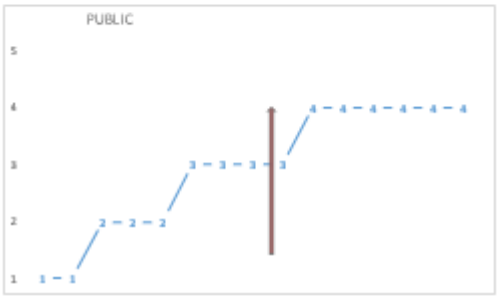


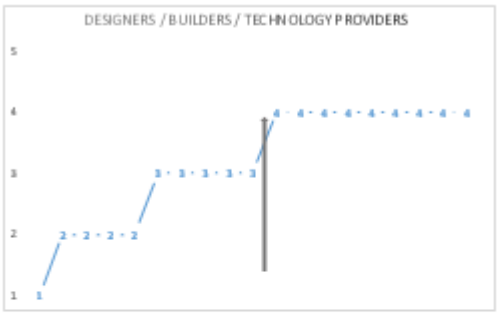


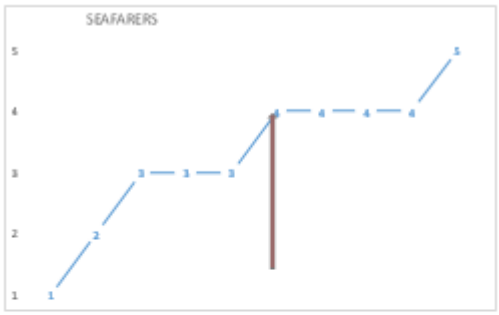


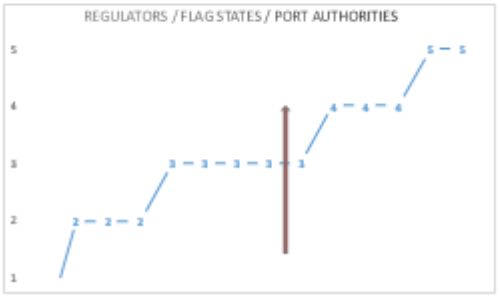
Q8.2 What do you think which are the biggest challenges for the development of autonomous shipping?: Operational costs

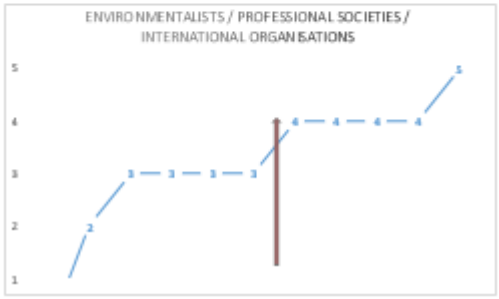




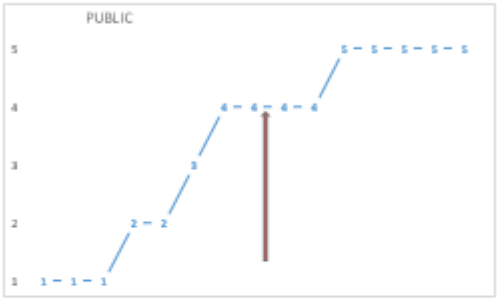


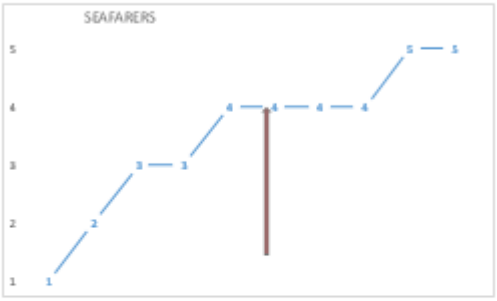


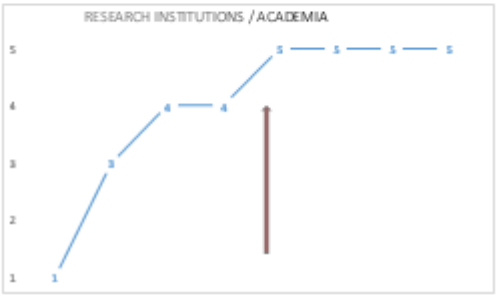


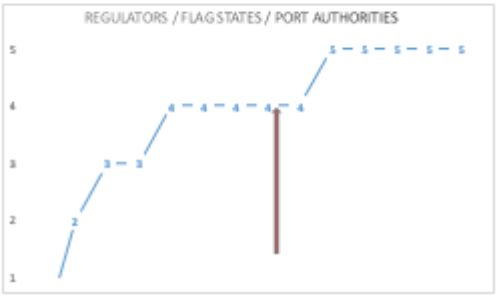


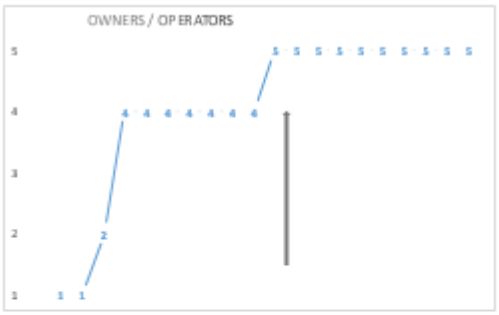
Q8.3 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of regulations

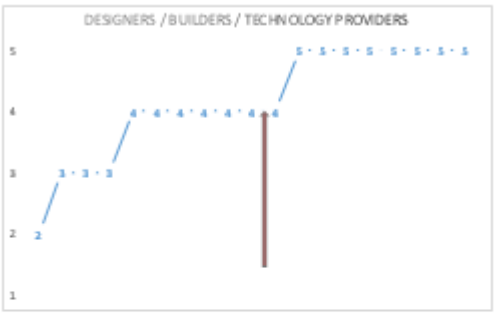


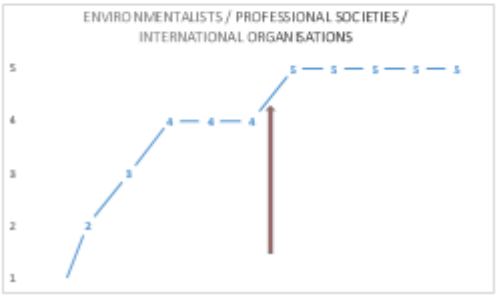




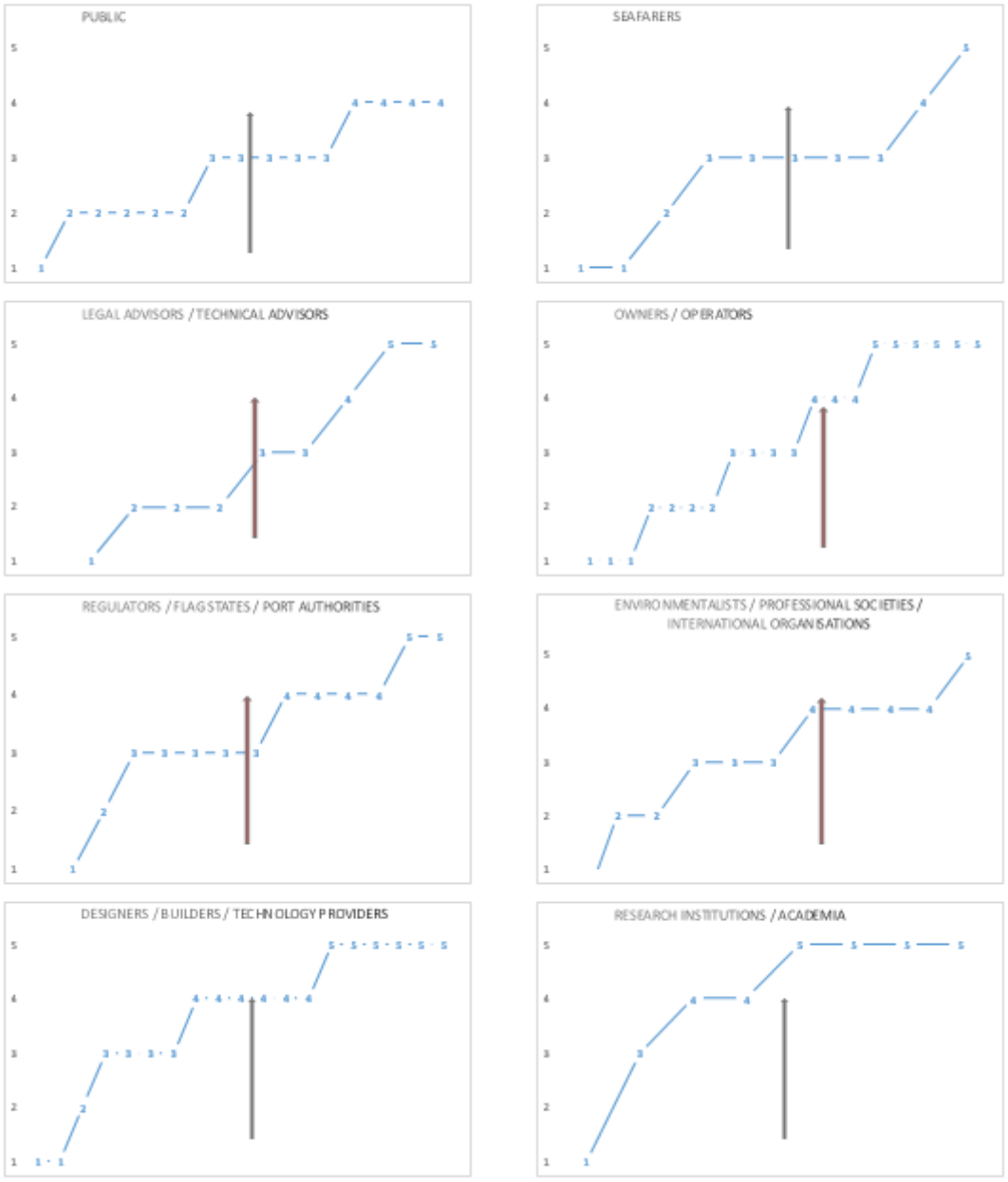




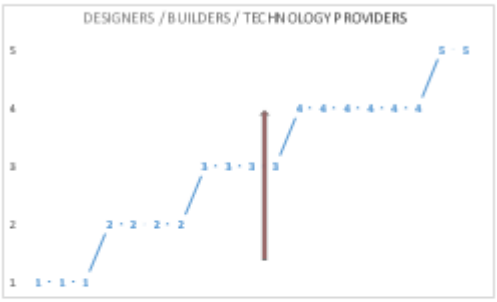


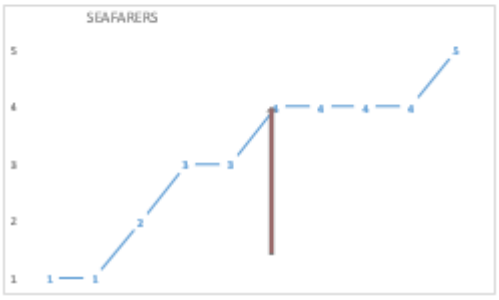


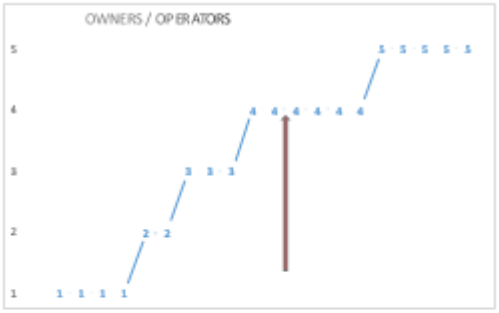
Q8.4 What do you think which are the biggest challenges for the development of autonomous shipping?: Political issues

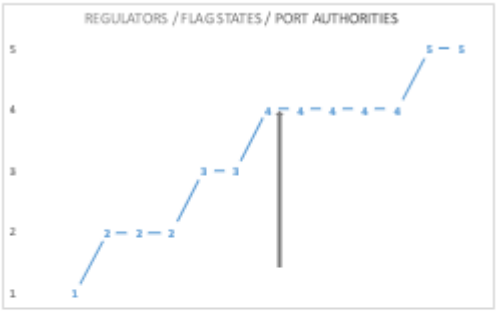


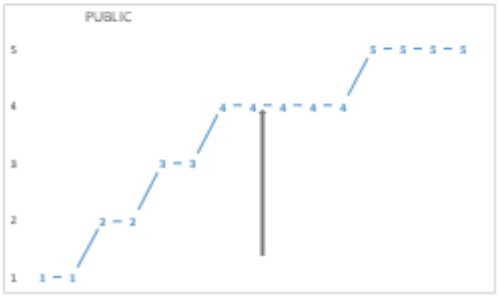
Q8.5 What do you think which are the biggest challenges for the development of autonomous shipping?: Technology maturity



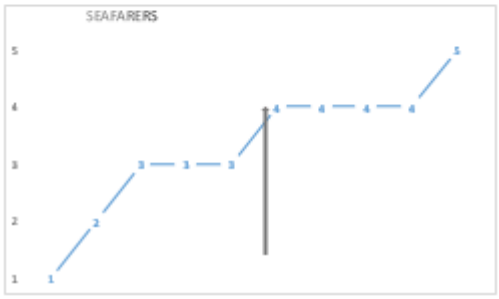


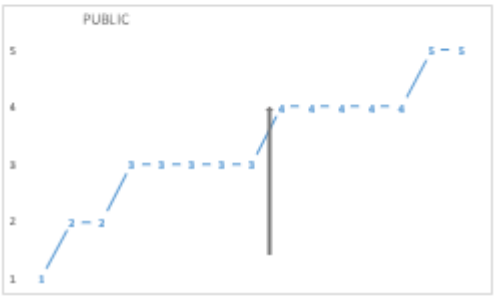


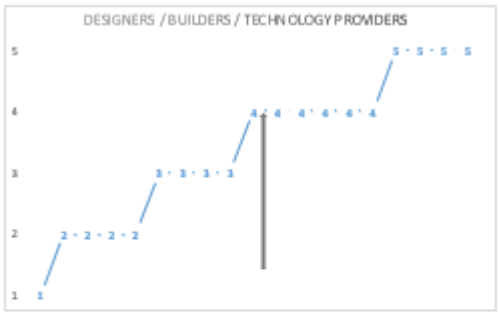


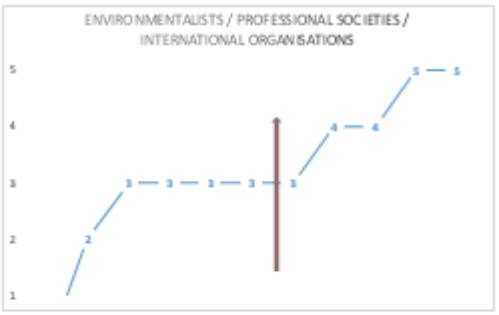


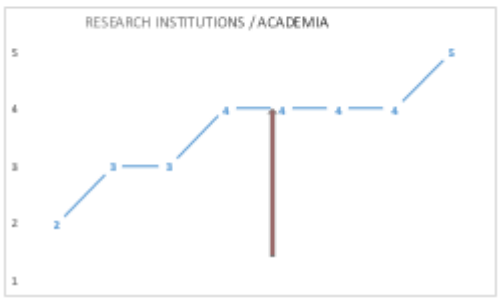
Q8.6 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of qualified workforce

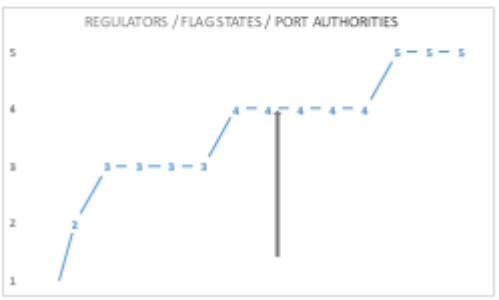




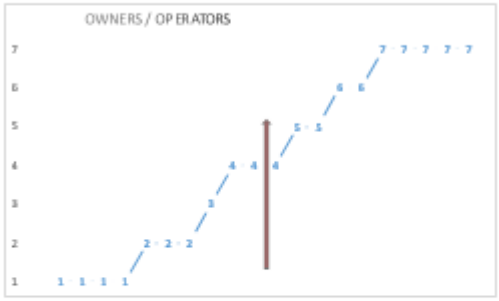


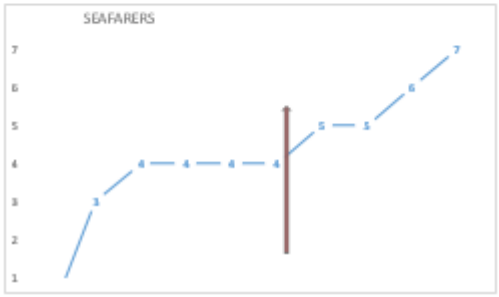


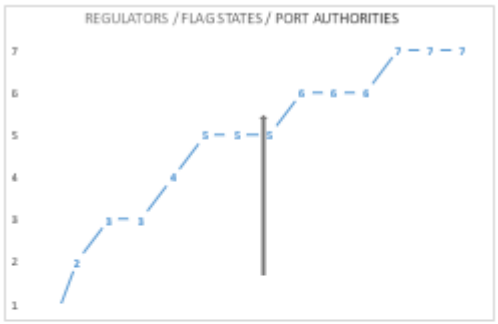


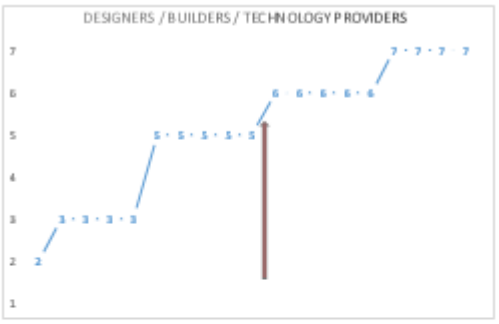


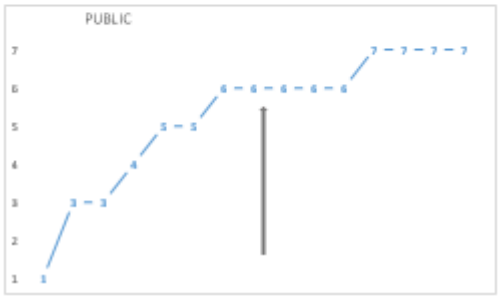
Q9.1 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Autonomous navigation (e.g. collision avoidance)

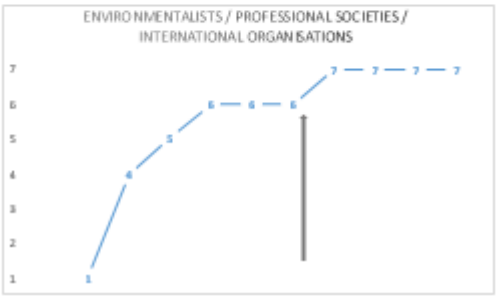




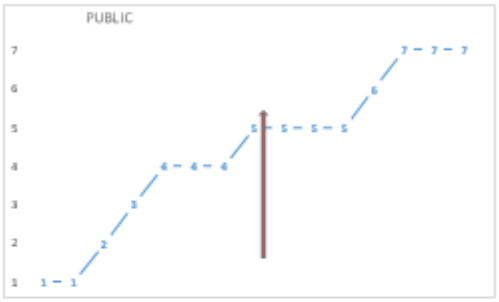


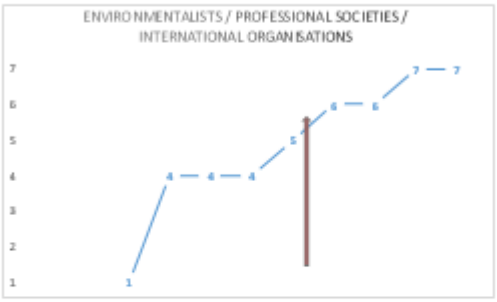


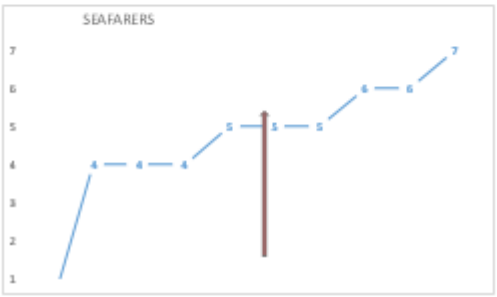


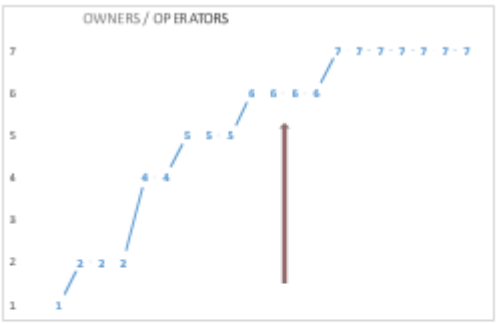


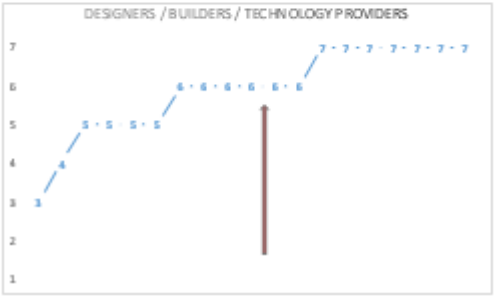
Q9.2 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Communication with the ship (including cyber-security issues and piracy)

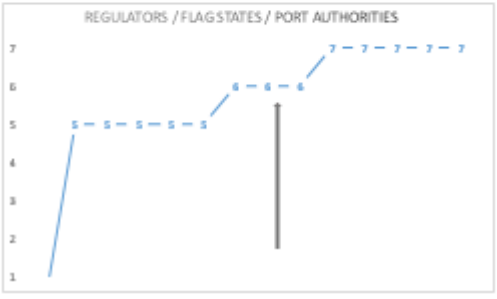




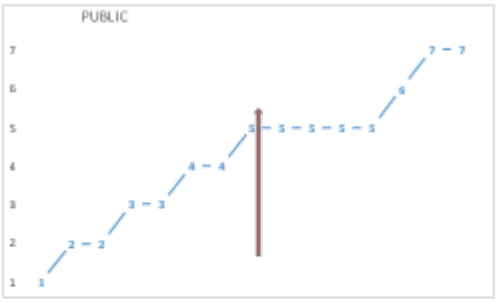


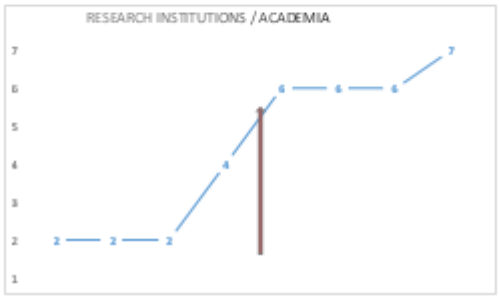


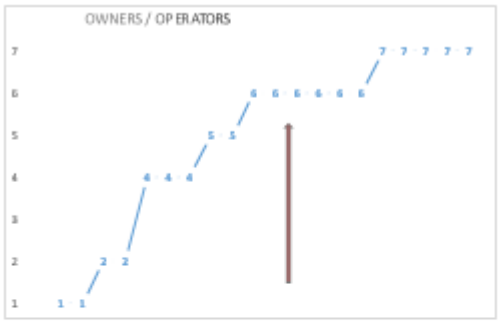


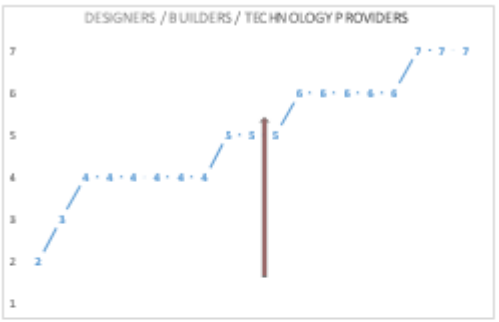


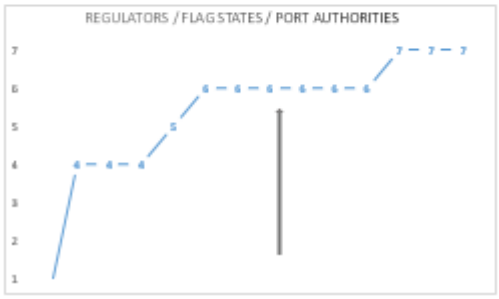
Q9.3 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Remote control centres (lack of operational experience)

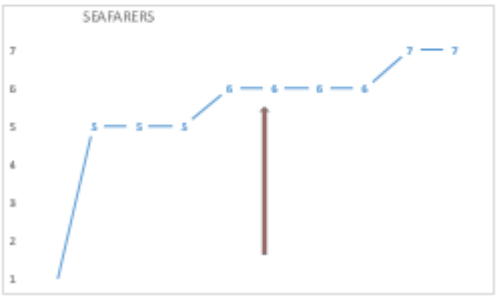




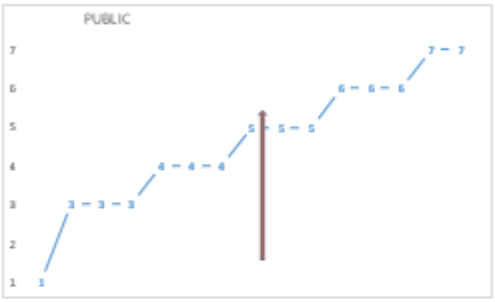


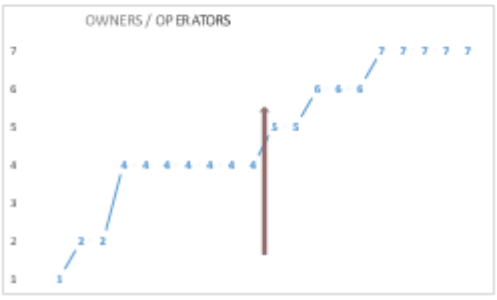


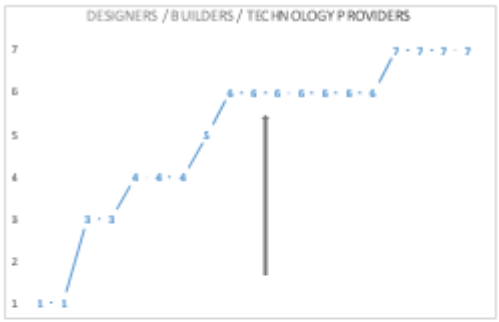


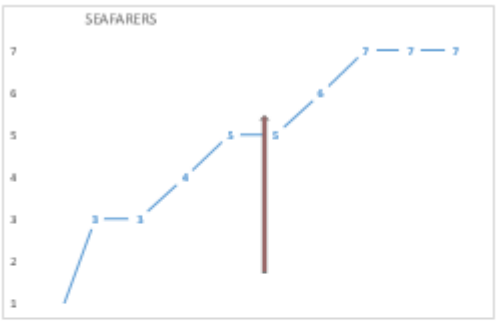


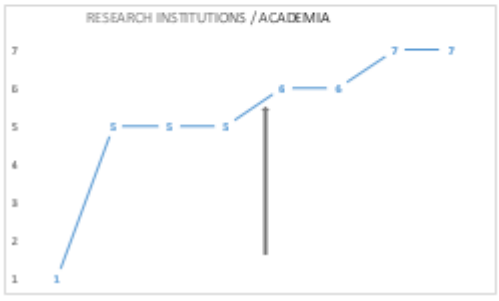
Q9.4 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: There are no procedures for testing, verification and validation

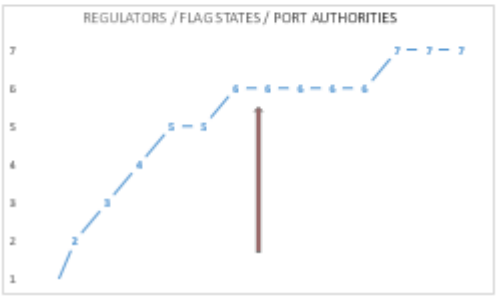




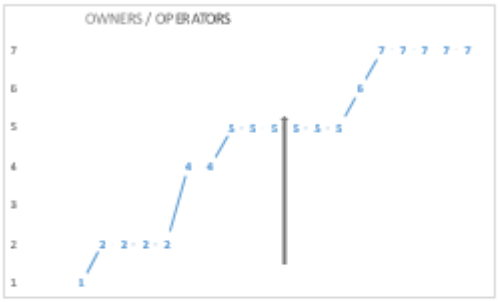


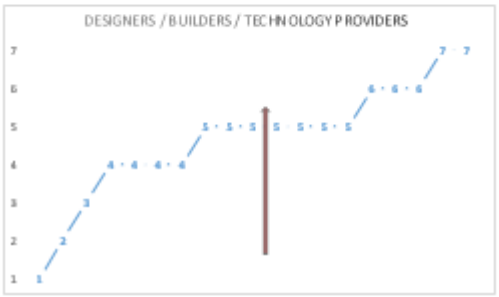


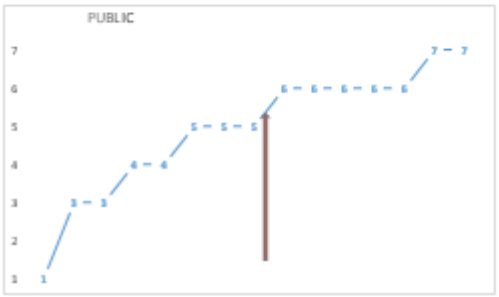


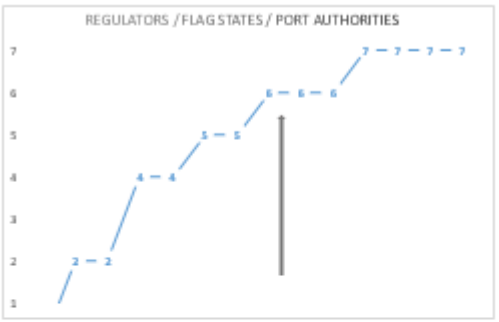


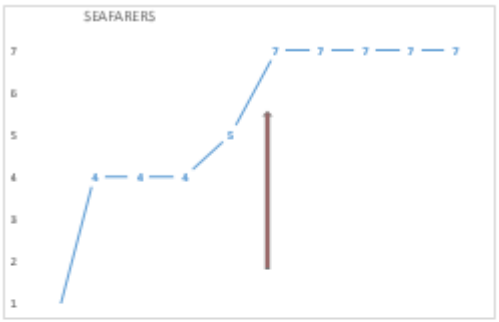
Q9.5 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Ship reliability and maintenance/repair requirements, especially during long voyages

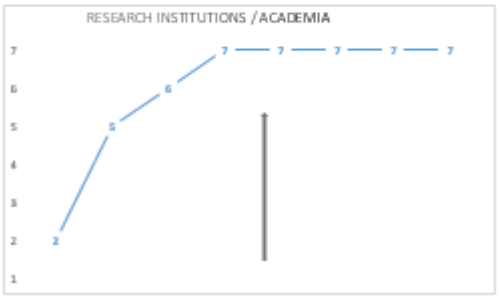




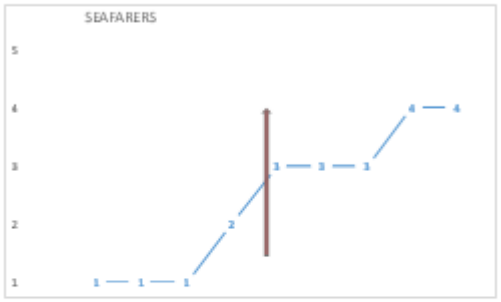


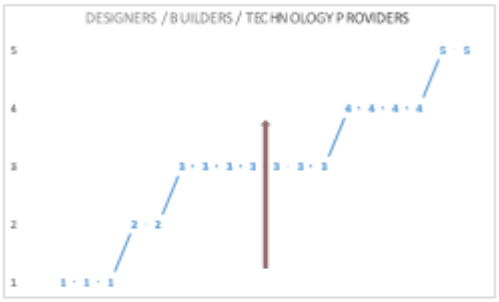


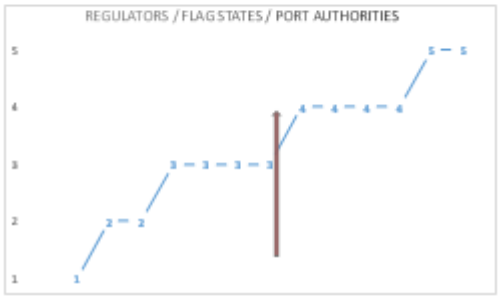


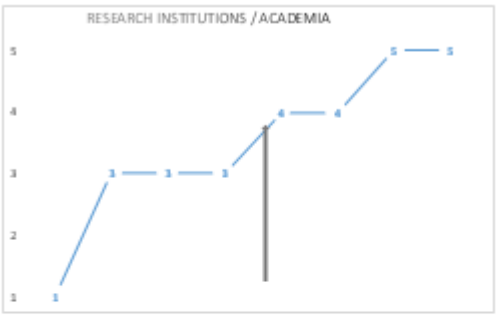


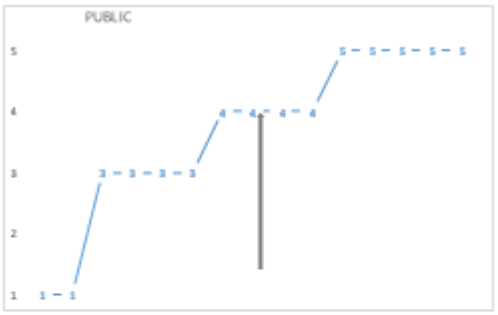
Q10.1 The role of governments:
Provide financial incentives to support the transition process to autonomous shipping

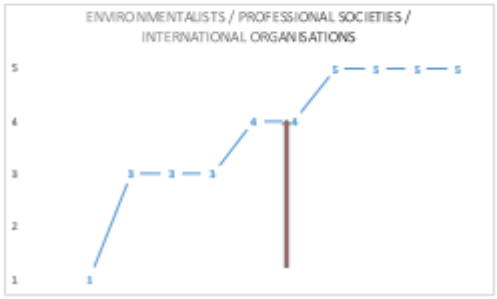


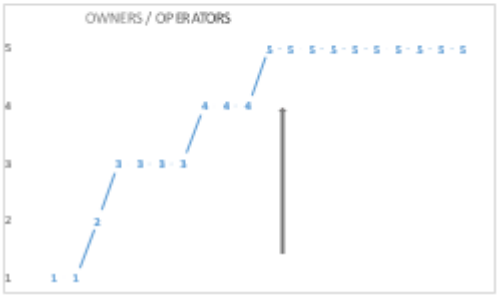




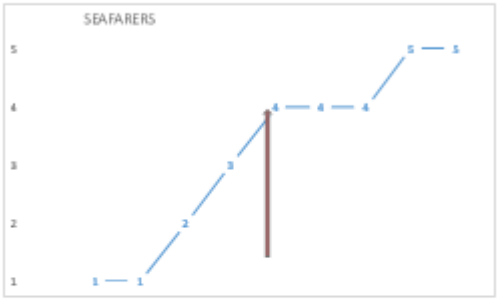


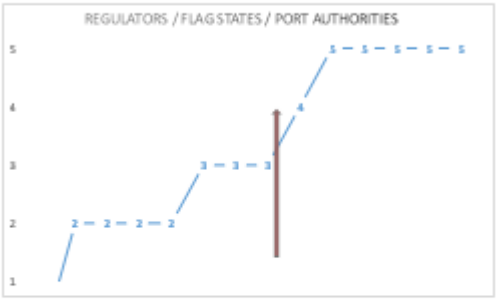


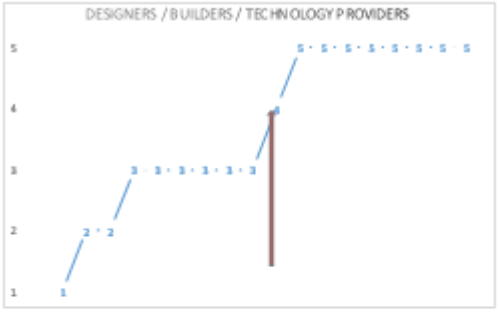


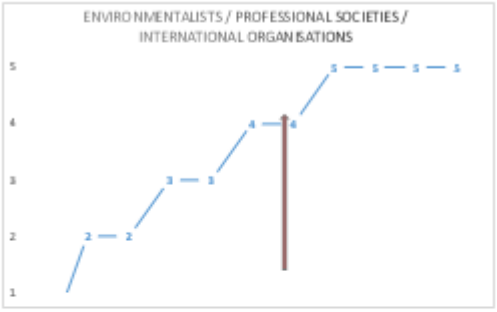


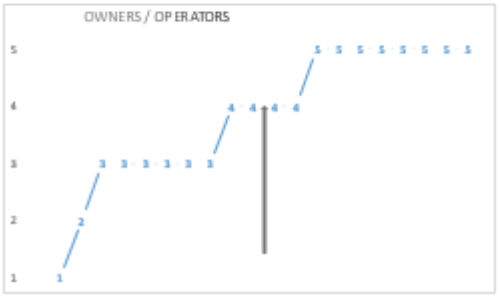
Q10.2 The role of governments:
Guarantee the safety of autonomous ships

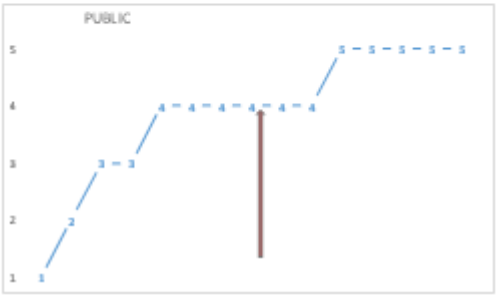




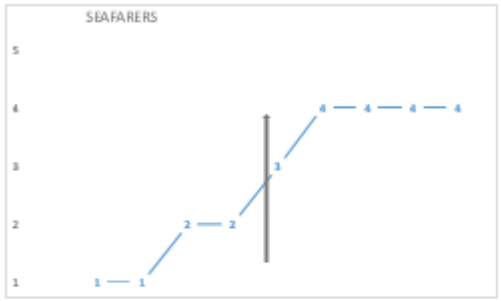


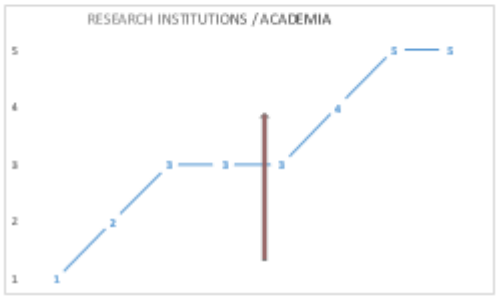


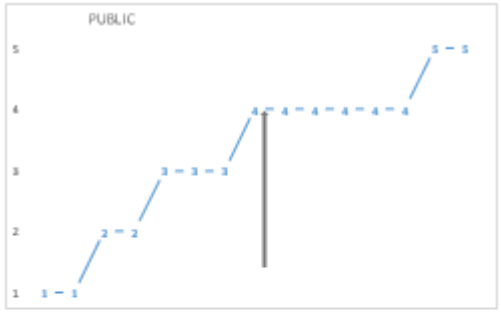


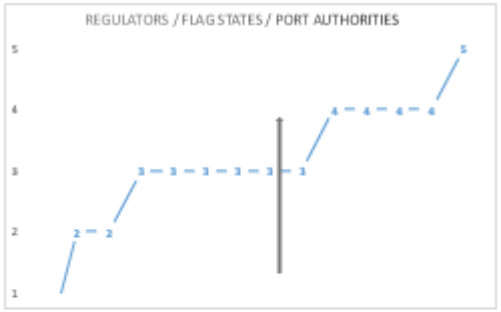


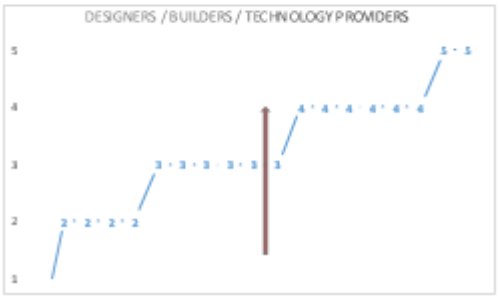
Q10.3 The role of governments:
Cover the infrastructure costs in port adaptation for autonomous ships

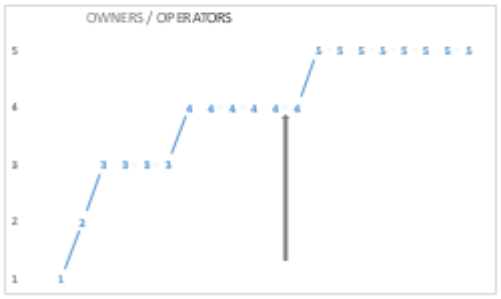




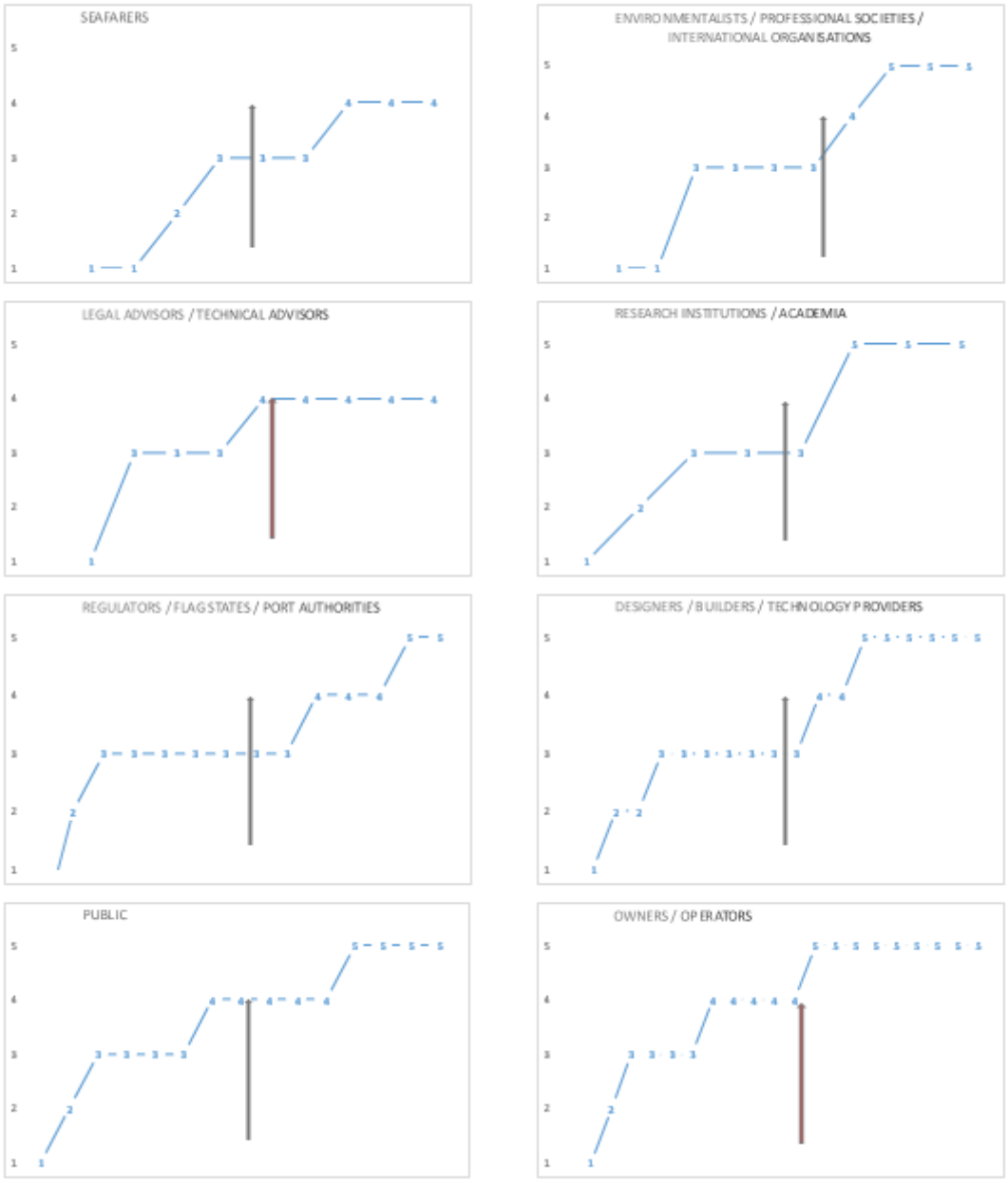








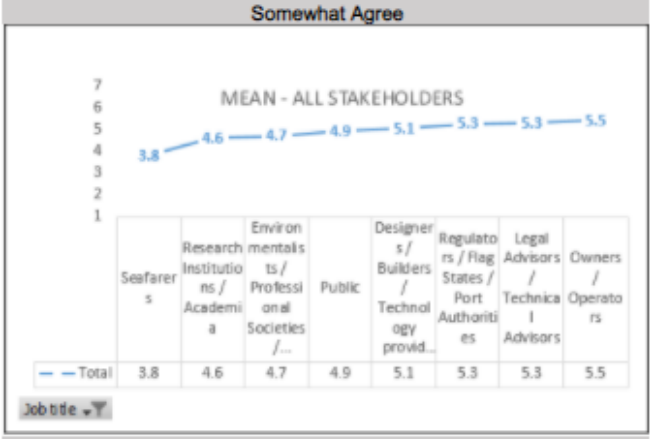
Q10.4 The role of governments:
Cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships



APPENDIX B – (SURVEY NO. 1) MEAN DIAGRAMS PER SUB-QUESTION

Q2. In my opinion, there is a need for the transition from the conventional to the autonomous shipping

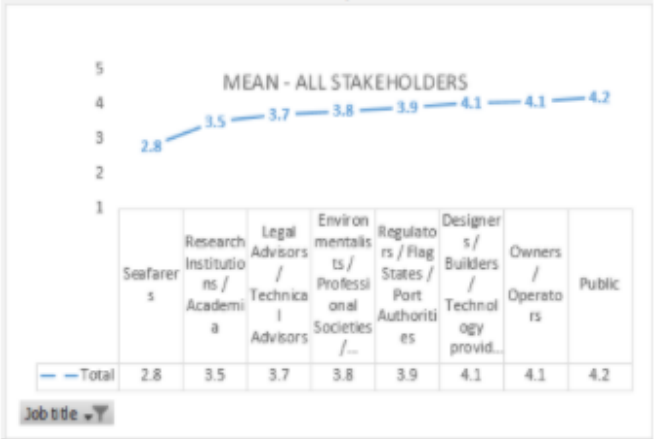
MEAN 5.1
Somewhat Agree



1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q3.1 Which would be the benefits from the transition to autonomous shipping?: Financial benefits (reduced fuel consumption, optimized routing, reduced manning cost etc.)

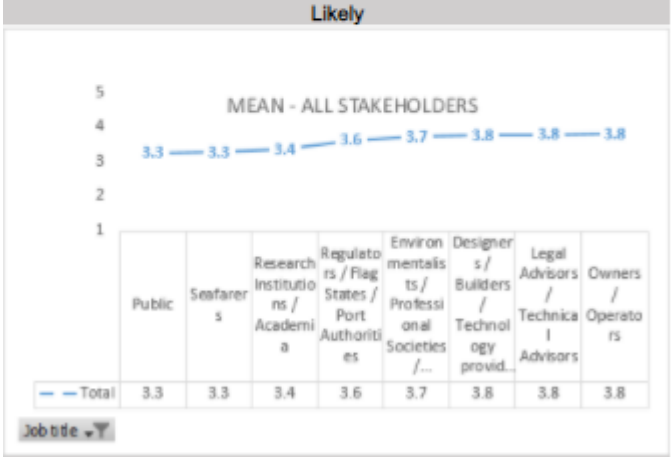
MEAN 3.9
Likely



1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

Q3.2 Which would be the benefits from the transition to autonomous shipping?: Environmental benefits (reduced environmental footprint)

MEAN 3.6
Likely



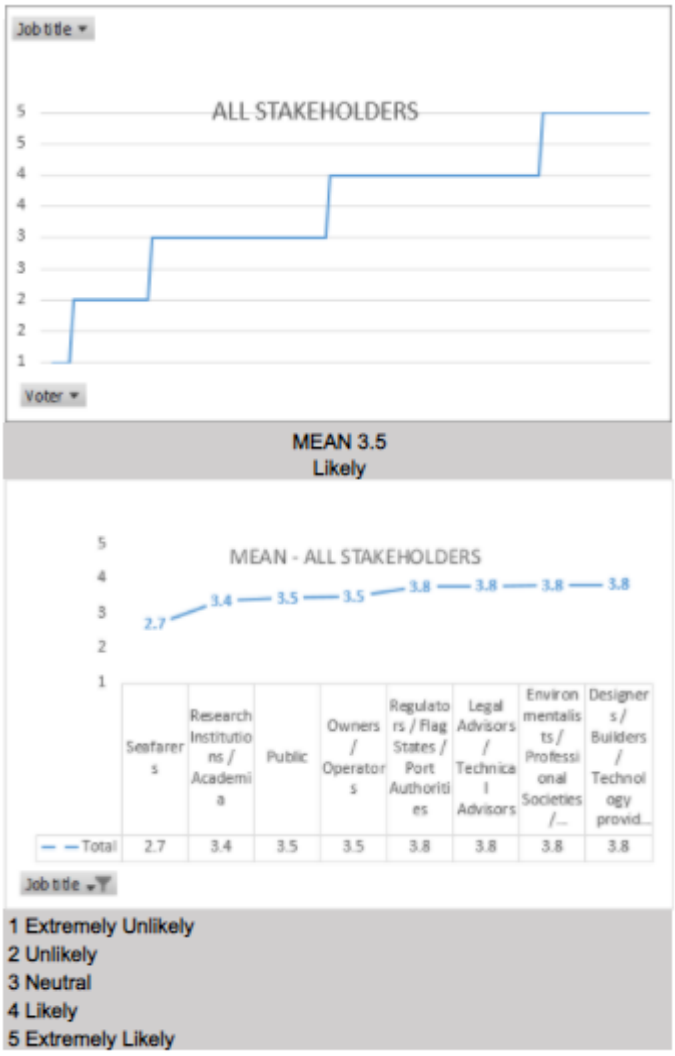
1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

Q3.3 Which would be the benefits from the transition to autonomous shipping?: Social benefits (increased job opportunities onshore - especially for women, better working conditions for seafarers)

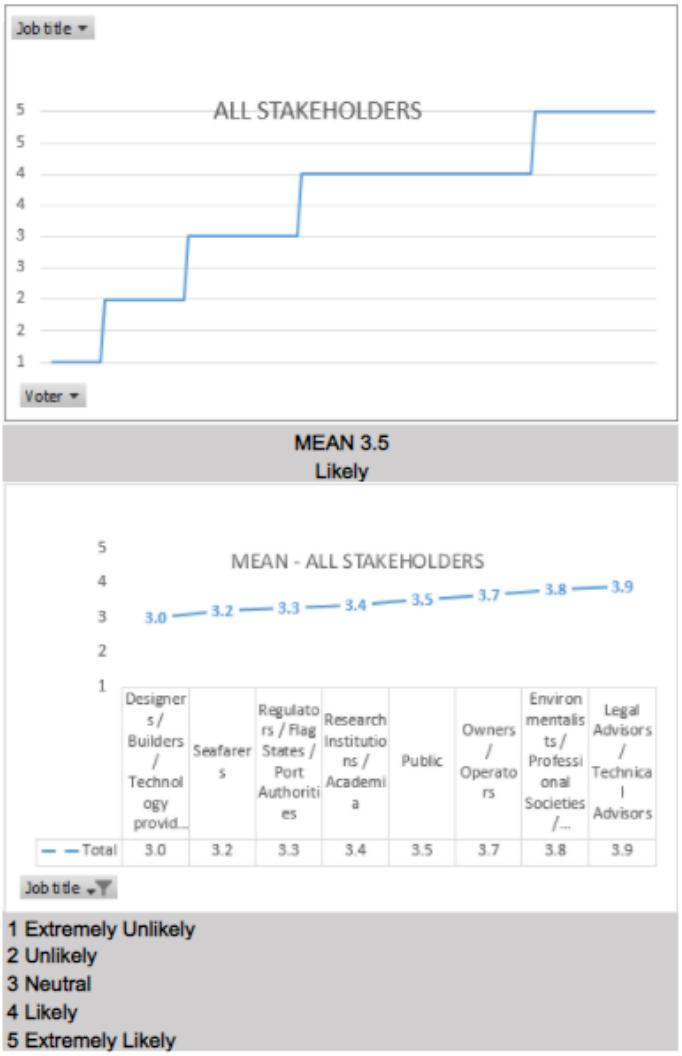
MEAN 3.4
Neutral

1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

Q3.4 Which would be the benefits from the transition to autonomous shipping?: Increased safety (due to system automation)

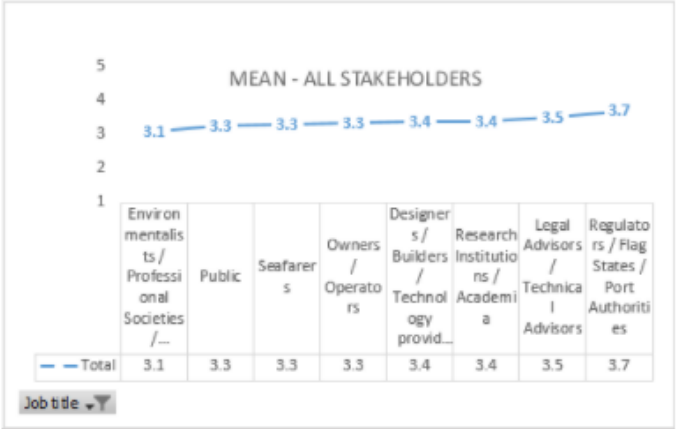


Q3.5 Which would be the benefits from the transition to autonomous shipping?: Added resilience in case of major worldwide disruptions (diseases, wars, piracy...)



Q4.1 How would the transition to autonomous shipping impact the shipping industry?: Increase the income

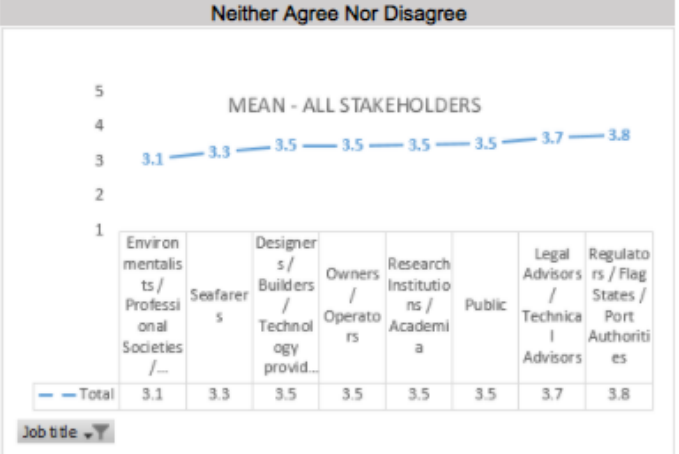
MEAN 3.3
Neither Agree Nor Disagree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q4.2 How would the transition to autonomous shipping impact the shipping industry?: Increase the profitability

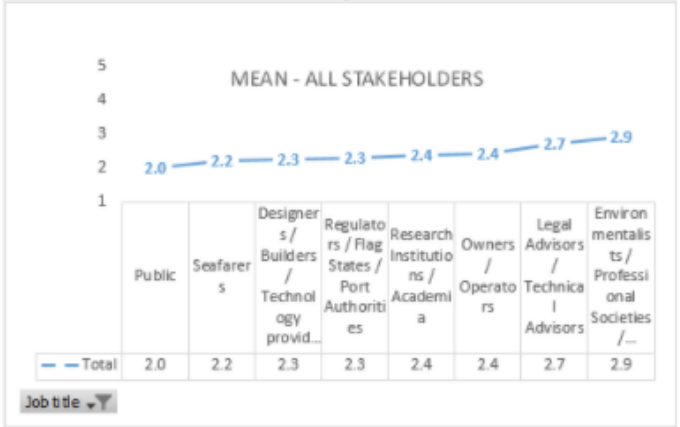
MEAN 3.5
Neither Agree Nor Disagree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q4.3 How would the transition to autonomous shipping impact the shipping industry?: Increase the number of employees

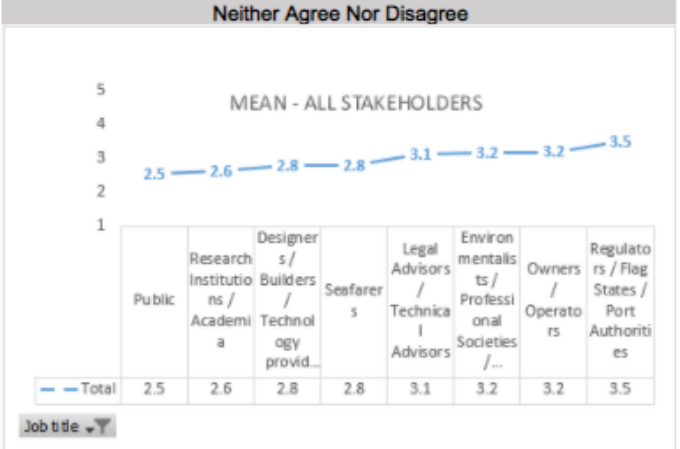
MEAN 2.4
Disagree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q4.4 How would the transition to autonomous shipping impact the shipping industry?: Improve the access to financing (easier access to loans)

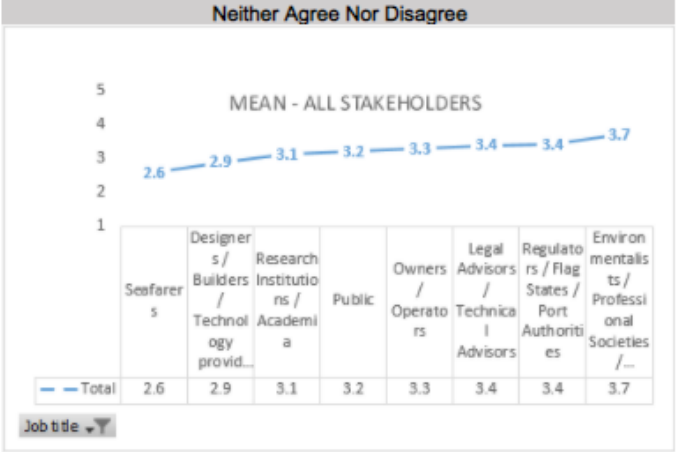
MEAN 2.9
Neither Agree Nor Disagree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

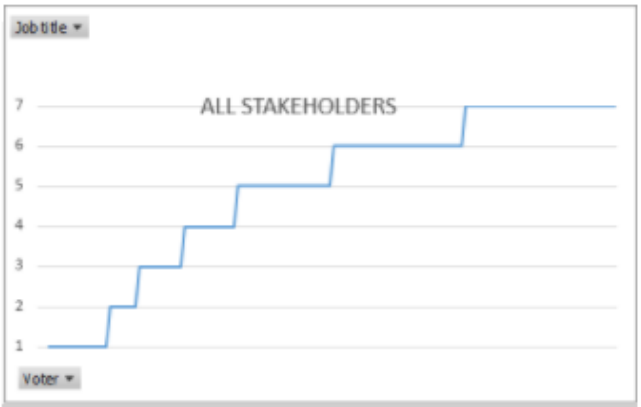
Q4.5 How would the transition to autonomous shipping impact the shipping industry?: Improve crisis resilience (reduce the risk of company exposure to disturbance in the market)

MEAN 3.2
Neither Agree Nor Disagree

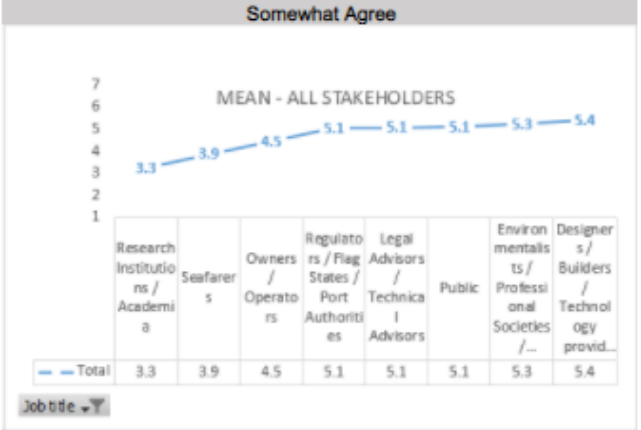


1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q5.1 I expect the autonomous shipping will be a viable option for the following shipping sectors: Ocean-going vessels



MEAN 4.9
Somewhat Agree



1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

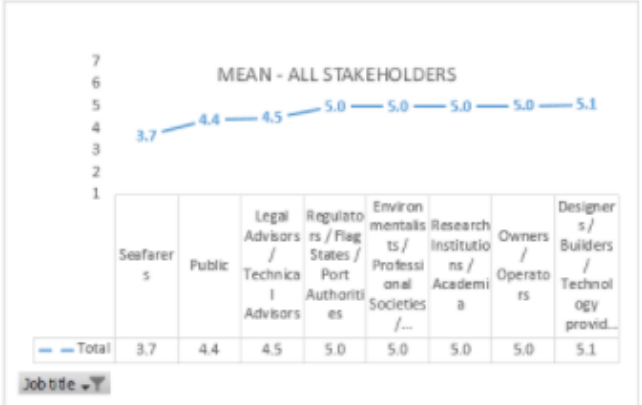
Q5.2 I expect the autonomous shipping will be a viable option for the following shipping sectors: Short-sea shipping

MEAN 5.1
Somewhat Agree

1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q5.3 I expect the autonomous shipping will be a viable option for the following shipping sectors: Inland shipping

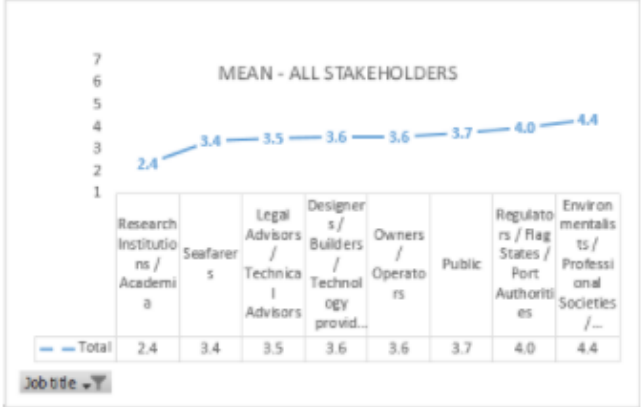
MEAN 4.8
Somewhat Agree



1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q5.4 I expect the autonomous shipping will be a viable option for the following shipping sectors: Working ships (tugs, dredgers)

MEAN 3.7
Neither Agree Nor Disagree



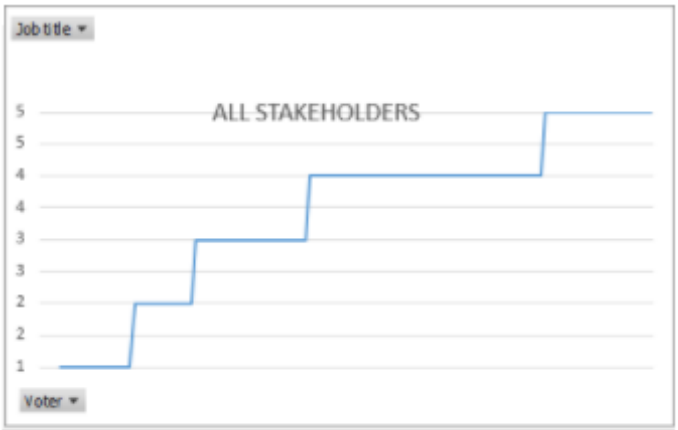
1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q5.5 I expect the autonomous shipping will be a viable option for the following shipping sectors: Cruisers

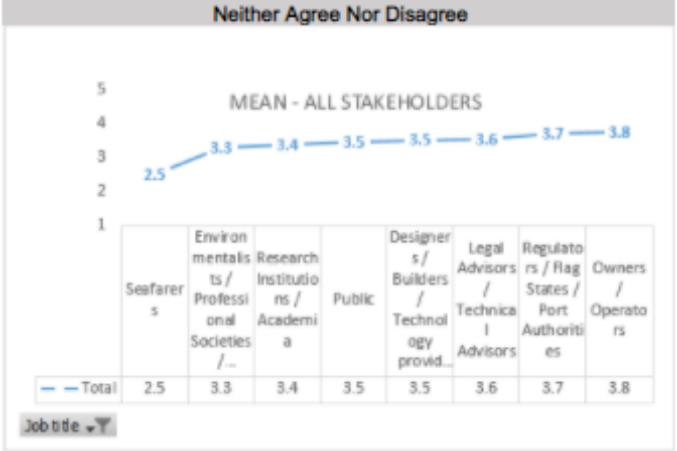
MEAN 3.3
Somewhat Disagree

1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q6.1 The transition to autonomous shipping will: Solve the deficit of seafarers



MEAN 3.4
Neither Agree Nor Disagree



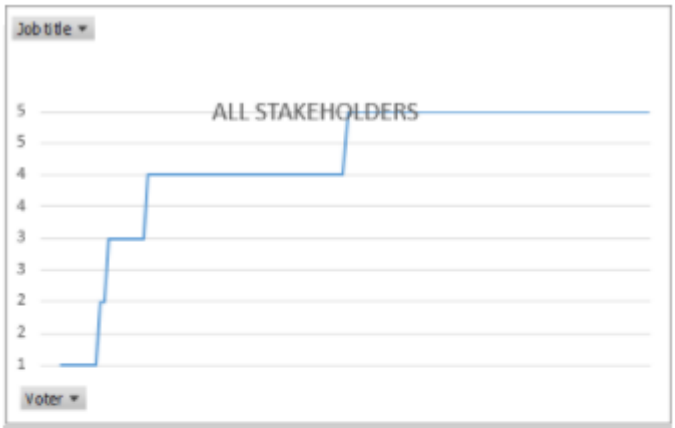
1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q6.2 The transition to autonomous shipping will: Improve the quality of life for the employees in the shipping sector

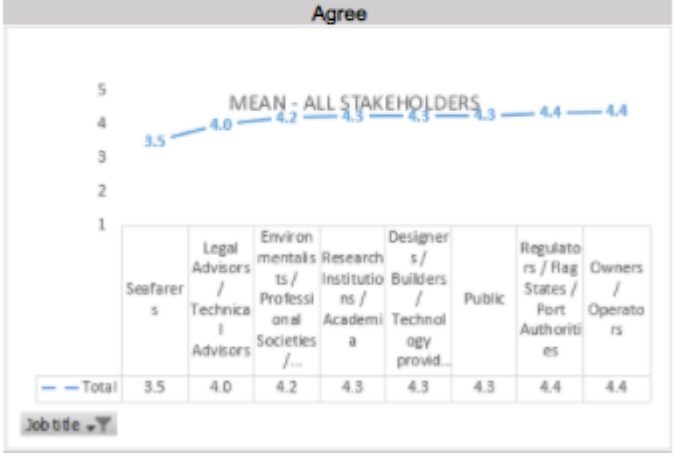
MEAN 3.5
Agree

1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q6.3 The transition to autonomous shipping will: Require the modification of the current training framework for seafarers



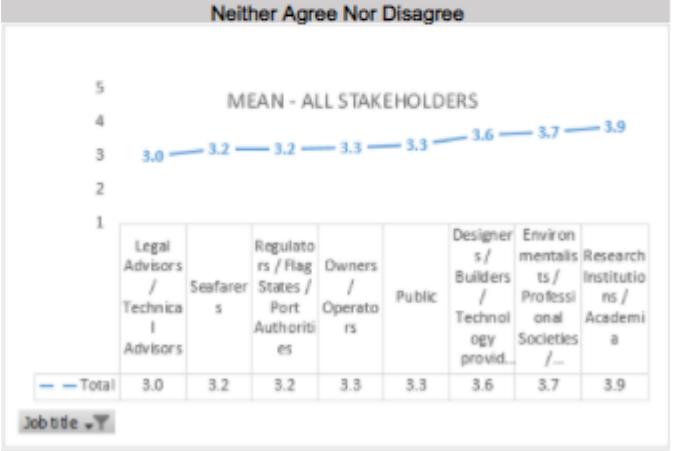
MEAN 4.2
Agree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q6.4 The transition to autonomous shipping will: Result in the loss of the existing knowledge, skills and experience of seafarers

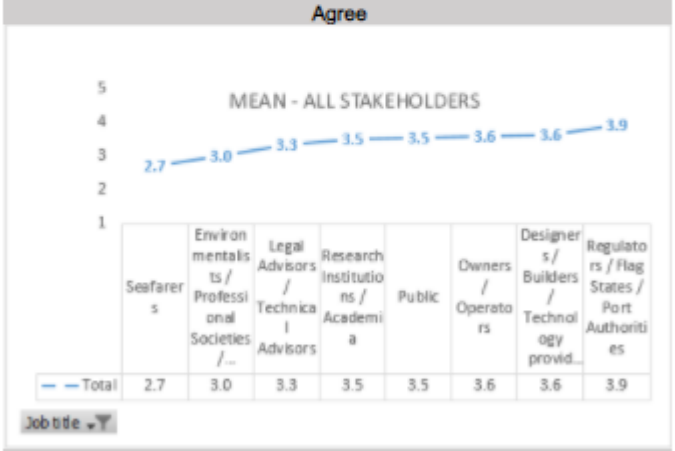
MEAN 3.3
Neither Agree Nor Disagree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

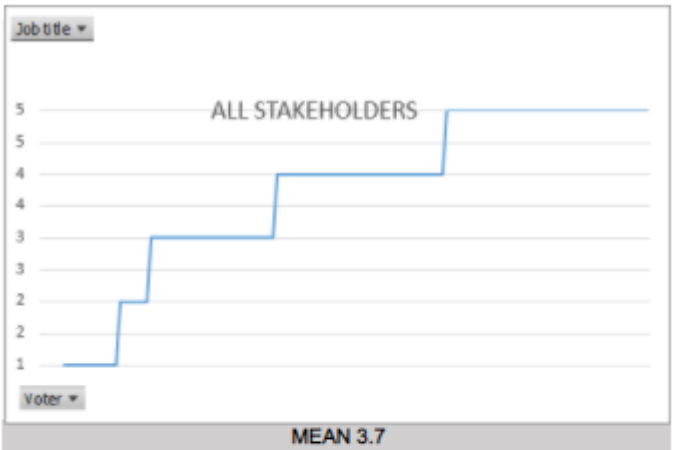
Q6.5 The transition to autonomous shipping will: Contribute to the transportation modal shift (from land or air to sea and inland waterways)

MEAN 3.5
Agree

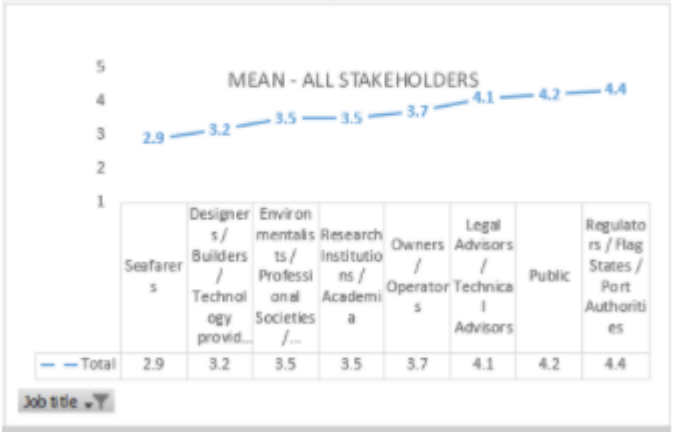


1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q6.6 The transition to autonomous shipping will: Render the use of smaller ships more attractive

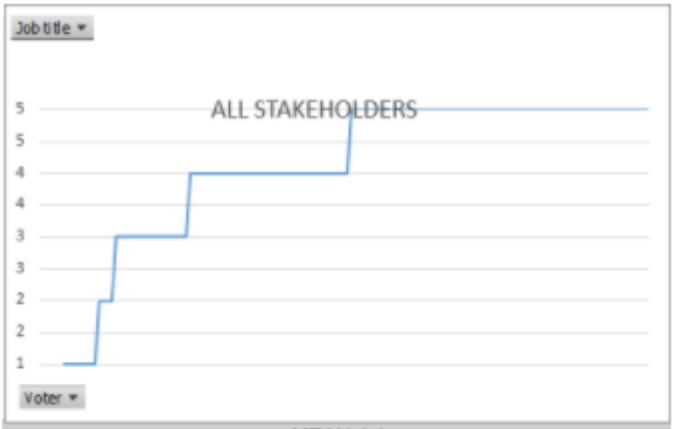


MEAN 3.7
Agree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q7.1 Please assess the impact of the following barriers to the transition to autonomous shipping: Regulatory barriers (ships will not be allowed to sail until new regulations have been implemented)



MEAN 4.1
Moderate Effect

1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

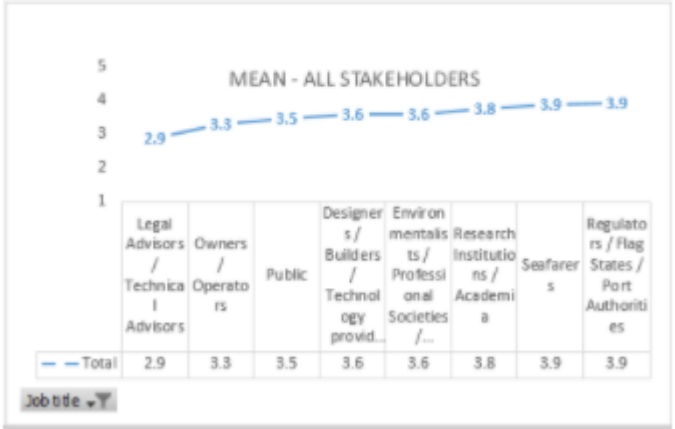
Q7.2 Please assess the impact of the following barriers to the transition to autonomous shipping: Technological limitations (technology not mature)

MEAN 3.4
Neutral

1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

Q7.3 Please assess the impact of the following barriers to the transition to autonomous shipping: Social limitations (lack of expert skills)

MEAN 3.5
Moderate Effect



1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

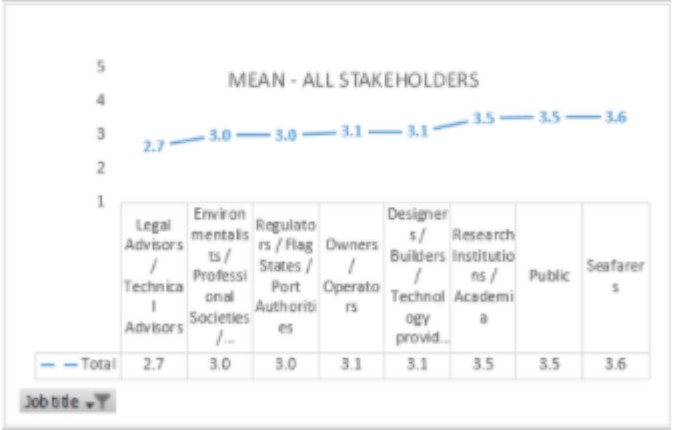
Q7.4 Please assess the impact of the following barriers to the transition to autonomous shipping: Safety and security issues

MEAN 3.8
Moderate Effect

1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

Q7.5 Please assess the impact of the following barriers to the transition to autonomous shipping: Economic barriers (a question of profitability)

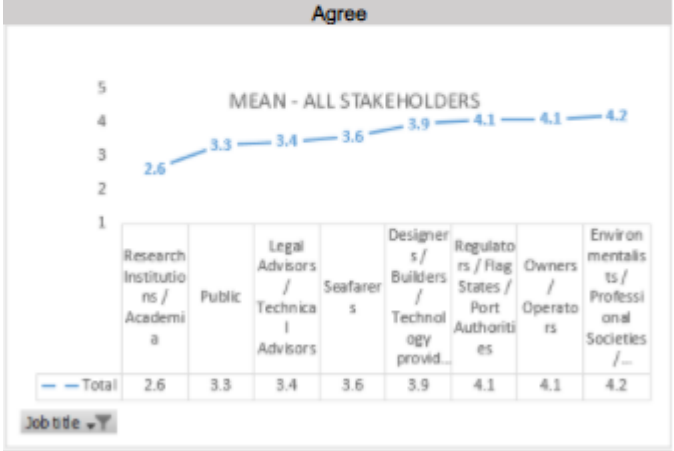
MEAN 3.2
Neutral



1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

Q8.1 What do you think which are the biggest challenges for the development of autonomous shipping?: Investment cost

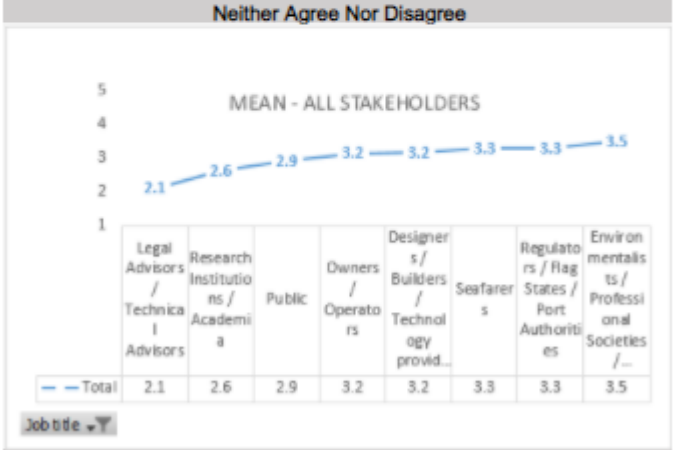
MEAN 3.8
Agree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

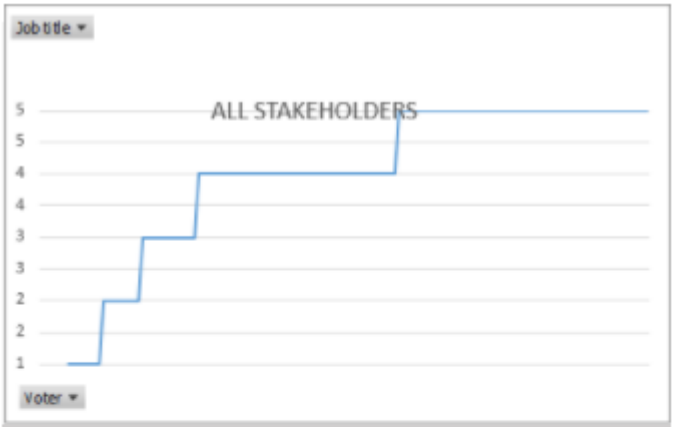
Q8.2 What do you think which are the biggest challenges for the development of autonomous shipping?: Operational costs

MEAN 3.0
Neither Agree Nor Disagree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

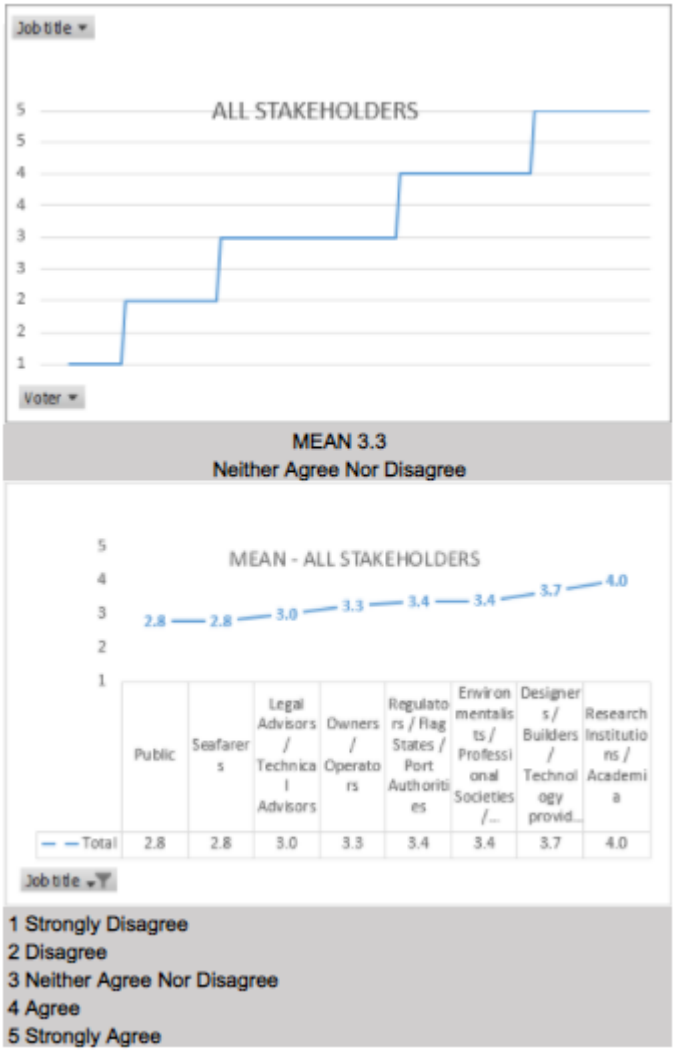
Q8.3 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of regulations



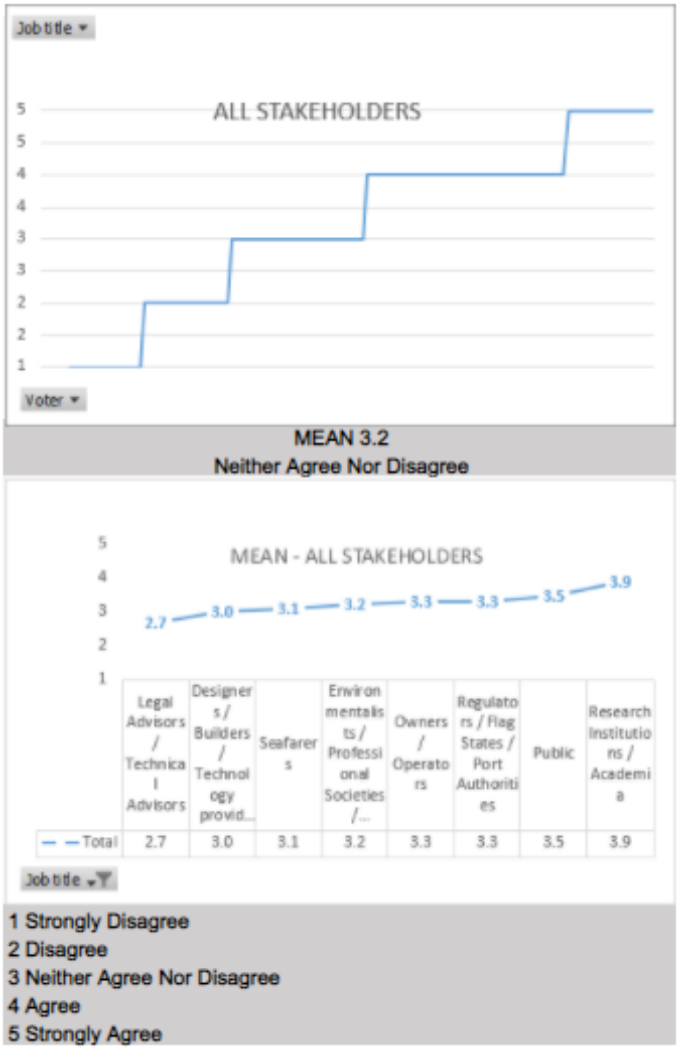
MEAN 4.0
Agree

1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

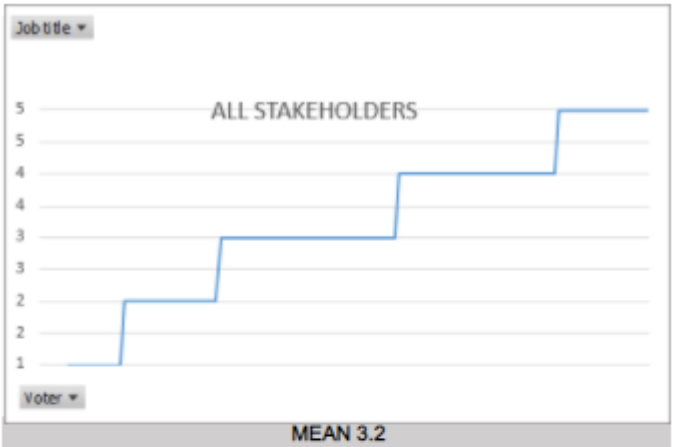
Q8.4 What do you think which are the biggest challenges for the development of autonomous shipping?: Political issues



Q8.5 What do you think which are the biggest challenges for the development of autonomous shipping?: Technology maturity



Q8.6 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of qualified workforce

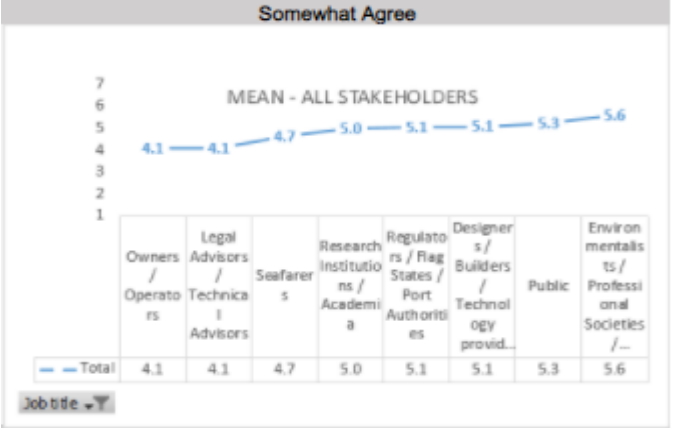


MEAN 3.2
Neither Agree Nor Disagree

1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

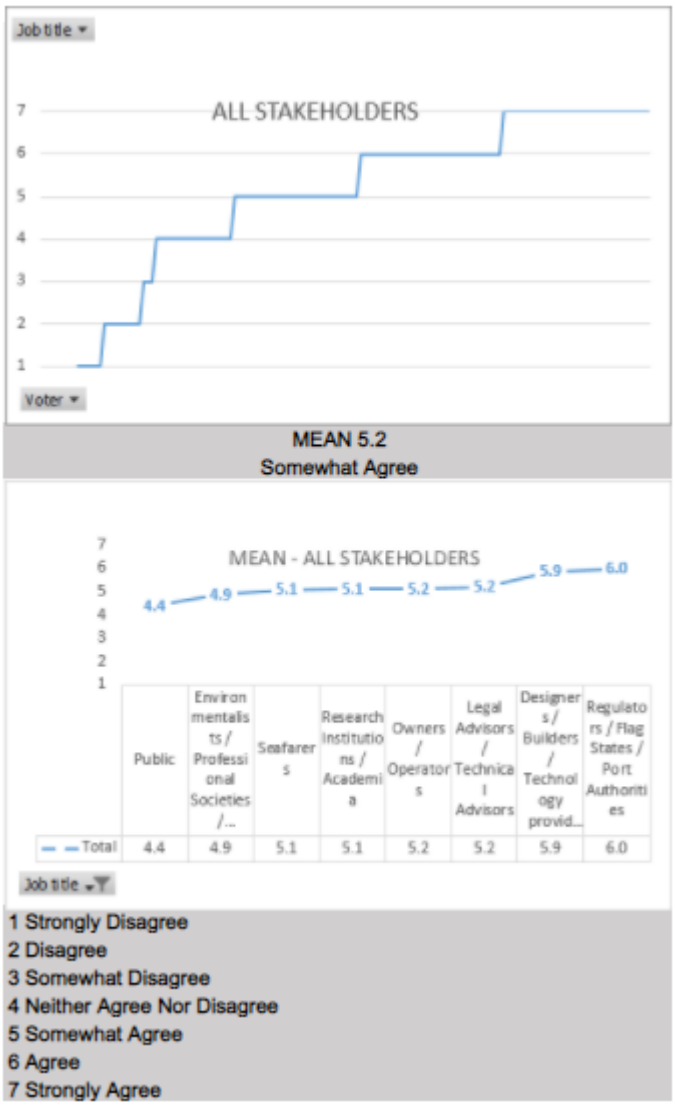
Q9.1 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Autonomous navigation (e.g. collision avoidance)

MEAN 4.8
Somewhat Agree



1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

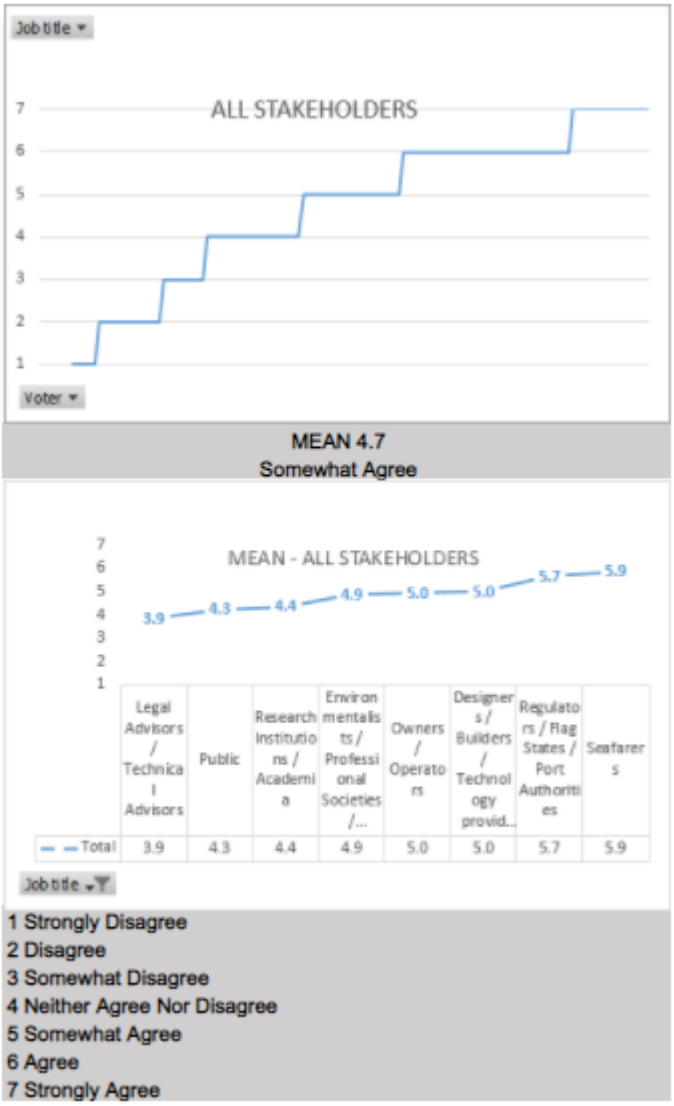
Q9.2 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Communication with the ship (including cyber-security issues and piracy)



MEAN 5.2
Somewhat Agree

1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

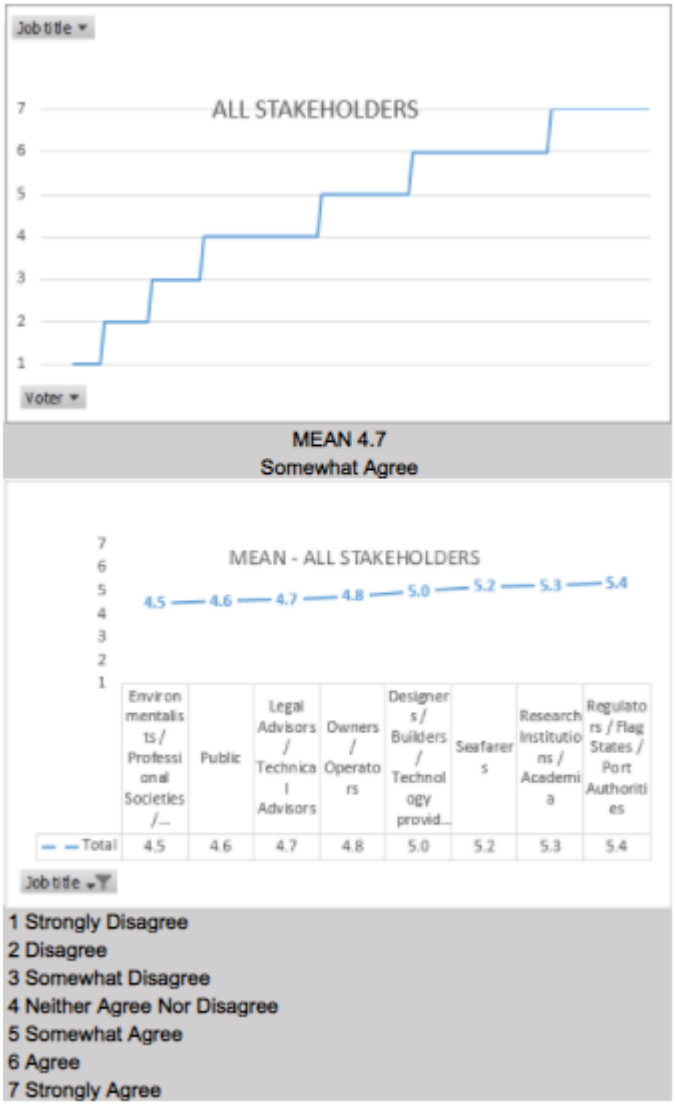
Q9.3 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Remote control centres (lack of operational experience)



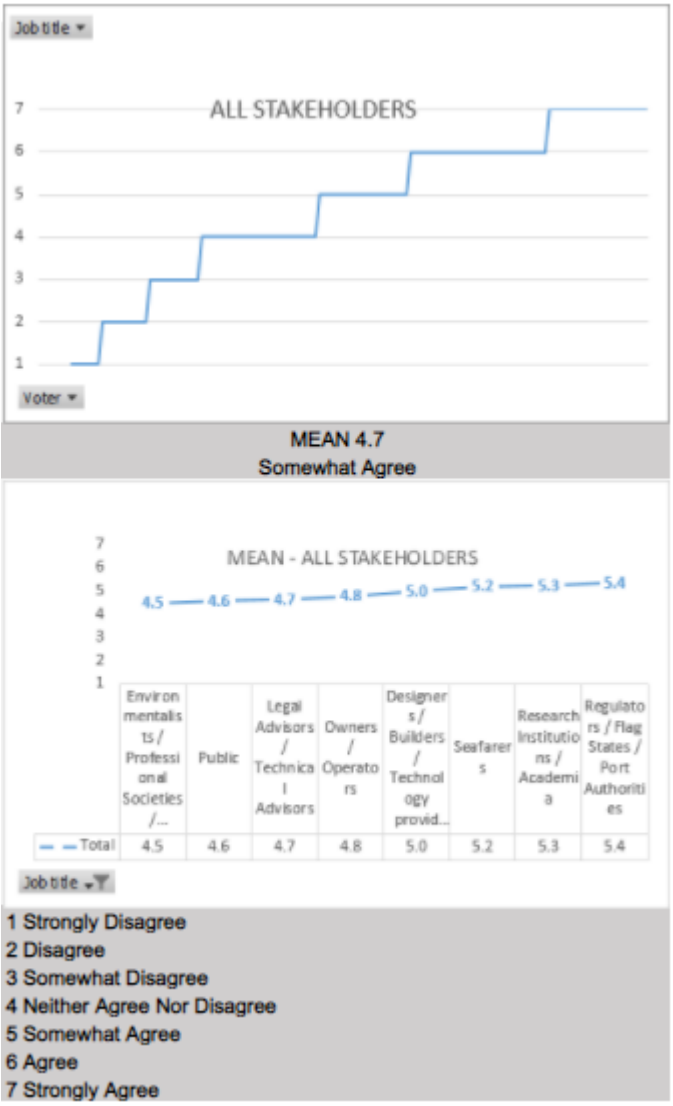
MEAN 4.7
Somewhat Agree

1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree Nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

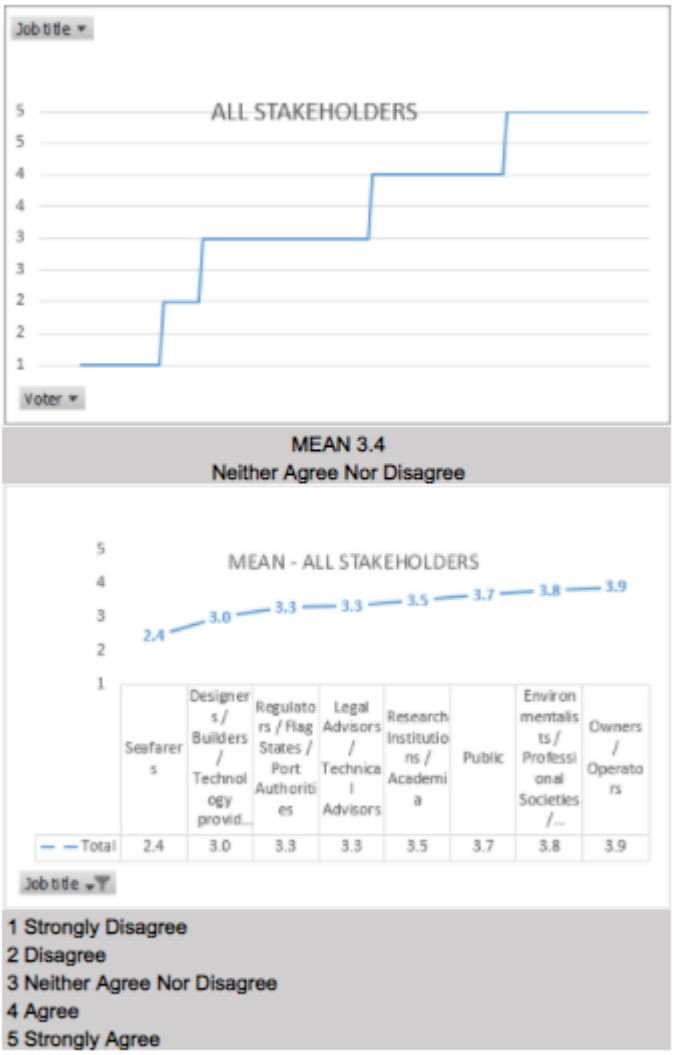
Q9.4 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: There are no procedures for testing, verification and validation



Q9.5 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Ship reliability and maintenance/repair requirements, especially during long voyages



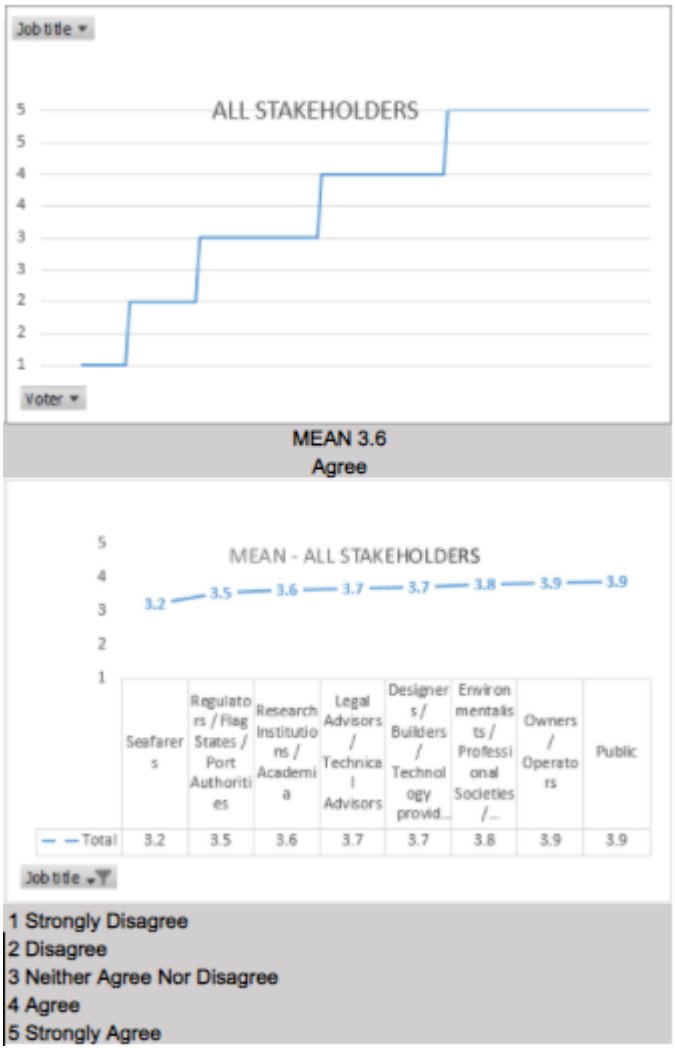
Q10.1 The role of governments: Provide financial incentives to support the transition process to autonomous shipping



MEAN 3.4
Neither Agree Nor Disagree

1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q10.2 The role of governments: Guarantee the safety of autonomous ships



MEAN 3.6
Agree

1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

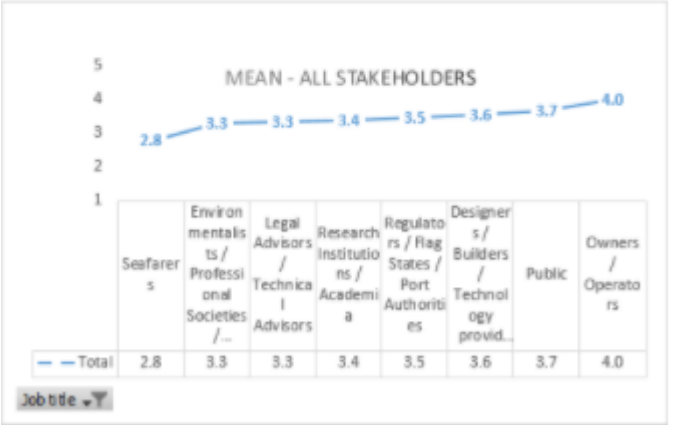
Q10.3 The role of governments: Cover the infrastructure costs in port adaptation for autonomous ships

MEAN 3.4
Neither Agree Nor Disagree

1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

Q10.4 The role of governments: Cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships

MEAN 3.6
Agree



1 Strongly Disagree
2 Disagree
3 Neither Agree Nor Disagree
4 Agree
5 Strongly Agree

APPENDIX C – (SURVEY NO. 1) GENERAL OVERVIEW TABLE

#	QUESTIONS	STAKEHOLDERS MEAN									
		Designers Builders Technology Providers	Environmentalists Professional Societies International Organisations	Legal Advisors Technical Advisors	Owners Operators	Public	Regulators Flag States Port Authorities	Seafarers	Research Institutions Academia	ALL	Characterisation
Q2	**In my opinion there is a need for the transition from the conventional to the autonomous shipping**	**5.1**	**4.7**	**5.3**	**5.5**	**4.9**	**5.3**	**3.8**	**4.6**	**5.1**	**Somewhat Agree**
Q3	**The benefits from the transition to autonomous shipping** Financial benefits | Environmental benefits | Social benefits | Increased safety | Added resilience in case of major worldwide disruptions	**3.6**	**3.7**	**3.7**	**3.8**	**3.6**	**3.6**	**3.0**	**3.3**	**3.6**	**Likely**
3.1	Financial benefits	4.1	3.8	3.7	4.1	4.2	3.9	2.8	3.5	**3.9**	**Likely**
3.2	Environmental benefits	3.8	3.7	3.8	3.8	3.3	3.6	3.3	3.4	**3.6**	**Likely**
3.3	Social benefits	3.5	3.6	3.3	3.7	3.4	3.3	2.8	2.9	**3.4**	**Neutral**
3.4	Increased safety	3.8	3.8	3.8	3.5	3.5	3.8	2.7	3.4	**3.6**	**Likely**
3.5	Added resilience in case of major worldwide disruptions	3.0	3.8	3.9	3.7	3.5	3.3	3.2	3.4	**3.5**	**Likely**
Q4	**Impact to the shipping industry as a consequence of the transition to autonomous shipping** Increase the income | Increase the profitability | Increase the number of employees | Improve the access to financing | Improve crisis resilience	**3.0**	**3.2**	**3.3**	**3.1**	**2.9**	**3.3**	**2.8**	**3.0**	**3.1**	**Neither Agree nor Disagree**
4.1	Increase the income	3.4	3.1	3.5	3.3	3.3	3.7	3.3	3.4	**3.3**	**Neither Agree nor Disagree**

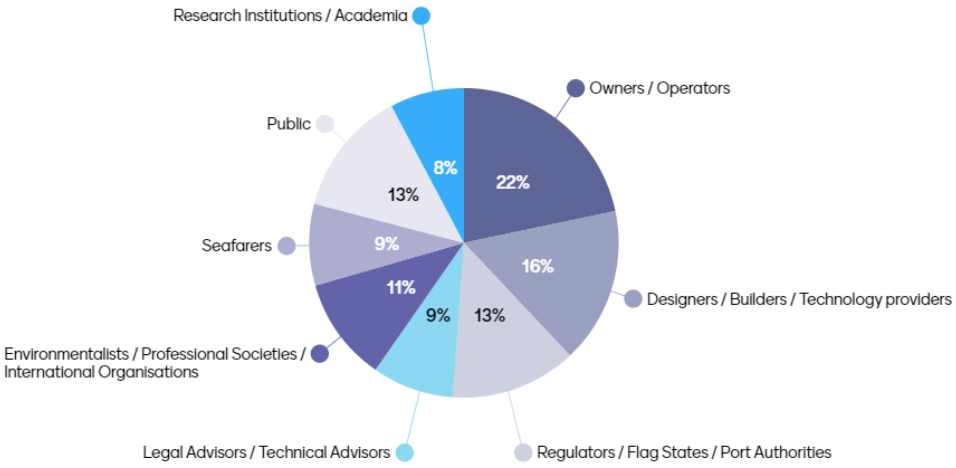
#	QUESTIONS	STAKEHOLDERS MEAN									
		Designers Builders Technology Providers	Environmentalists Professional Societies International Organisations	Legal Advisors Technical Advisors	Owners Operators	Public	Regulators Flag States Port Authorities	Seafarers	Research Institutions Academia	ALL	Characterisation
4.2	Increase the profitability	3.5	3.1	3.7	3.5	3.5	3.8	3.3	3.5	**3.5**	**Neither Agree nor Disagree**
4.3	Increase the number of employees	2.3	2.9	2.7	2.4	2.0	2.3	2.2	2.4	**2.4**	**Disagree**
4.4	Improve the access to financing	2.8	3.2	3.1	3.2	2.5	3.5	2.8	2.6	**3.0**	**Neither Agree nor Disagree**
4.5	Improve the access to financing	2.9	3.7	3.4	3.3	3.2	3.4	2.6	3.1	**3.2**	**Neither Agree nor Disagree**
Q5	**I expect the autonomous shipping will be a viable option for the following shipping sectors**	**4.6**	**4.7**	**4.4**	**4.3**	**4.5**	**4.3**	**3.7**	**3.6**	**4.4**	**Neither Agree nor Disagree**
	Ocean-going vessels | Short-sea shipping | Inland shipping | Working ships (tugs, dredgers) | Cruisers										
5.1	Ocean-going vessels	5.4	5.3	5.1	4.5	5.1	5.1	3.9	3.3	**4.9**	**Somewhat Agree**
5.2	Short-sea shipping	5.3	5.0	5.4	5.1	5.4	4.9	4.3	4.6	**5.1**	**Somewhat Agree**
5.3	Inland shipping	5.1	5.0	4.5	5.0	4.4	5.0	3.7	5.0	**4.8**	**Somewhat Agree**
5.4	Working ships (tugs, dredgers)	3.6	4.4	3.5	3.6	3.7	4.0	3.4	2.4	**3.7**	**Neither Agree nor Disagree**
5.5	Cruisers	3.4	4.0	3.6	3.4	3.7	2.5	3.1	2.5	**3.3**	**Somewhat Disagree**
Q6	**The transition to autonomous shipping will:**	**3.6**	**3.5**	**3.6**	**3.7**	**3.7**	**3.9**	**2.9**	**3.7**	**3.6**	**Agree**
	Solve the deficit of seafarers | Improve the quality of life for the employees in the shipping sector | Require the modification of the current training framework for seafarers | Result in the loss of the existing knowledge, skills and experience of seafarers | Contribute to the transportation modal shift | Render the use of smaller ships more attractive										

#	QUESTIONS	STAKEHOLDERS MEAN									
		Designers Builders Technology Providers	Environmentalists Professional Societies International Organisations	Legal Advisors Technical Advisors	Owners Operators	Public	Regulators Flag States Port Authorities	Seafarers	Research Institutions Academia	ALL	Characterisation
6.1	Solve the deficit of seafarers	3.5	3.3	3.6	3.8	3.5	3.7	2.5	3.4	**3.4**	**Neither Agree nor Disagree**
6.2	Improve the quality of life for the employees in the shipping sector	3.3	3.5	3.8	3.7	3.6	3.6	2.5	3.6	**3.5**	**Agree**
6.3	Require the modification of the current training framework for seafarers	4.3	4.2	4.0	4.4	4.3	4.4	3.5	4.3	**4.2**	**Agree**
6.4	Result in the loss of the existing knowledge, skills and experience of seafarers	3.6	3.7	3.0	3.3	3.3	3.2	3.2	3.9	**3.3**	**Neither Agree nor Disagree**
6.5	Contribute to the transportation modal shift	3.6	3.0	3.3	3.6	3.5	3.9	2.7	3.5	**3.5**	**Agree**
6.6	Render the use of smaller ships more attractive	3.2	3.5	4.1	3.7	4.2	4.4	2.9	3.5	**3.7**	**Agree**
	Impact of the following barriers to the autonomous shipping transition:										
Q7	Regulatory barriers | Technological limitations | Social limitations | Safety and security issues | Economical barriers	**3.6**	**3.6**	**3.4**	**3.5**	**3.7**	**3.7**	**3.7**	**3.9**	**3.6**	**Moderate Effect**
7.1	Regulatory barriers	4.2	3.9	4.4	4.2	4.1	4.6	3.3	4.5	**4.1**	**Moderate Effect**
7.2	Technological limitations	3.3	3.7	2.8	3.6	3.8	3.1	3.7	3.8	**3.4**	**Neutral**
7.3	Social limitations	3.6	3.6	2.9	3.3	3.5	3.9	3.9	3.8	**3.5**	**Moderate Effect**
7.4	Safety and security issues	3.8	3.7	4.1	3.4	3.7	4.1	3.8	4.1	**3.8**	**Moderate Effect**
7.5	Economic barriers	3.1	3.0	2.7	3.1	3.5	3.0	3.6	3.5	**3.2**	**Neutral**

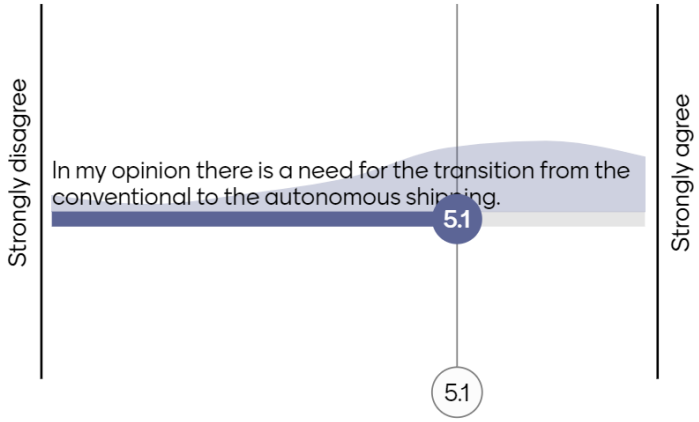
#	QUESTIONS	STAKEHOLDERS MEAN									
		Designers Builders Technology Providers	Environmentalists Professional Societies International Organisations	Legal Advisors Technical Advisors	Owners Operators	Public	Regulators Flag States Port Authorities	Seafarers	Research Institutions Academia	ALL	Characterisation
	The challenges for the development of autonomous shipping										
Q8	Investment cost | Operational costs | Lack of regulations | Political issues | Technology maturity | Lack of qualified workforce	**3.6**	**3.7**	**2.9**	**3.5**	**3.2**	**3.7**	**3.3**	**3.5**	**3.4**	**Neither Agree nor Disagree**
8.1	Investment cost	3.9	4.2	3.4	4.1	3.3	4.1	3.6	2.6	**3.8**	**Agree**
8.2	Operational costs	3.2	3.5	2.1	3.2	2.9	3.3	3.3	2.6	**3.0**	**Neither Agree nor Disagree**
8.3	Lack of regulations	4.2	4.2	4.3	4.1	3.4	4.1	3.5	4.0	**4.0**	**Agree**
8.4	Political issues	3.7	3.4	3.0	3.3	2.8	3.4	2.8	4.0	**3.3**	**Neither Agree nor Disagree**
8.5	Technology maturity	3.0	3.2	2.7	3.3	3.5	3.3	3.1	3.9	**3.2**	**Neither Agree nor Disagree**
8.6	Lack of qualified workforce	3.4	3.5	2.0	3.2	3.3	3.8	3.3	3.6	**3.3**	**Neither Agree nor Disagree**
	Technical limitations as the biggest challenge when designing and operating autonomous ships										
Q9	Autonomous navigation | Communication with the ship | Remote Control Centres | There are no procedures for testing, verification and validation | Ship reliability and maintenance/repair requirements, especially during long voyages	**5.1**	**4.9**	**4.8**	**4.7**	**4.7**	**5.5**	**5.3**	**5.2**	**4.9**	**Somewhat Agree**
9.1	Autonomous navigation	5.1	5.6	4.1	4.1	5.3	5.1	4.7	5.0	**4.8**	**Somewhat Agree**
9.2	Communication with the ship	5.9	4.9	5.2	5.2	4.4	6.0	5.1	5.1	**5.2**	**Somewhat Agree**
9.3	Remote Control Centres	5.0	4.9	3.9	5.0	4.3	5.7	5.9	4.4	**4.9**	**Somewhat Agree**

APPENDIX D – (SURVEY NO. 1) MEAN DIAGRAMS PER QUESTION

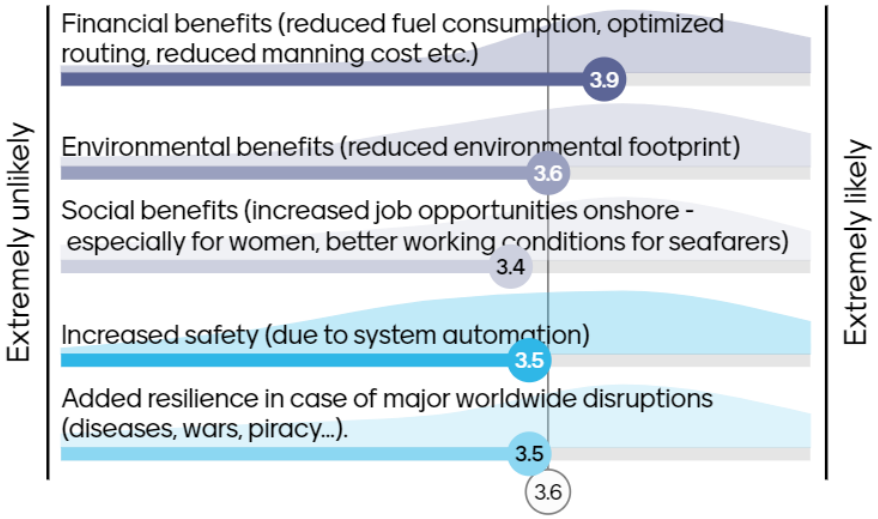
Q1 out of 10: Which of the following categories most closely matches your job title?



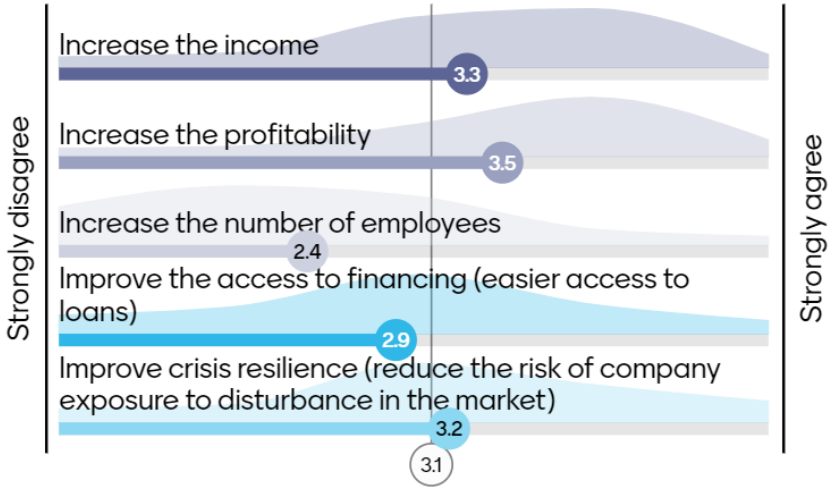
Q2 out of 10



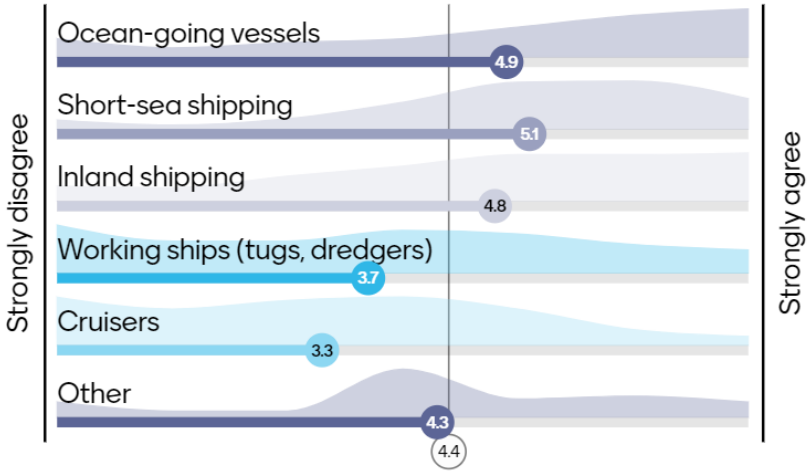
Q3 out of 10: Which would be the benefits from the transition to autonomous shipping?



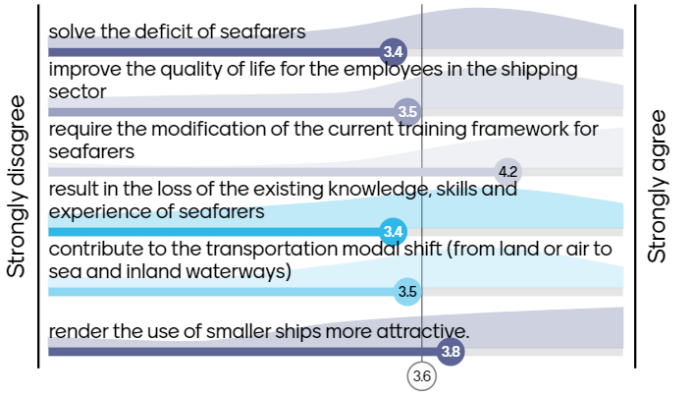
Q4 out of 10: How would the transition to autonomous shipping impact the shipping industry?



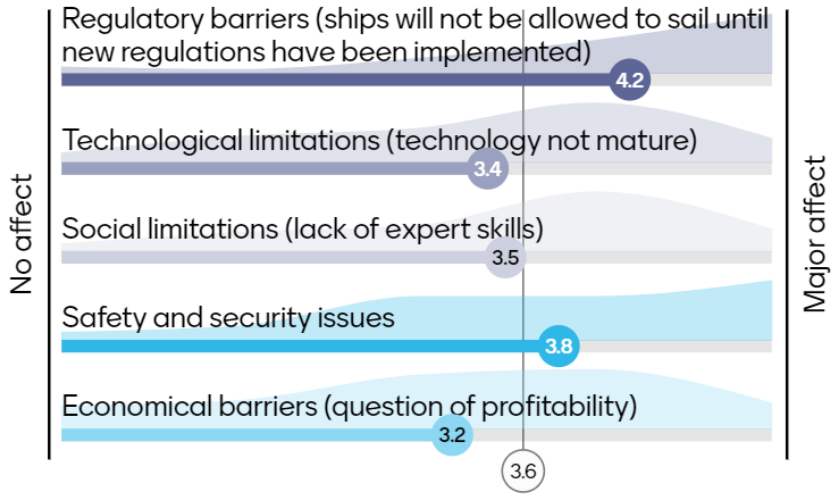
Q5 out of 10: I expect the autonomous shipping will be a viable option for the following shipping sectors:



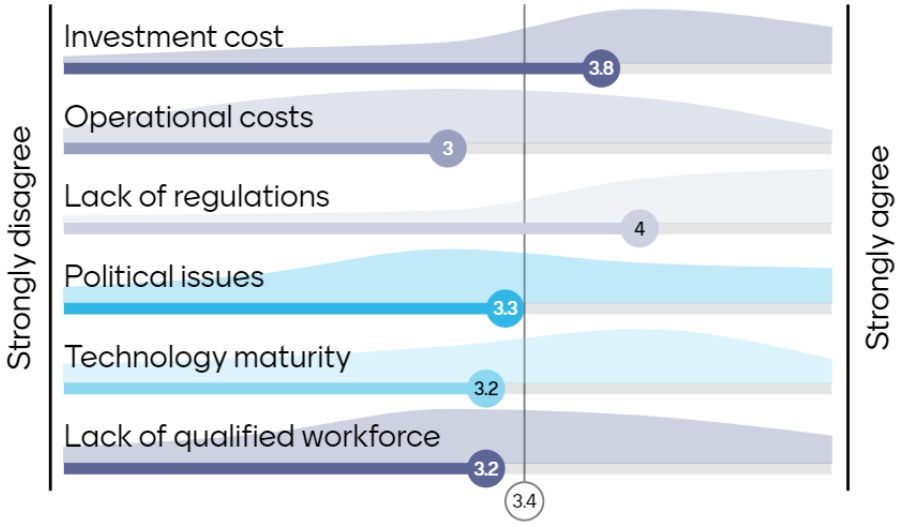
Q6 out of 10: The transition to autonomous shipping will:



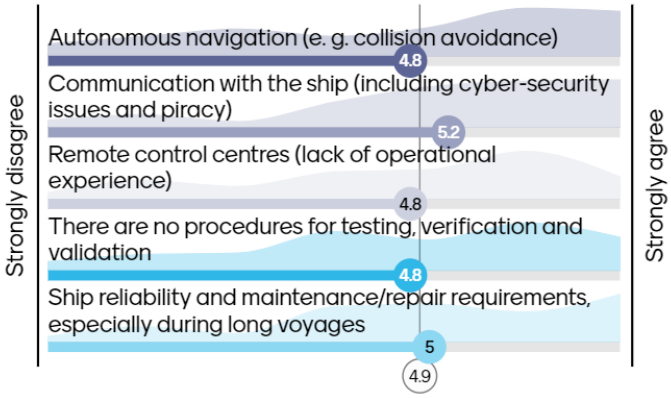
Q7 out of 10: Please assess the impact of the following barriers to the transition to autonomous shipping.



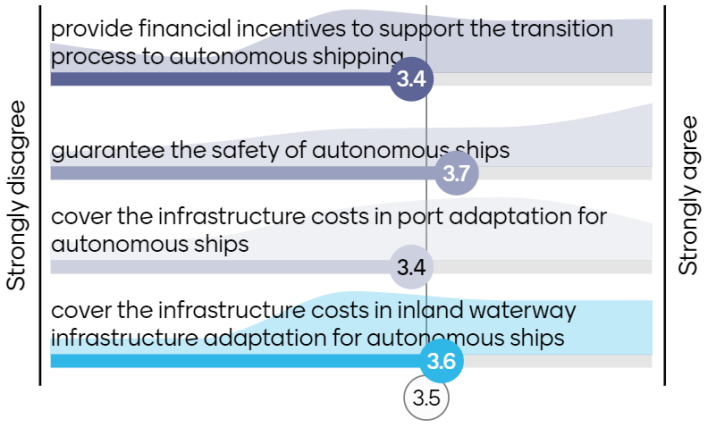
Q8 out of 10: What do you think which are the biggest challenges for the development of autonomous shipping?



Q9 out of 10: Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?

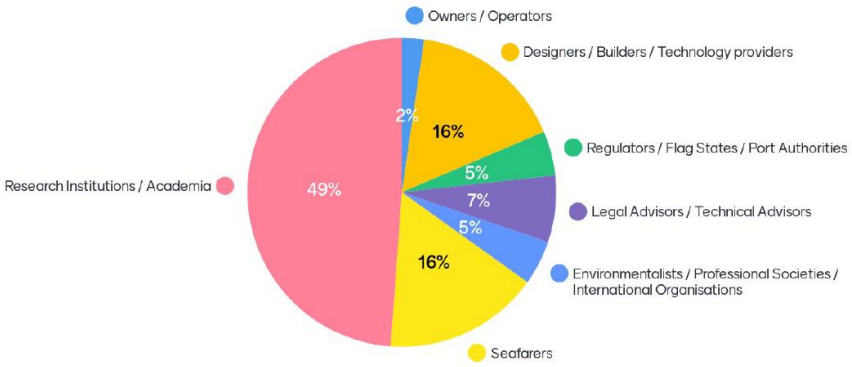


Q10 out of 10: The role of governments



APPENDIX E – (SURVEY NO. 2) MEAN DIAGRAMS PER-QUESTION

Q1a out of 10: Which of the following categories most closely matches your job title?

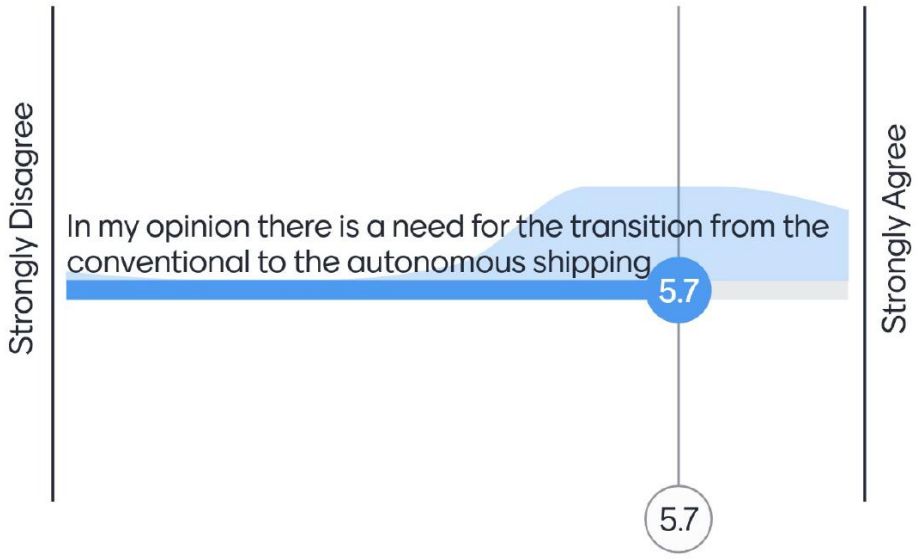


Q1b out of 10: Which is your exact job title?

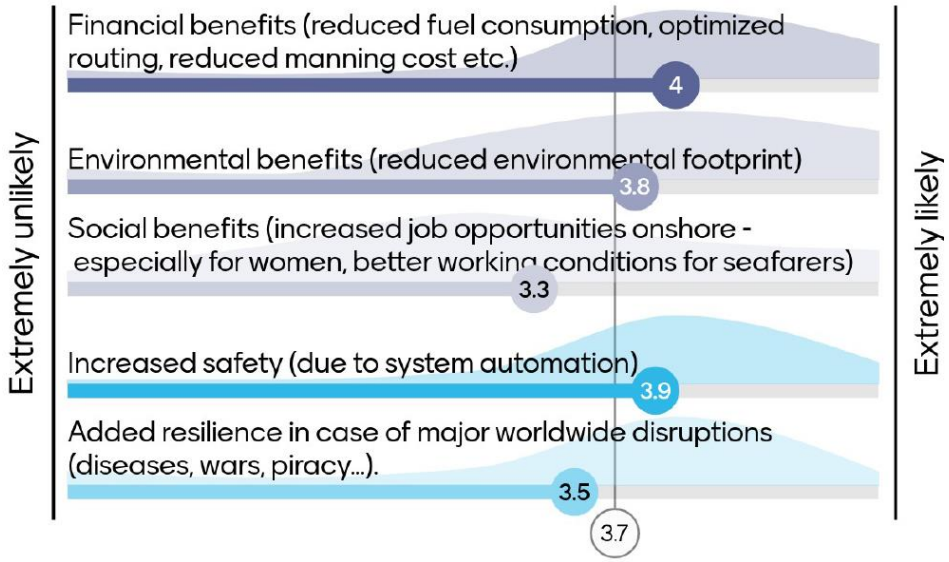
Academic	Academic	Research Assistant
Senior Scientist	Principal Senior Engineer	Postdoctoral Researcher
Professor- Maritime and Commercial Law	Postdoctoral researcher	PhD Student
Data scientist	CTO of automated shipping technology developer/provider company	R&D Manager
CEO	yes	Captain
Researcher	Unmanned Service Vessel Team Lead	Chief engineer

Project Engineer,Dual C.O.C Chief Mate &OOW Engineering	Manager Maritime Technology	Advisor International Maritime Regulations
Manager	Legal adviser/ practitioner	Special adviser
Legal Practitioner	SHIPBROKER	Senior Lecturer in the University
Business developer sustainable turism	Research Engineer	Researcher
2nd mate onboard RoRo ships. Currently studying Maritime management at Chalmers	Director	Researcher, PhD Candidate
Research Associate	Researcher	Marine engineer

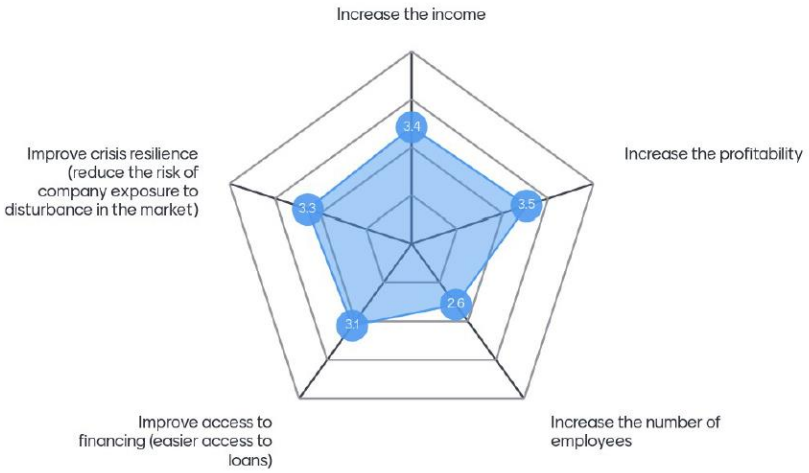
Q2 out of 10



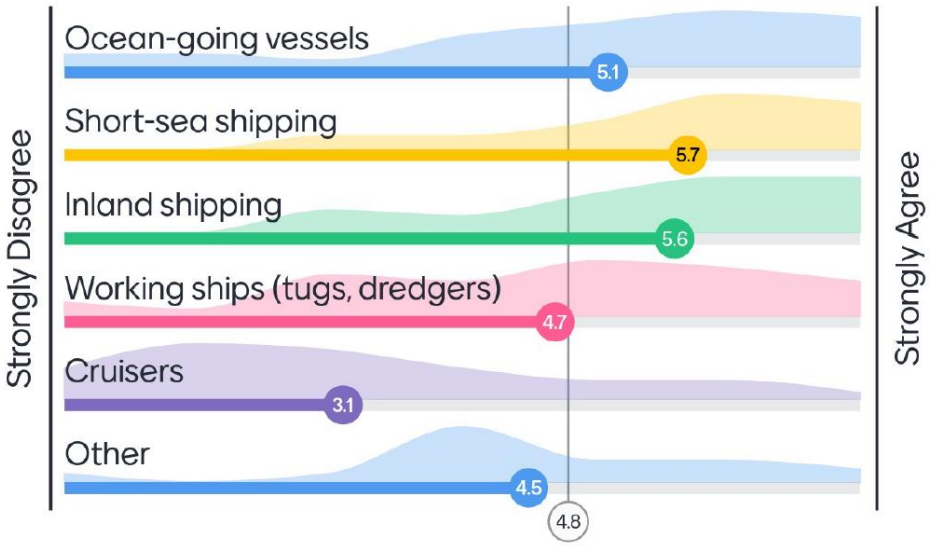
Q3 out of 10: Which would be the benefits from the transition to autonomous shipping?



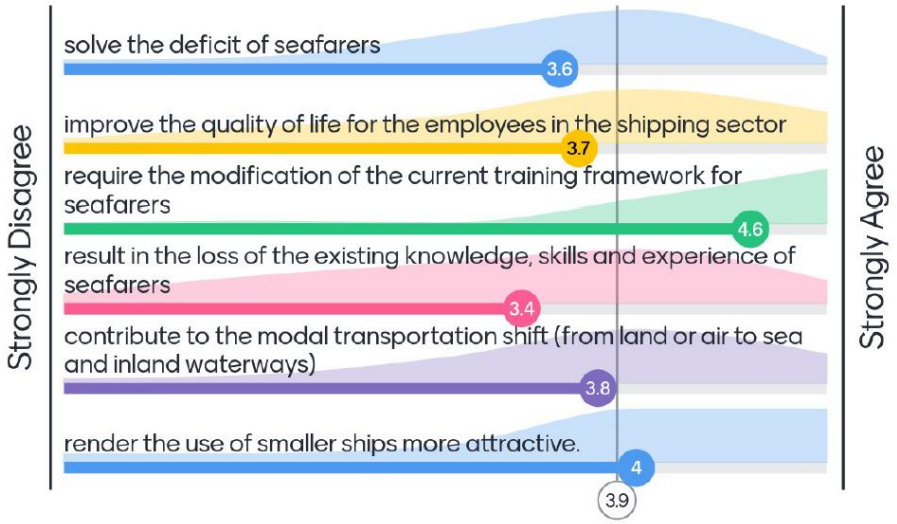
Q4 out of 10: How would the transition to autonomous shipping impact the shipping industry?



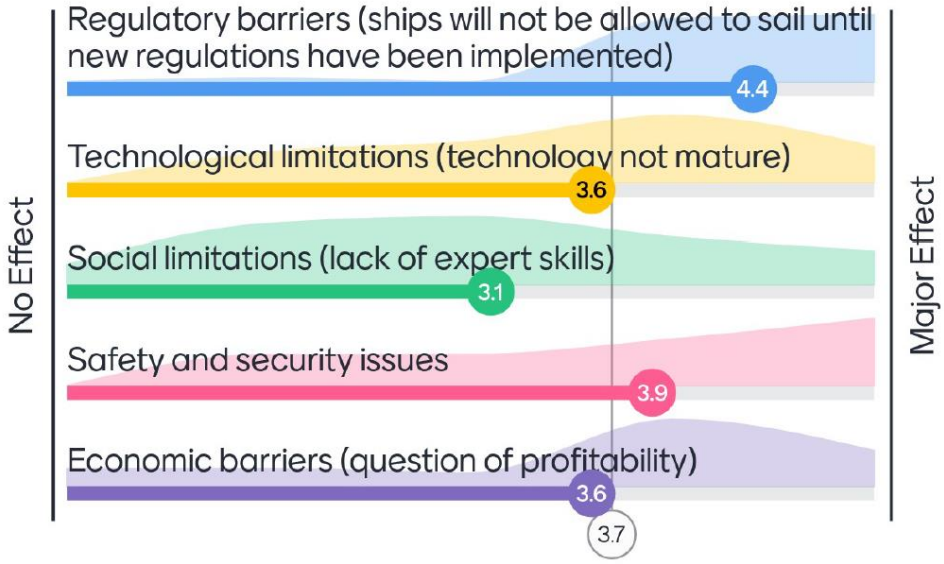
Q5 out of 10: I expect the autonomous shipping will be a viable option for the following shipping sectors:



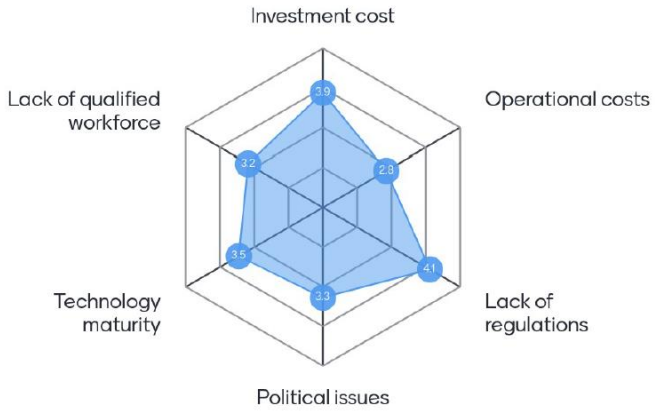
Q6 out of 10: The transition to autonomous shipping will:



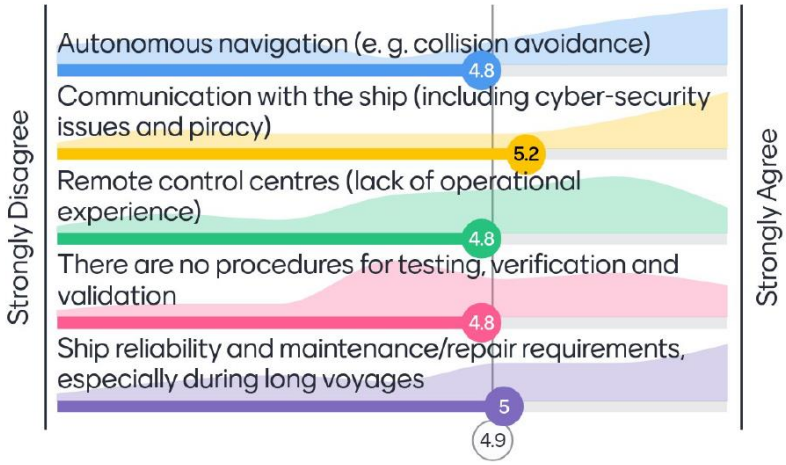
Q7 out of 10: Please assess the impact of the following barriers to the transition to autonomous shipping.



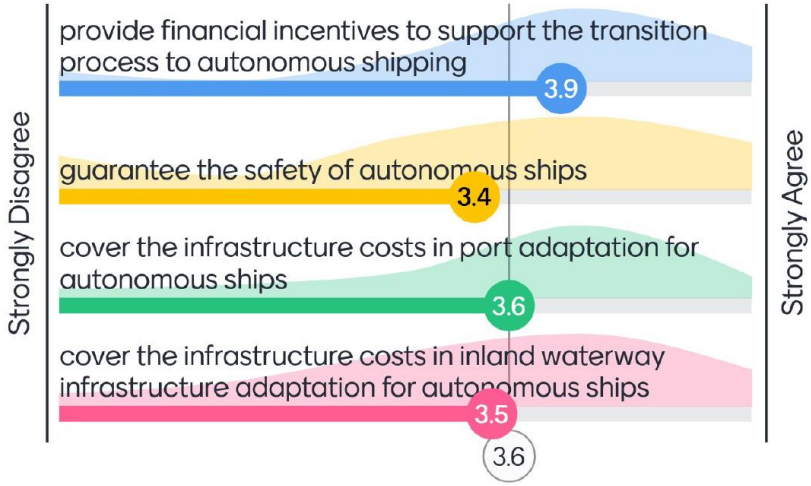
Q8 out of 10: What do you think which are the most significant challenges for the development of autonomous shipping?



Q9 out of 10: Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?

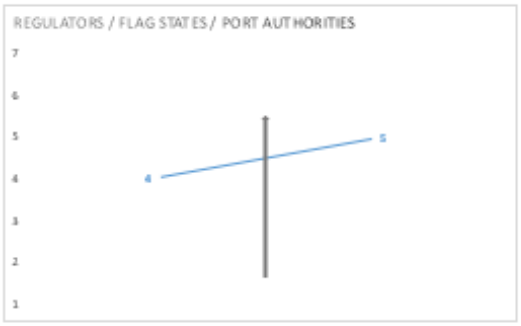


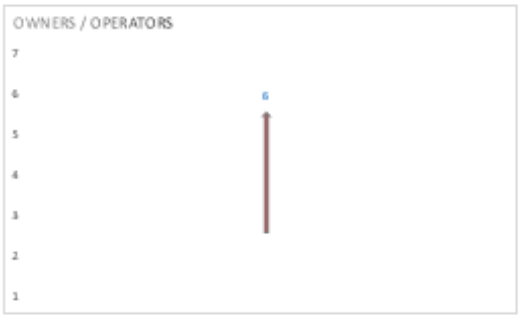
Q10 out of 10: The role of governments

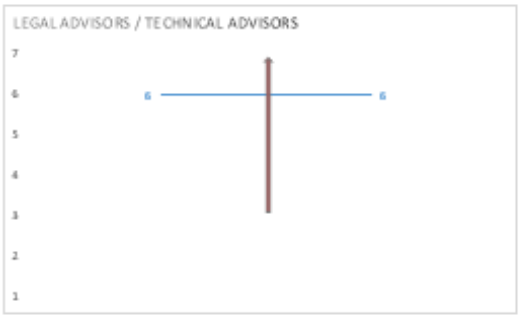


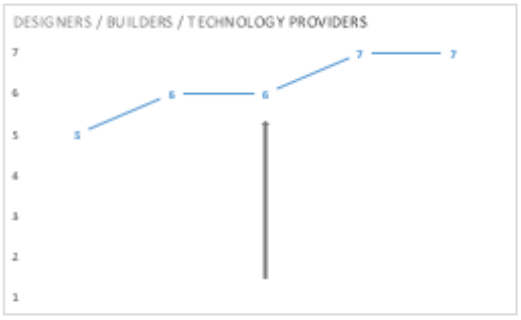
APPENDIX F – (SURVEY NO. 2) GROUP DIAGRAMS PER SUB-QUESTION

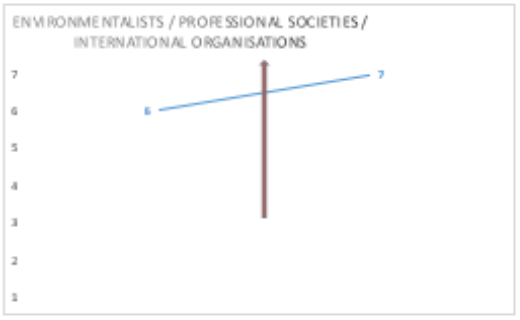
Q2 In my opinion there is a need for the transition from the conventional to the autonomous shipping

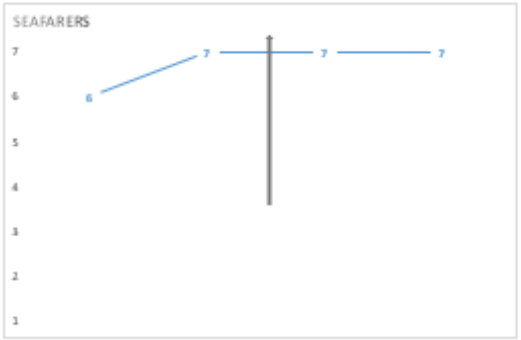




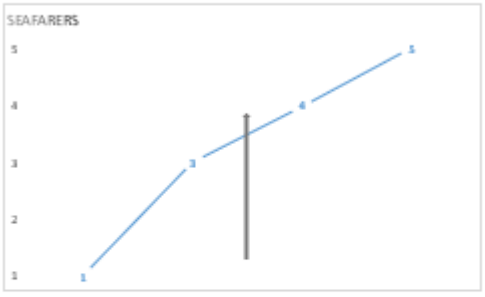


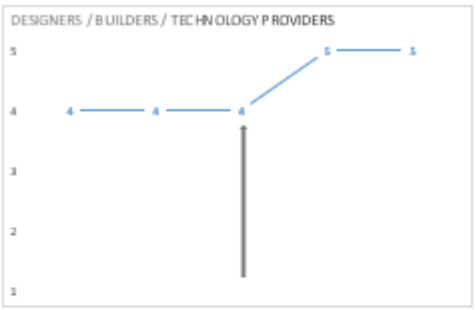


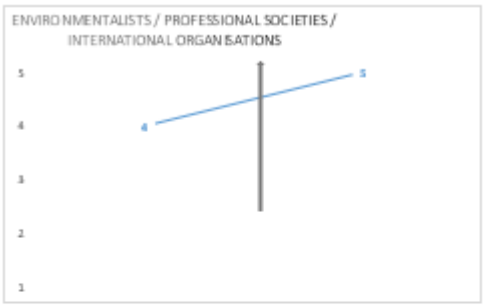


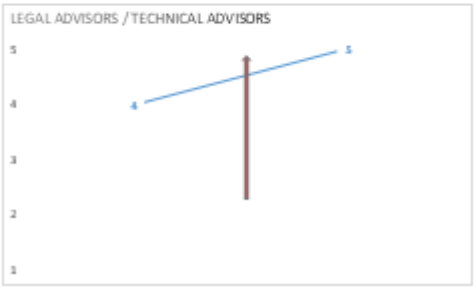


Q3.1 Which would be the benefits from the transition to autonomous shipping?: Financial benefits (reduced fuel consumption, optimized routing, reduced manning cost etc.)

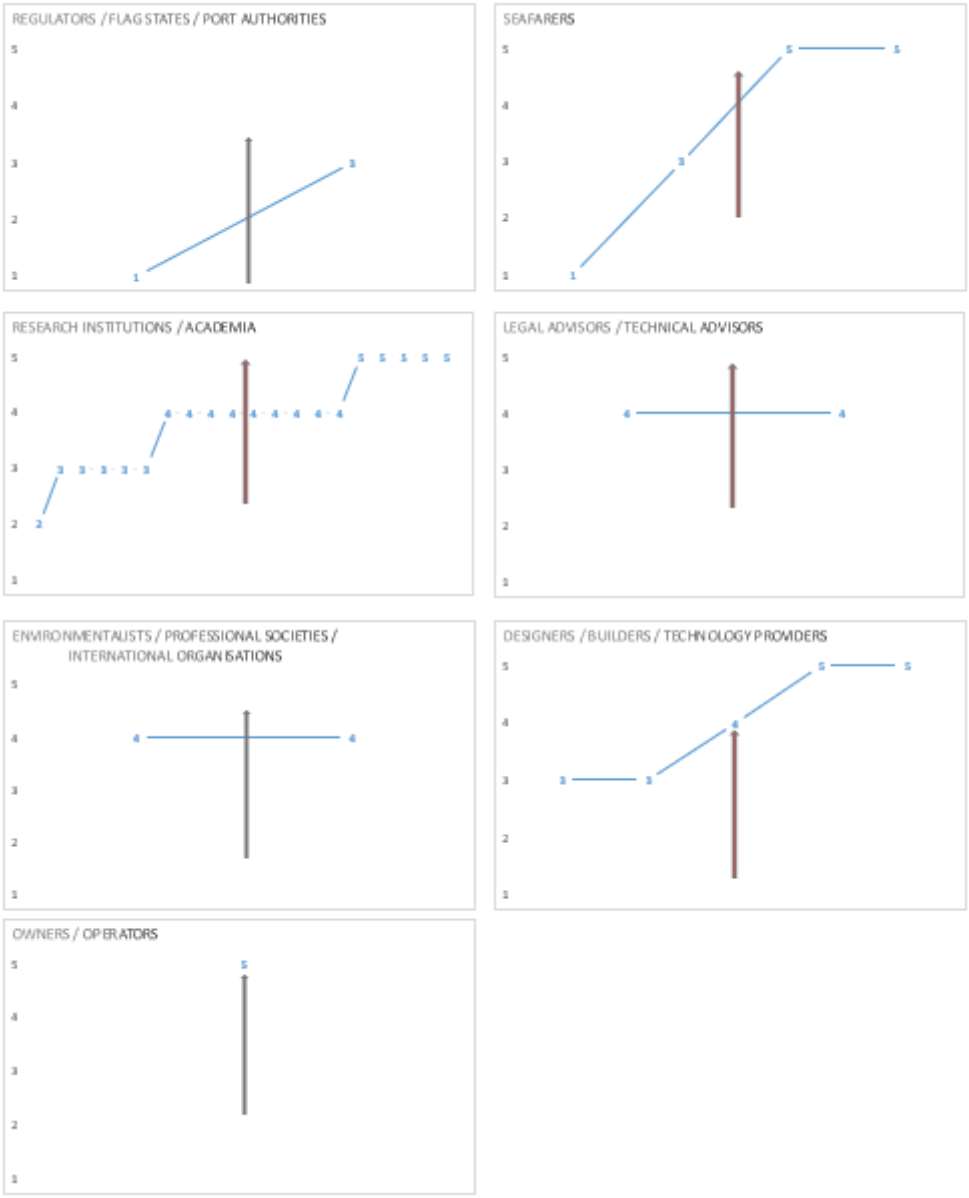




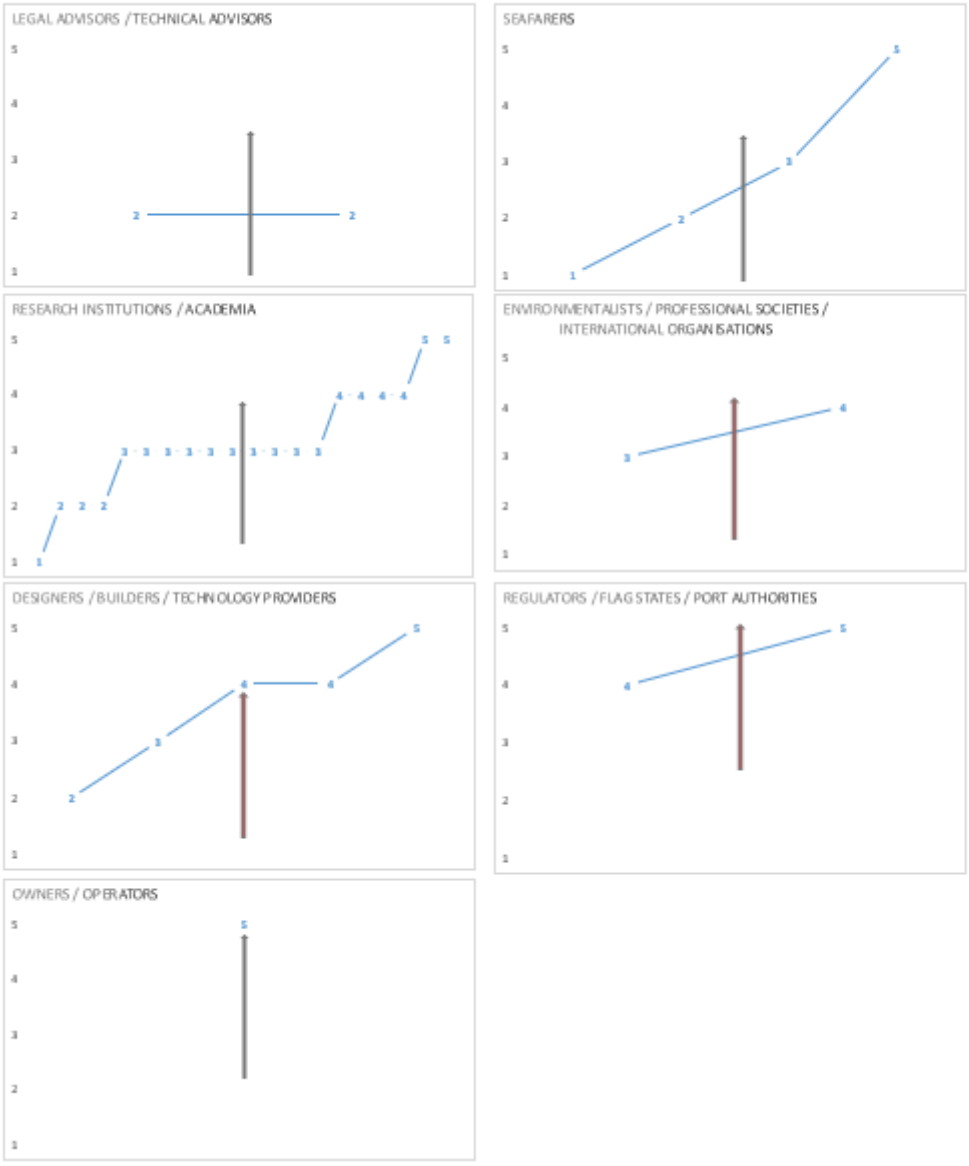




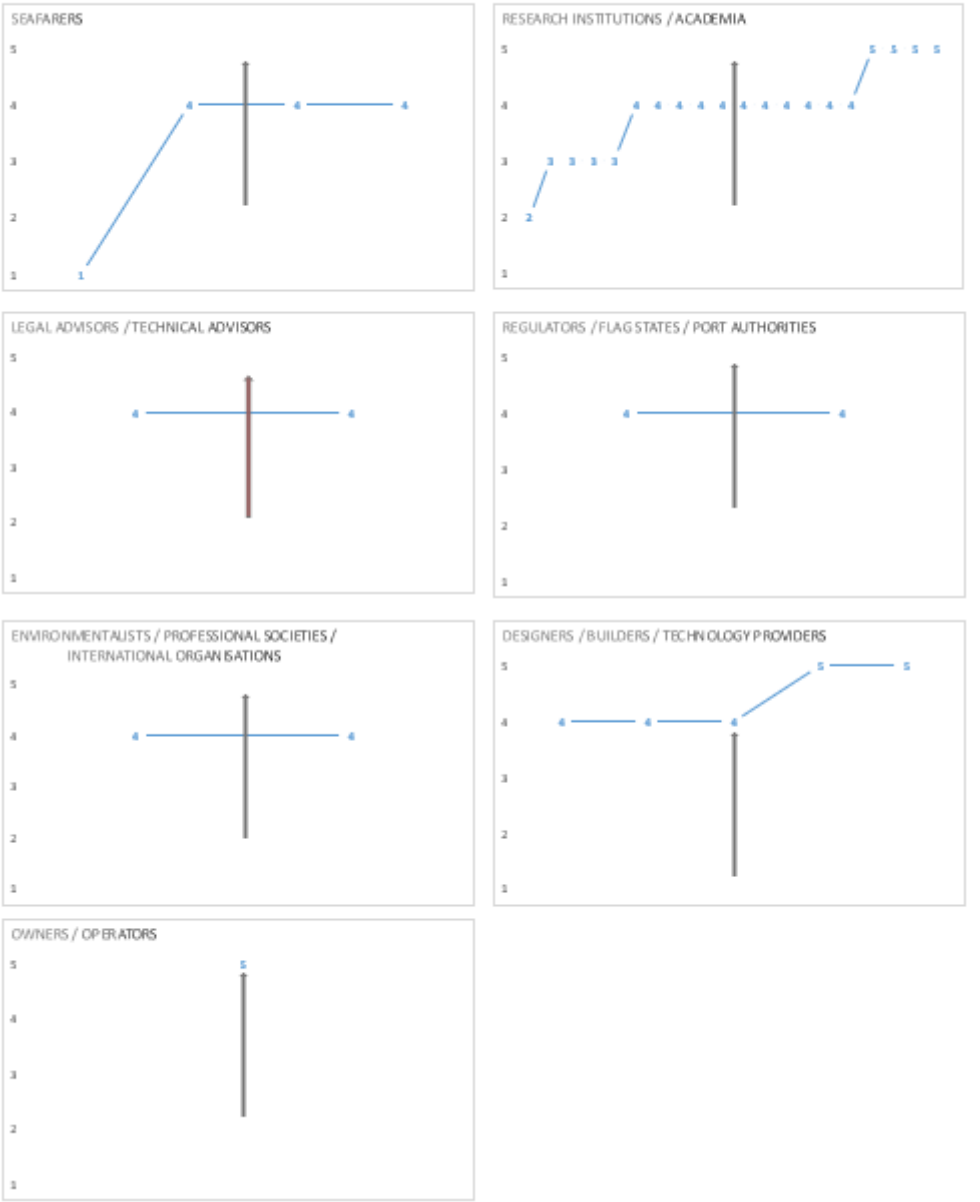
Q3.2 Which would be the benefits from the transition to autonomous shipping?: Environmental benefits (reduced environmental footprint)



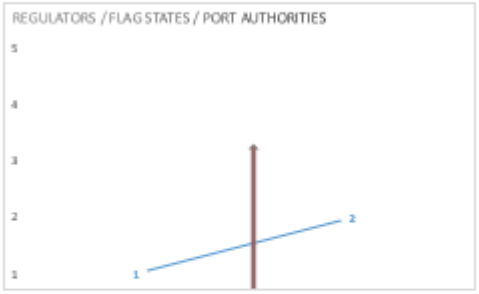
Q3.3 Which would be the benefits from the transition to autonomous shipping?: Social benefits (increased job opportunities onshore - especially for women, better working conditions for seafarers)

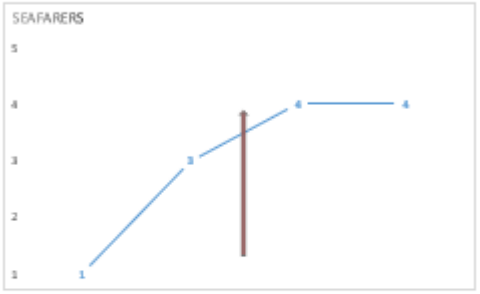


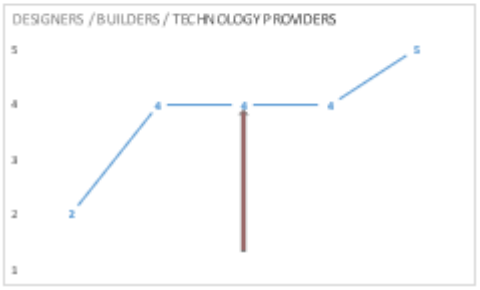
Q3.4 Which would be the benefits from the transition to autonomous shipping?: Increased safety (due to system automation)

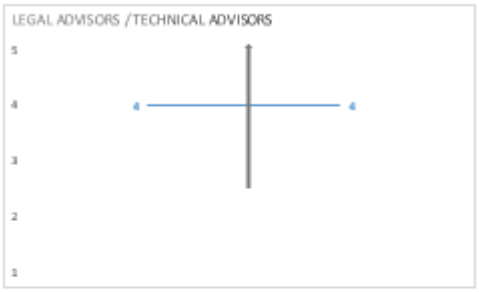


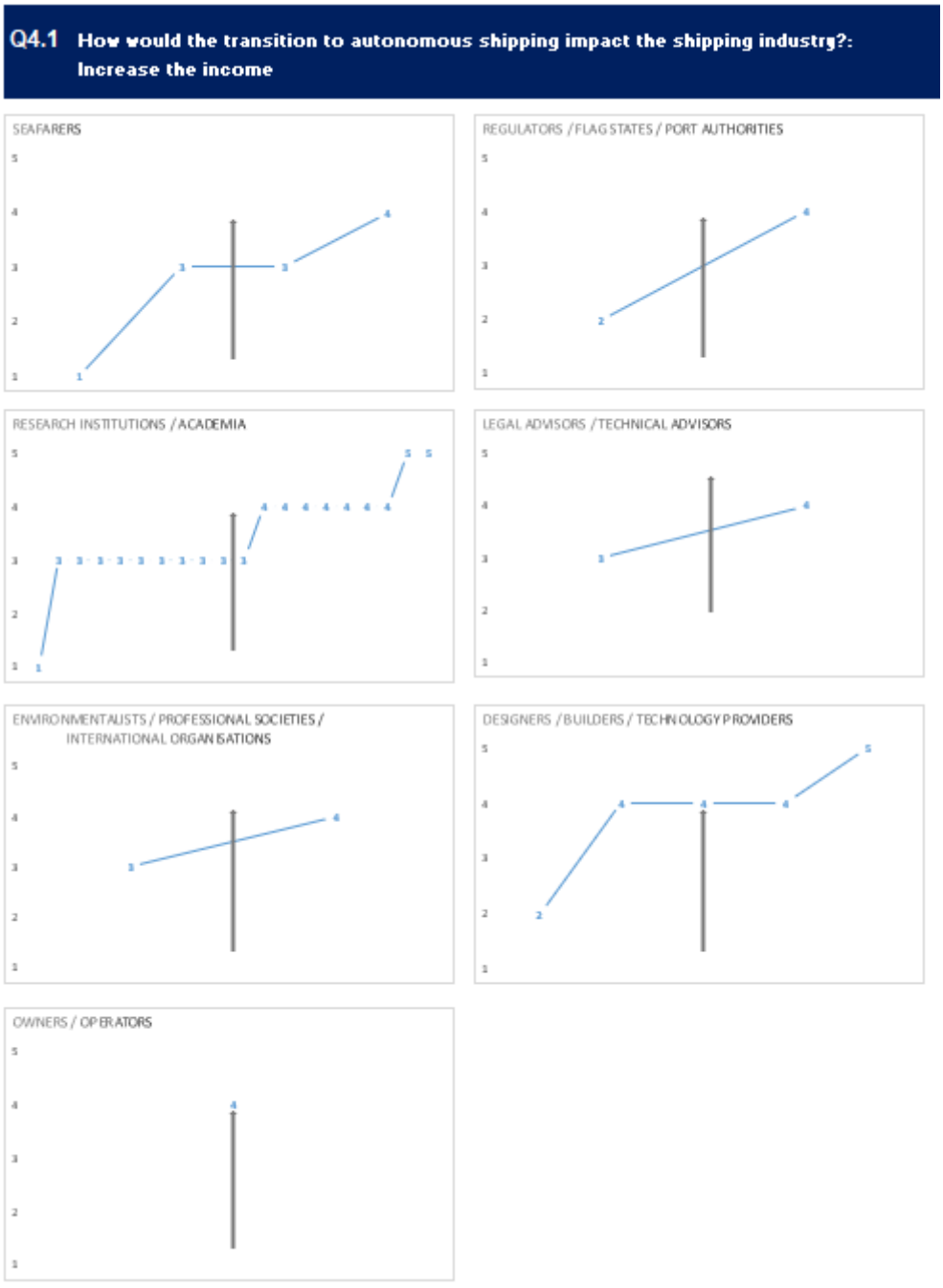
Q3.5 Which would be the benefits from the transition to autonomous shipping?: Added resilience in case of major worldwide disruptions (diseases, wars, piracy...)



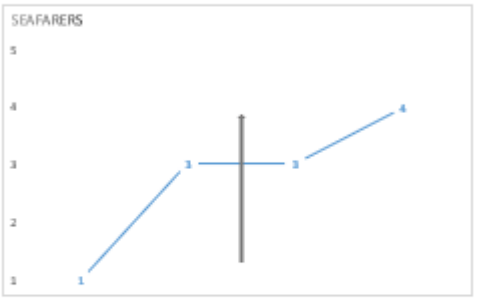


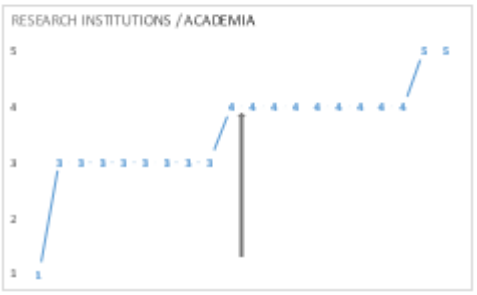


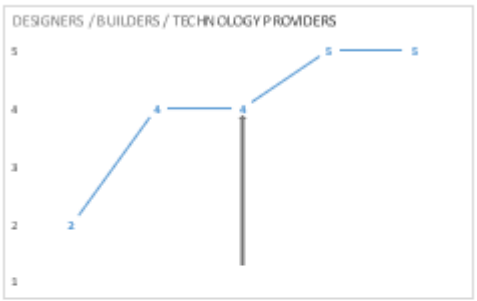


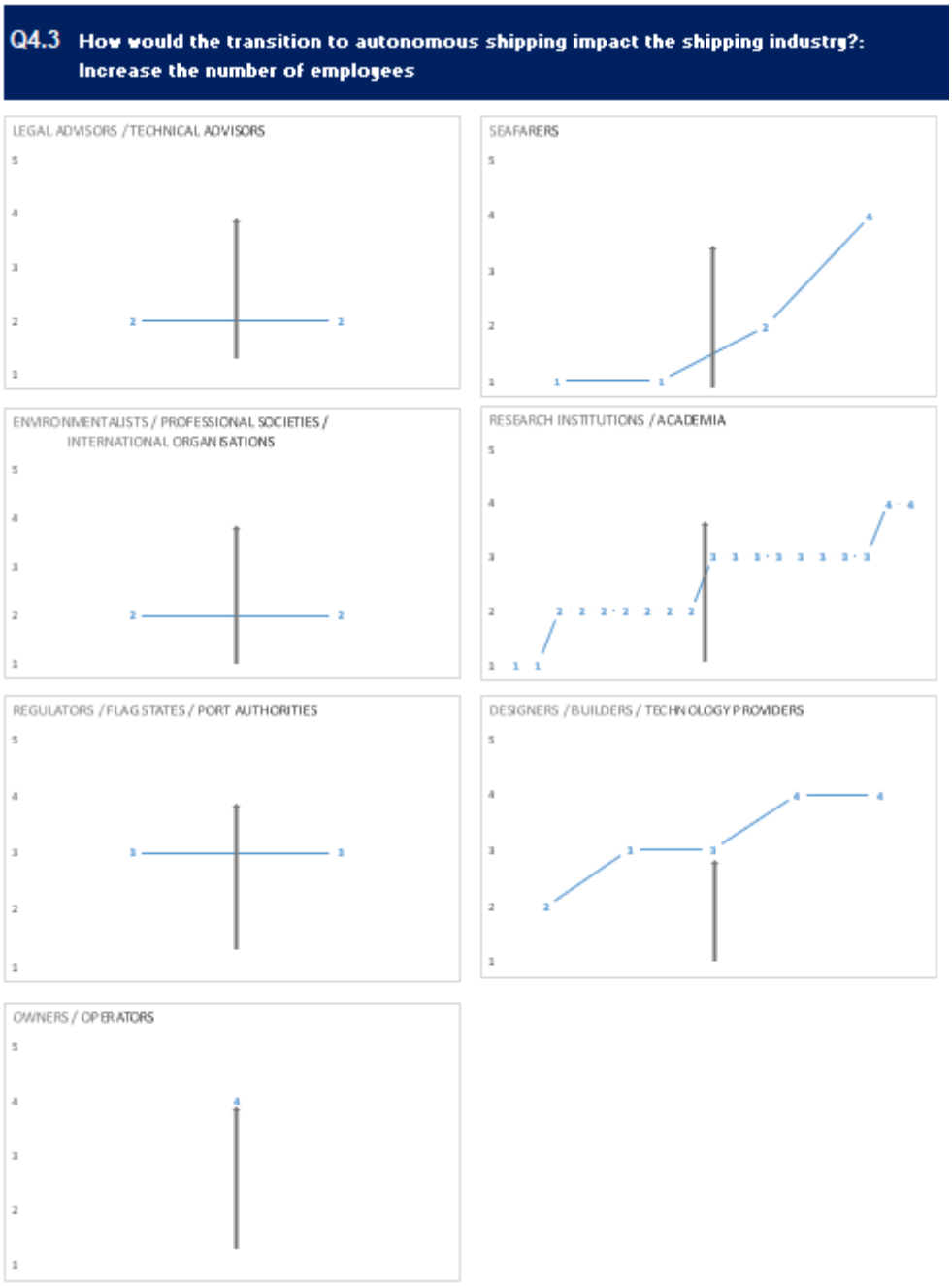

Q4.1 How would the transition to autonomous shipping impact the shipping industry?: Increase the income
SEAFARERS
REGULATORS / FLAG STATES / PORT AUTHORITIES
RESEARCH INSTITUTIONS / ACADEMIA
LEGAL ADVISORS / TECHNICAL ADVISORS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
OWNERS / OPERATORS

Q4.2 How would the transition to autonomous shipping impact the shipping industry?: Increase the profitability

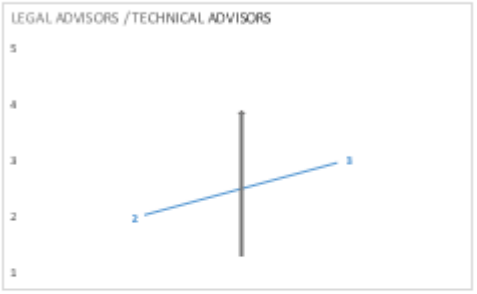


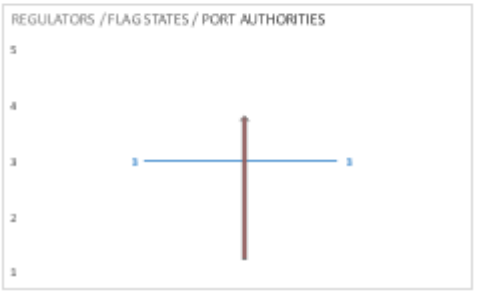


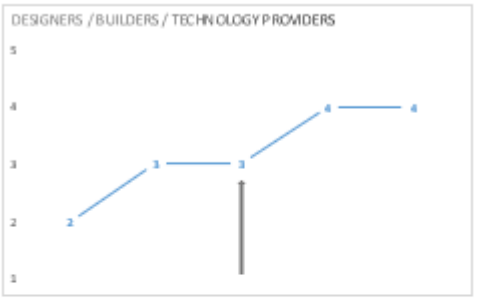


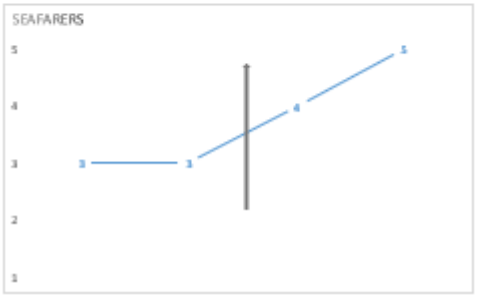

Q4.3 How would the transition to autonomous shipping impact the shipping industry?: Increase the number of employees
LEGAL ADVISORS / TECHNICAL ADVISORS
SEAFARERS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
RESEARCH INSTITUTIONS / ACADEMIA
REGULATORS / FLAG STATES / PORT AUTHORITIES
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
OWNERS / OPERATORS

Q4.4 How would the transition to autonomous shipping impact the shipping industry?: Improve the access to financing (easier access to loans)

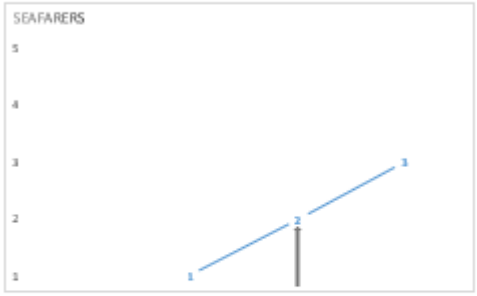


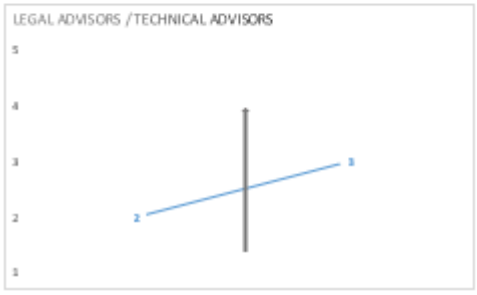


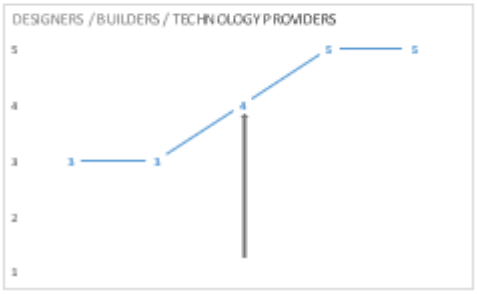




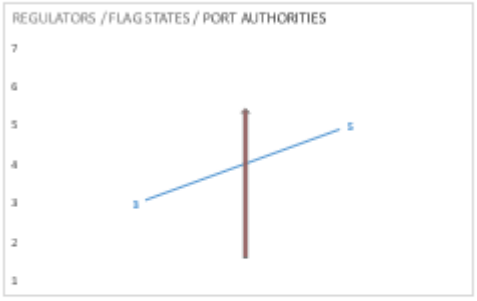
Q4.5 How would the transition to autonomous shipping impact the shipping industry?: Improve crisis resilience (reduce the risk of company exposure to disturbance in the market)

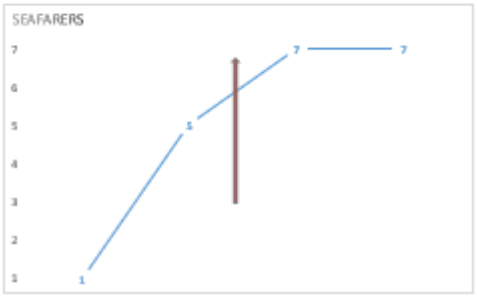


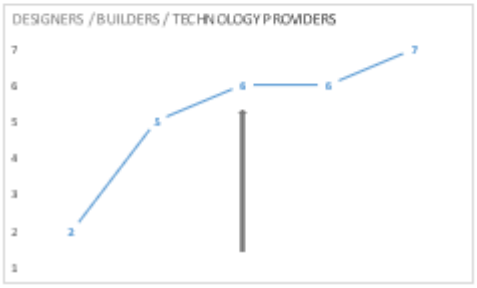


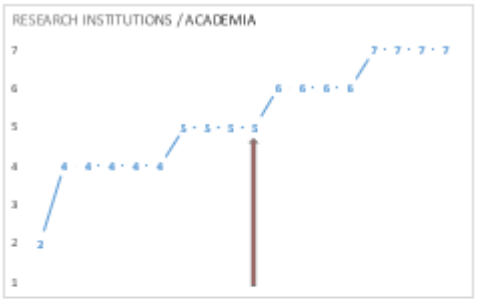


Q5.1 I expect the autonomous shipping will be a viable option for the following shipping sectors: Ocean-going vessels

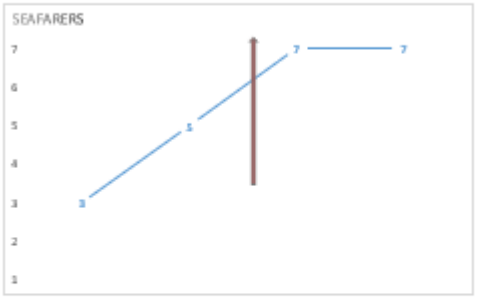


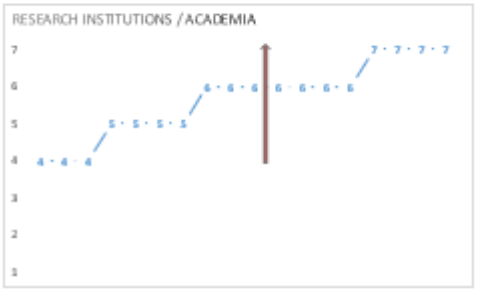


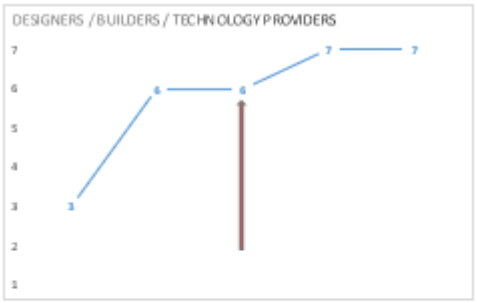


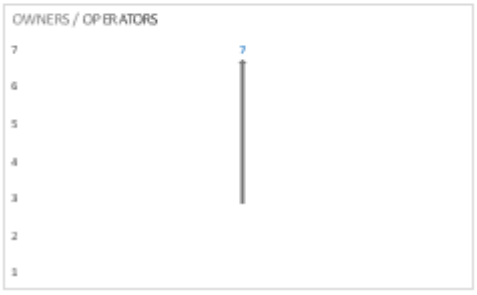


Q5.2 I expect the autonomous shipping will be a viable option for the following shipping sectors: Short-sea shipping

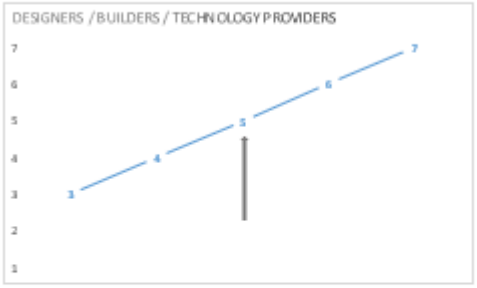


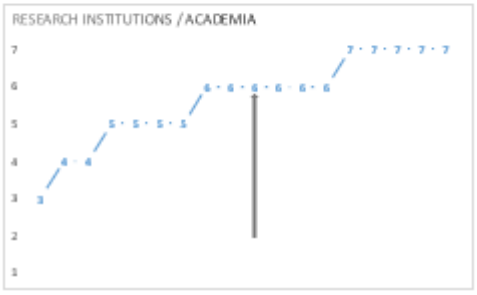




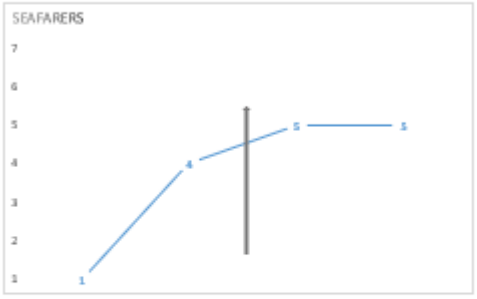


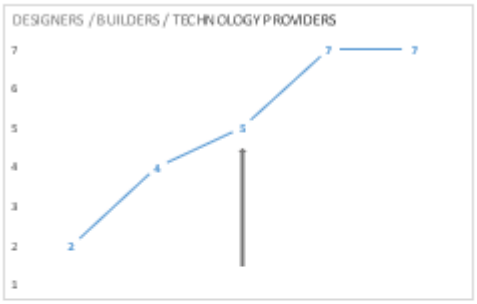
Q5.3 I expect the autonomous shipping will be a viable option for the following shipping sectors: Inland shipping

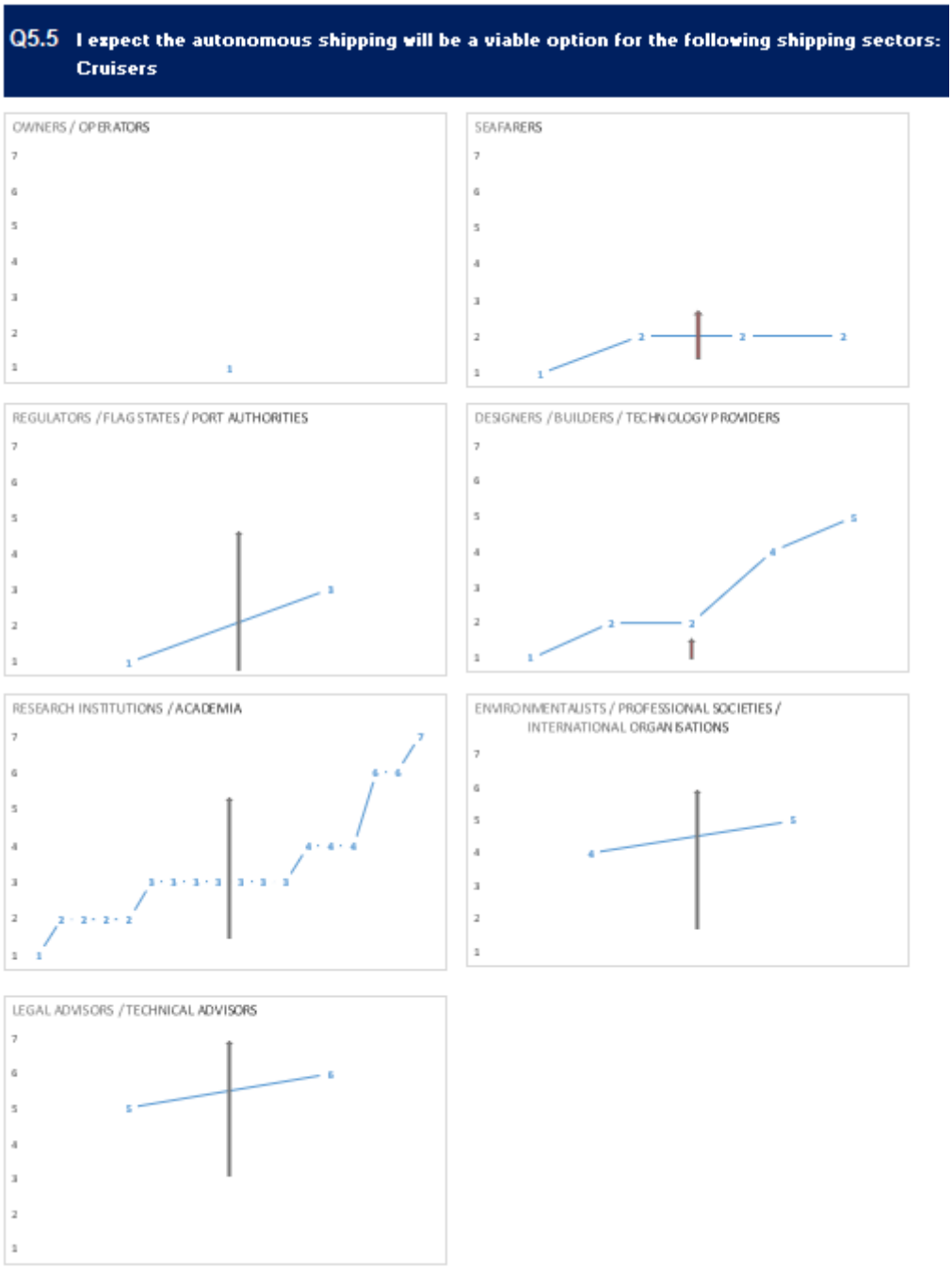


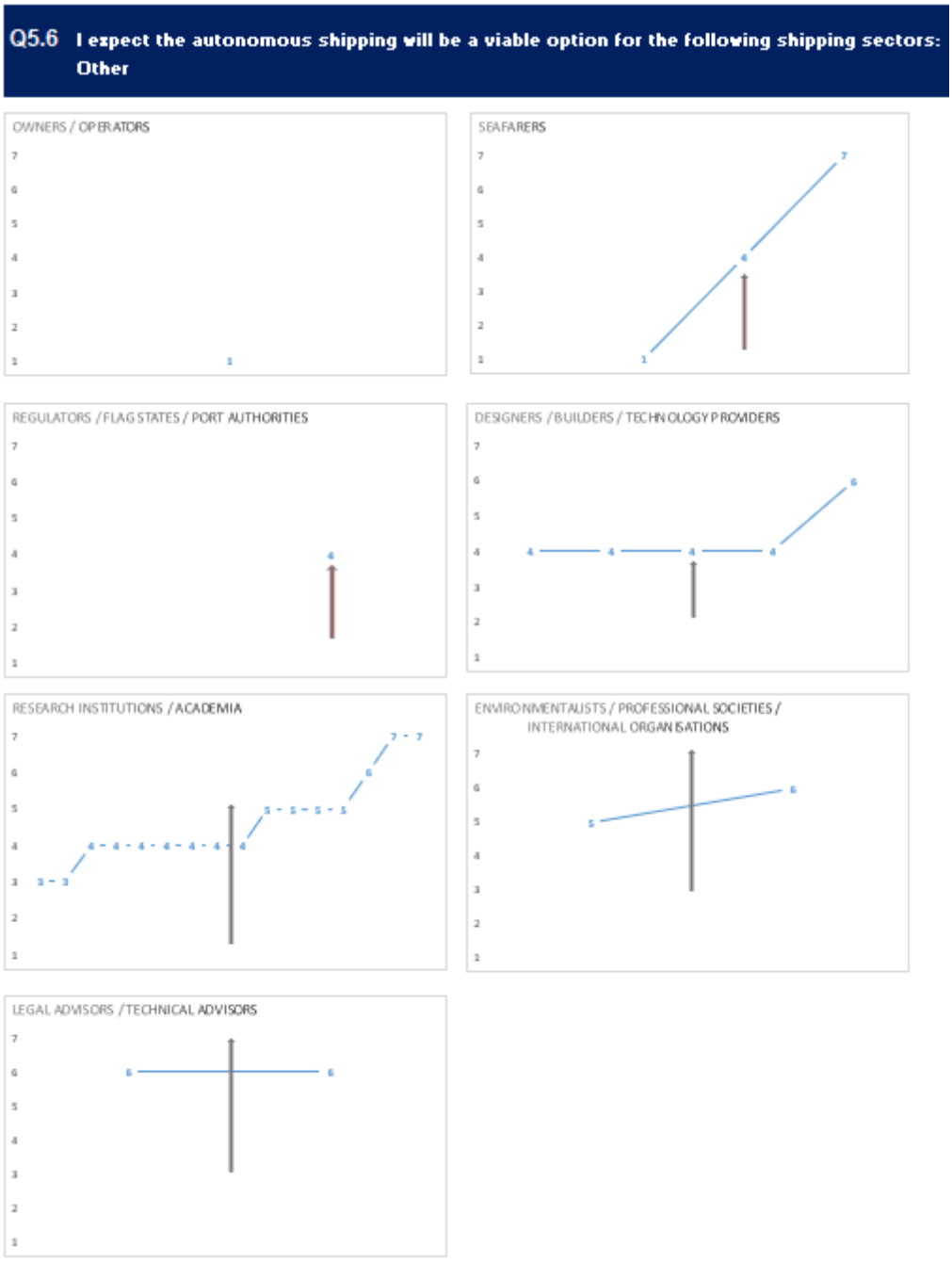


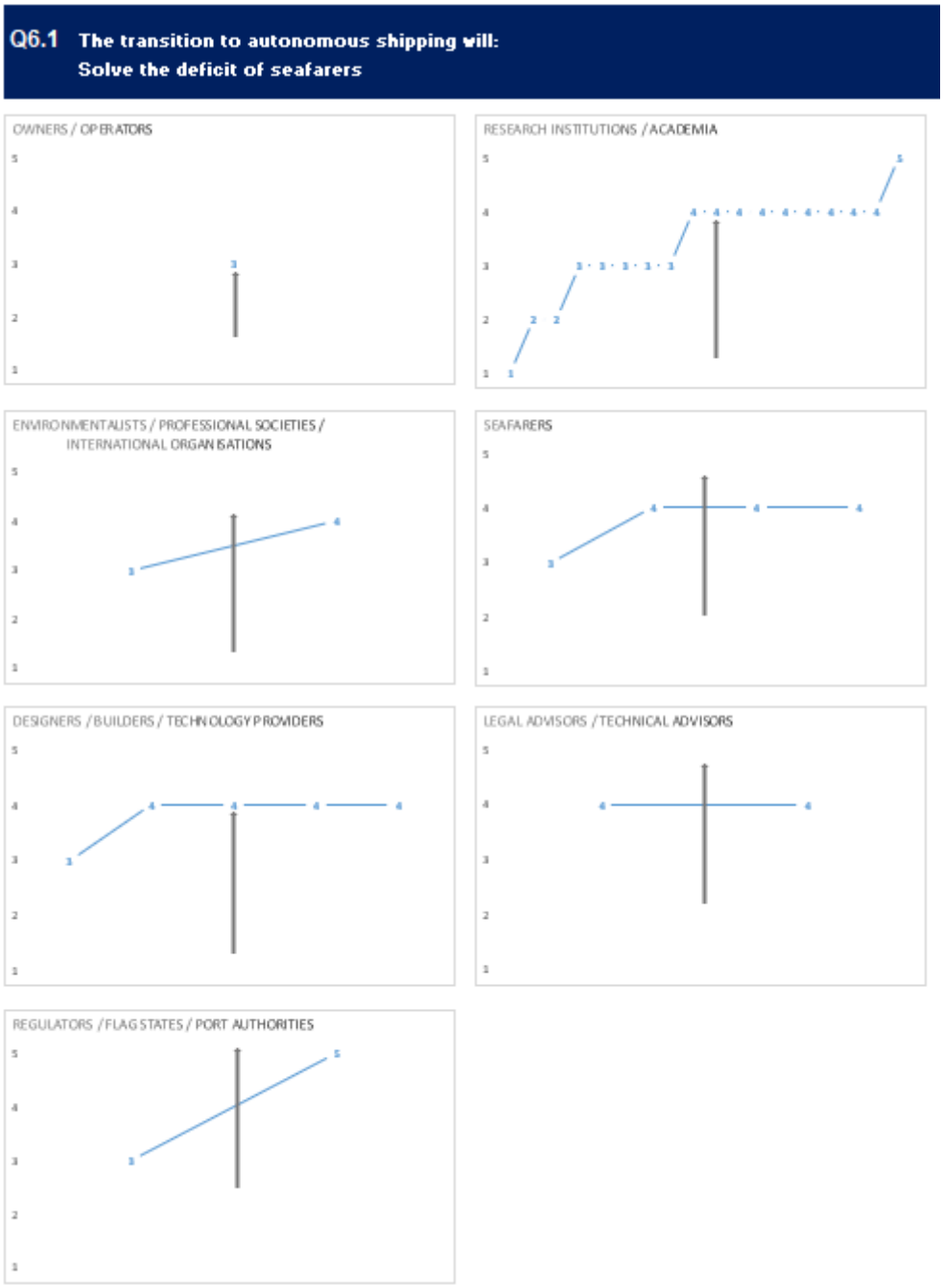
Q5.4 I expect the autonomous shipping will be a viable option for the following shipping sectors: Working ships (tugs, dredgers)

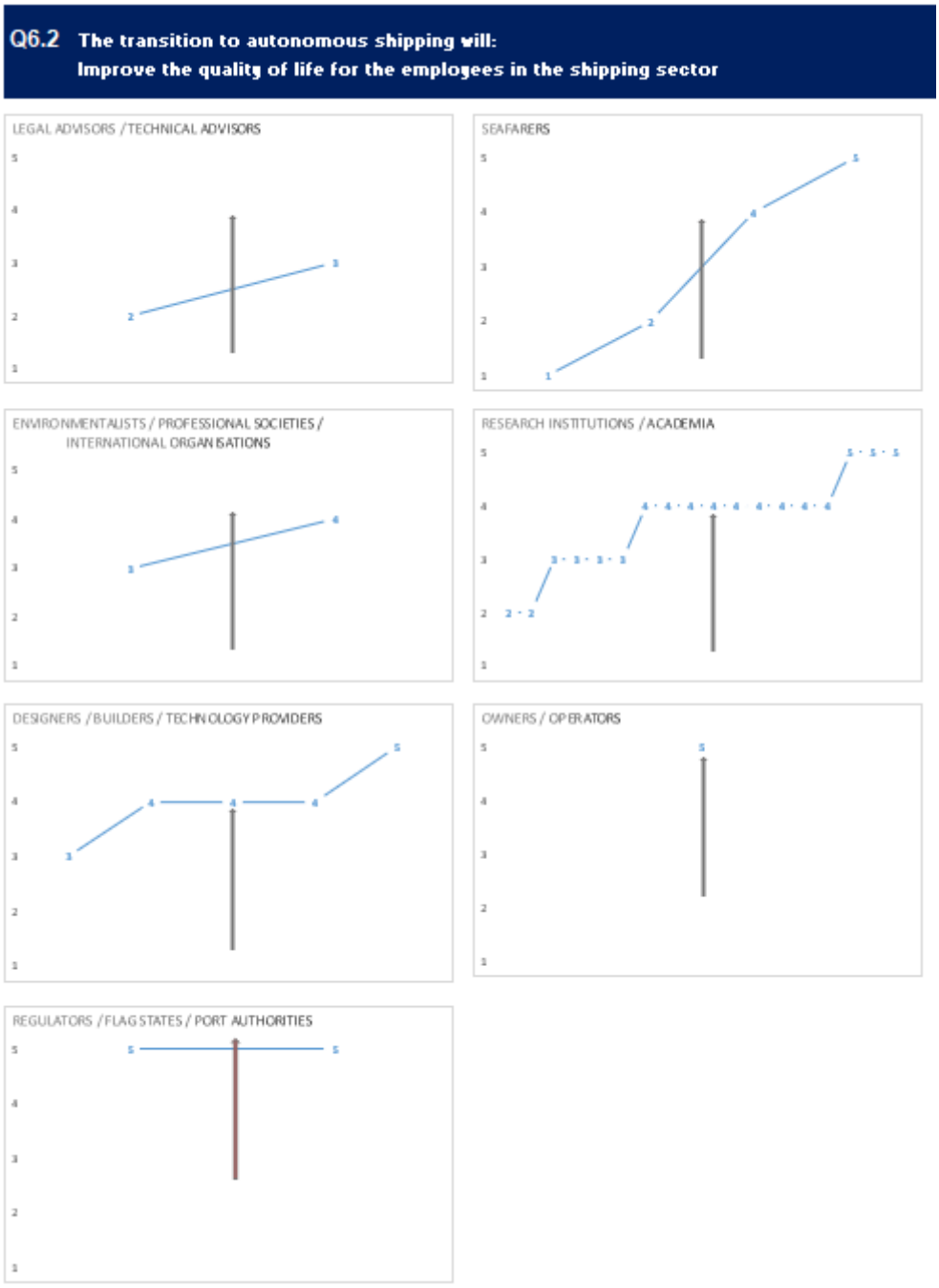


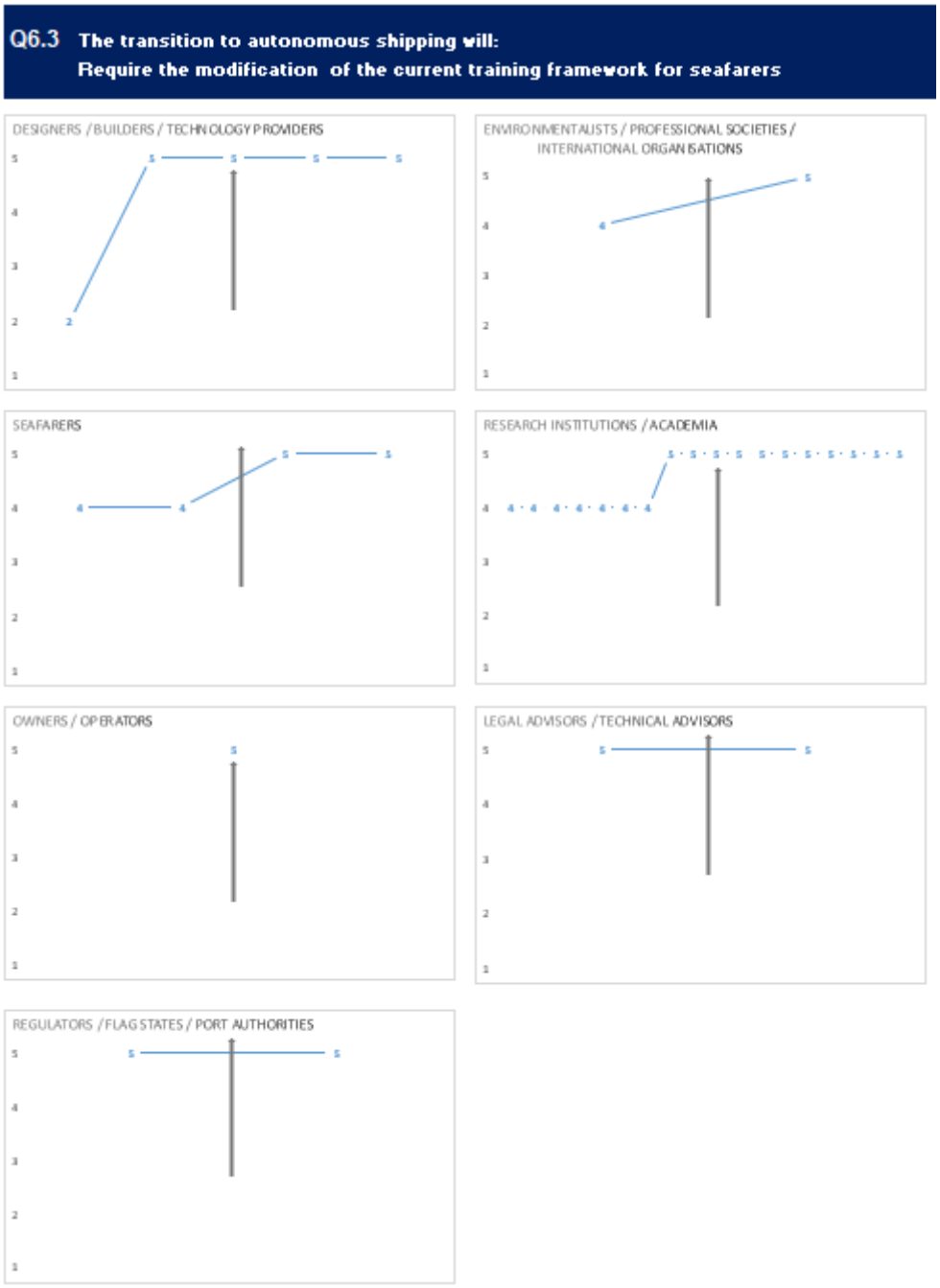


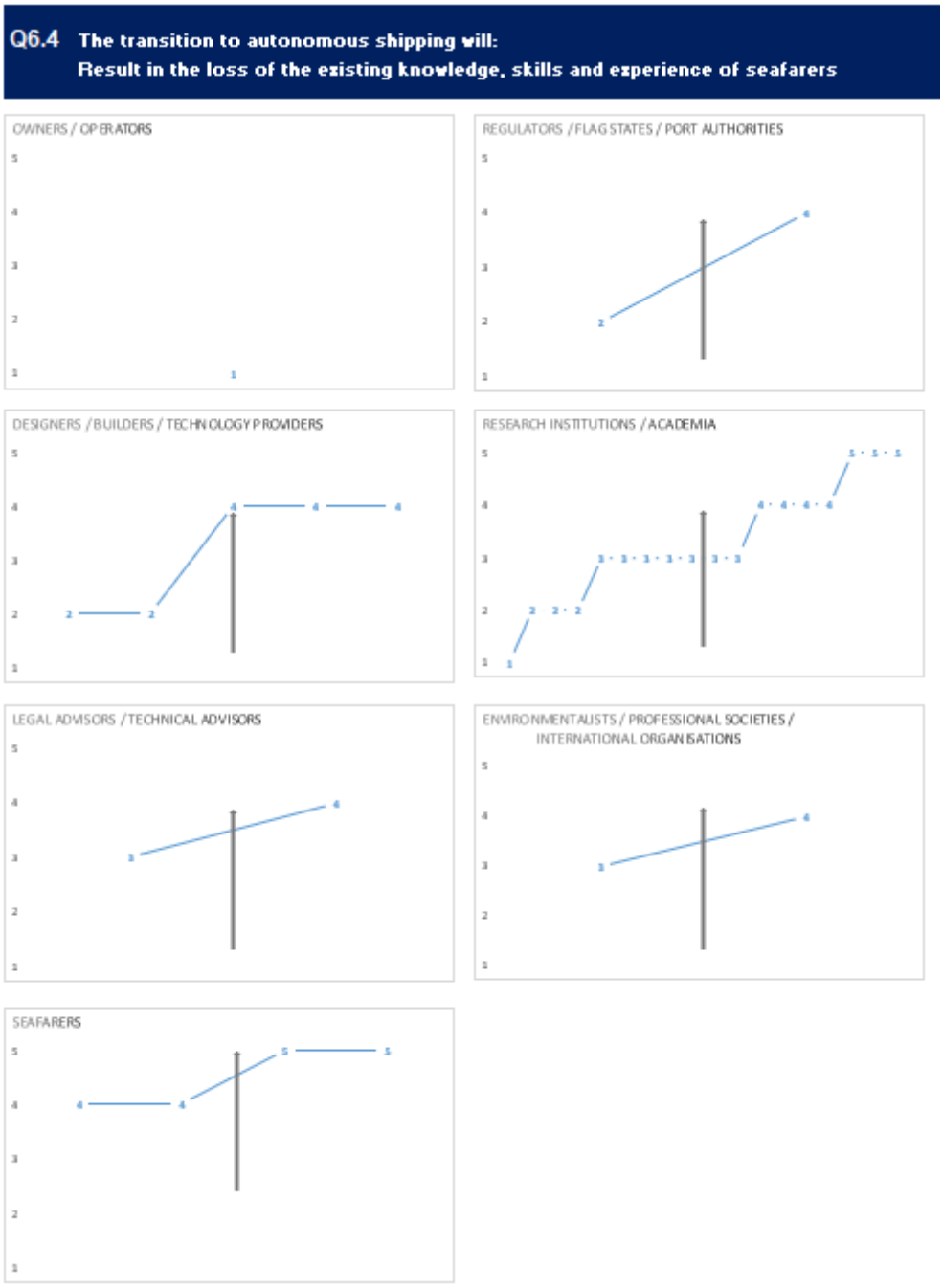

Q5.5 I expect the autonomous shipping will be a viable option for the following shipping sectors: Cruisers
OWNERS / OPERATORS
SEAFARERS
REGULATORS / FLAG STATES / PORT AUTHORITIES
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
RESEARCH INSTITUTIONS / ACADEMIA
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
LEGAL ADVISORS / TECHNICAL ADVISORS

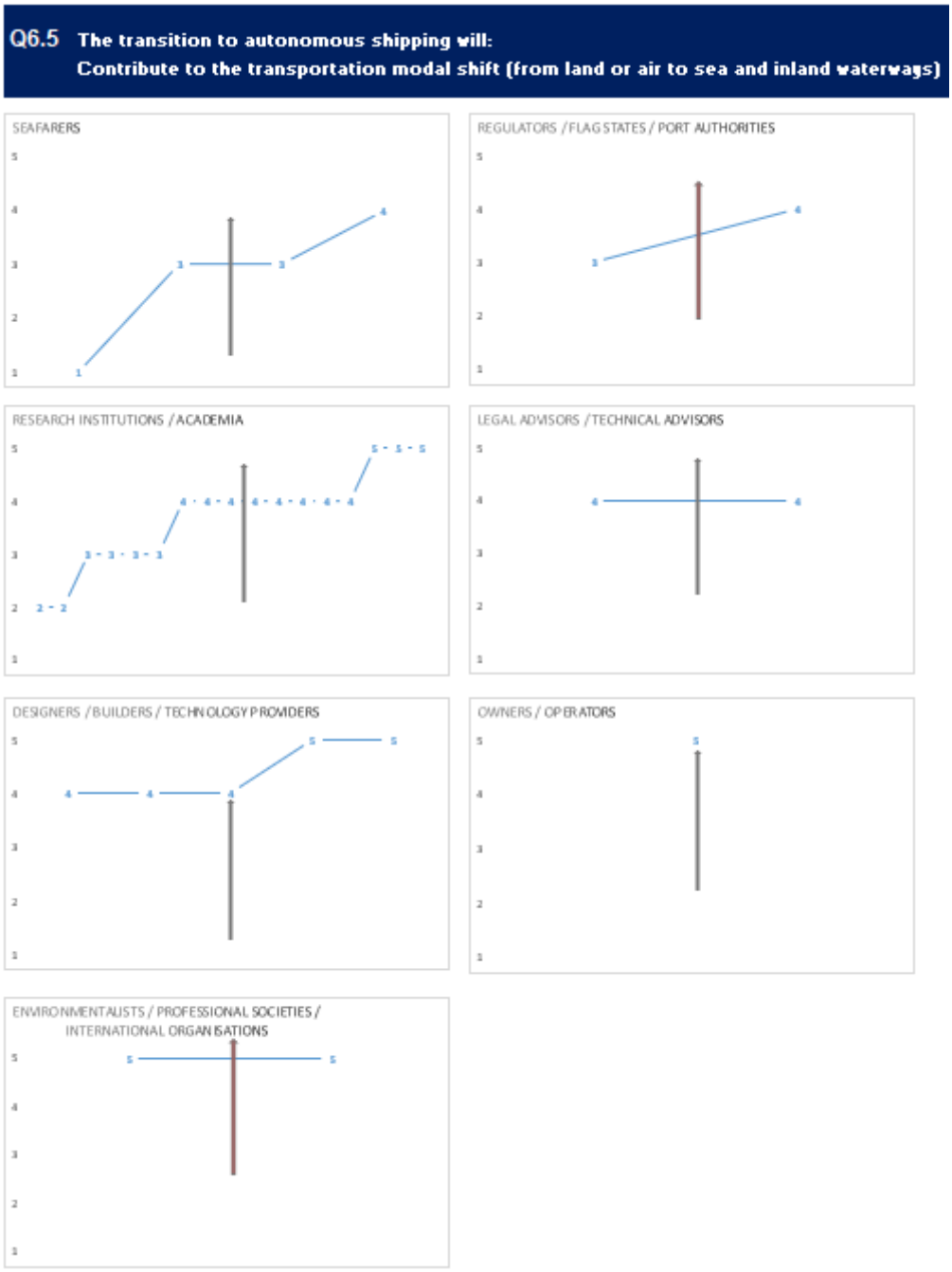

Q5.6 I expect the autonomous shipping will be a viable option for the following shipping sectors: Other
OWNERS / OPERATORS
SEAFARERS
REGULATORS / FLAG STATES / PORT AUTHORITIES
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
RESEARCH INSTITUTIONS / ACADEMIA
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
LEGAL ADVISORS / TECHNICAL ADVISORS

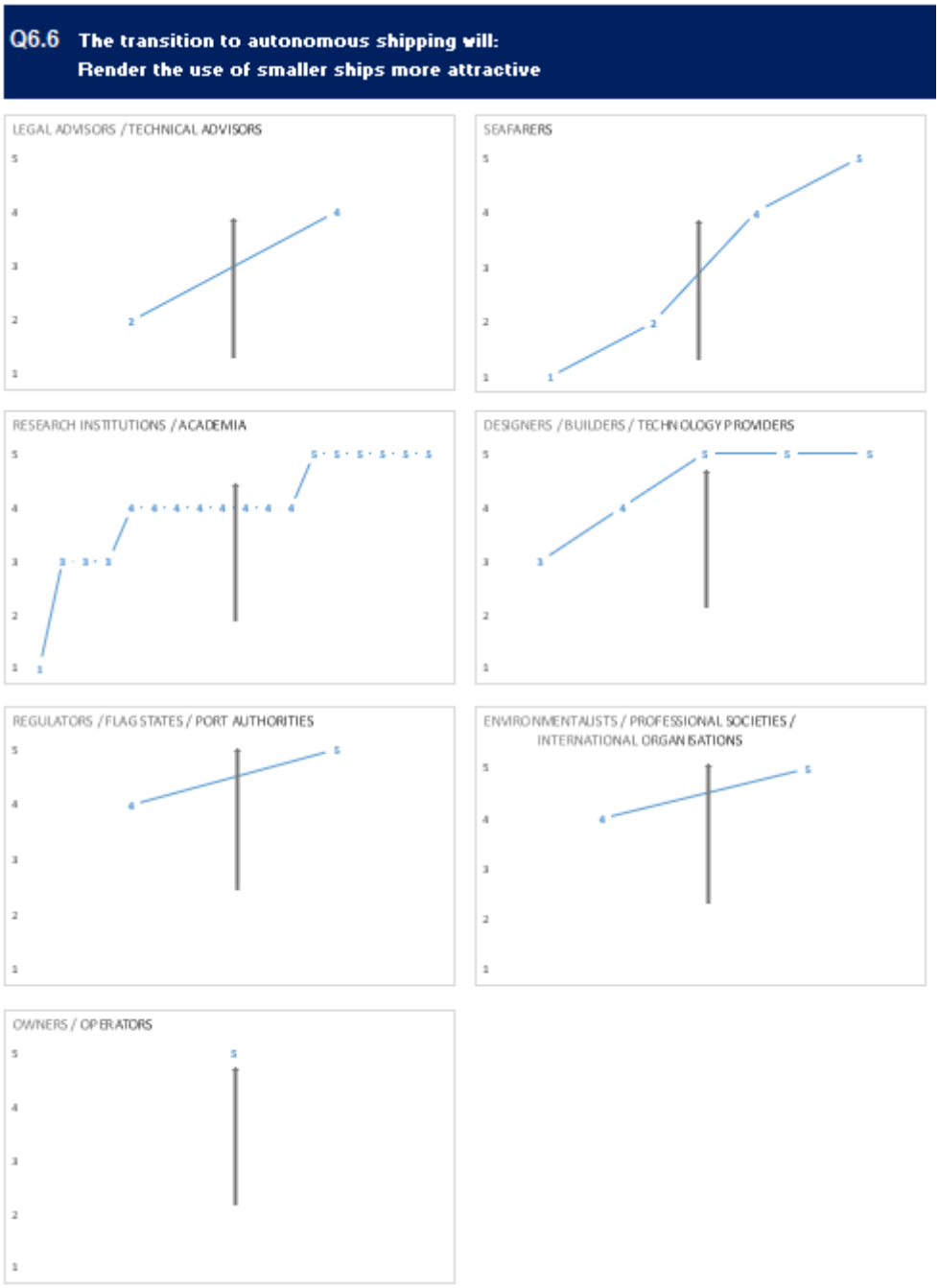

Q6.1 The transition to autonomous shipping will:
Solve the deficit of seafarers
OWNERS / OPERATORS
RESEARCH INSTITUTIONS / ACADEMIA
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
SEAFARERS
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
LEGAL ADVISORS / TECHNICAL ADVISORS
REGULATORS / FLAG STATES / PORT AUTHORITIES


Q6.2 The transition to autonomous shipping will:
Improve the quality of life for the employees in the shipping sector
LEGAL ADVISORS / TECHNICAL ADVISORS
SEAFARERS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
RESEARCH INSTITUTIONS / ACADEMIA
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
OWNERS / OPERATORS
REGULATORS / FLAG STATES / PORT AUTHORITIES

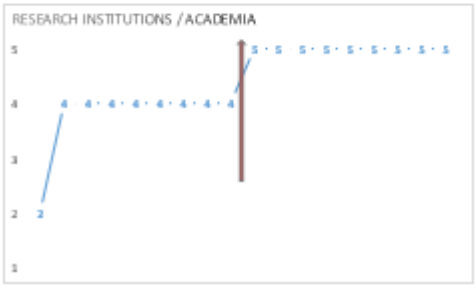

Q6.3 The transition to autonomous shipping will:
Require the modification of the current training framework for seafarers
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
SEAFARERS
RESEARCH INSTITUTIONS / ACADEMIA
OWNERS / OPERATORS
LEGAL ADVISORS / TECHNICAL ADVISORS
REGULATORS / FLAG STATES / PORT AUTHORITIES

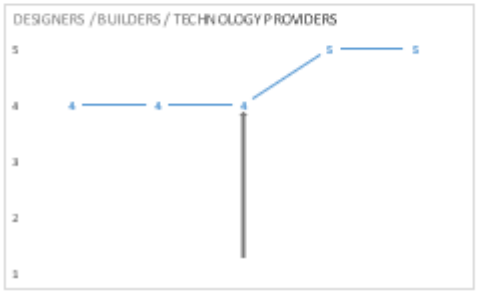

Q6.4 The transition to autonomous shipping will:
Result in the loss of the existing knowledge, skills and experience of seafarers
OWNERS / OPERATORS
REGULATORS / FLAG STATES / PORT AUTHORITIES
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
RESEARCH INSTITUTIONS / ACADEMIA
LEGAL ADVISORS / TECHNICAL ADVISORS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
SEAFARERS


Q6.5 The transition to autonomous shipping will:
Contribute to the transportation modal shift (from land or air to sea and inland waterways)
SEAFARERS
REGULATORS / FLAG STATES / PORT AUTHORITIES
RESEARCH INSTITUTIONS / ACADEMIA
LEGAL ADVISORS / TECHNICAL ADVISORS
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
OWNERS / OPERATORS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS

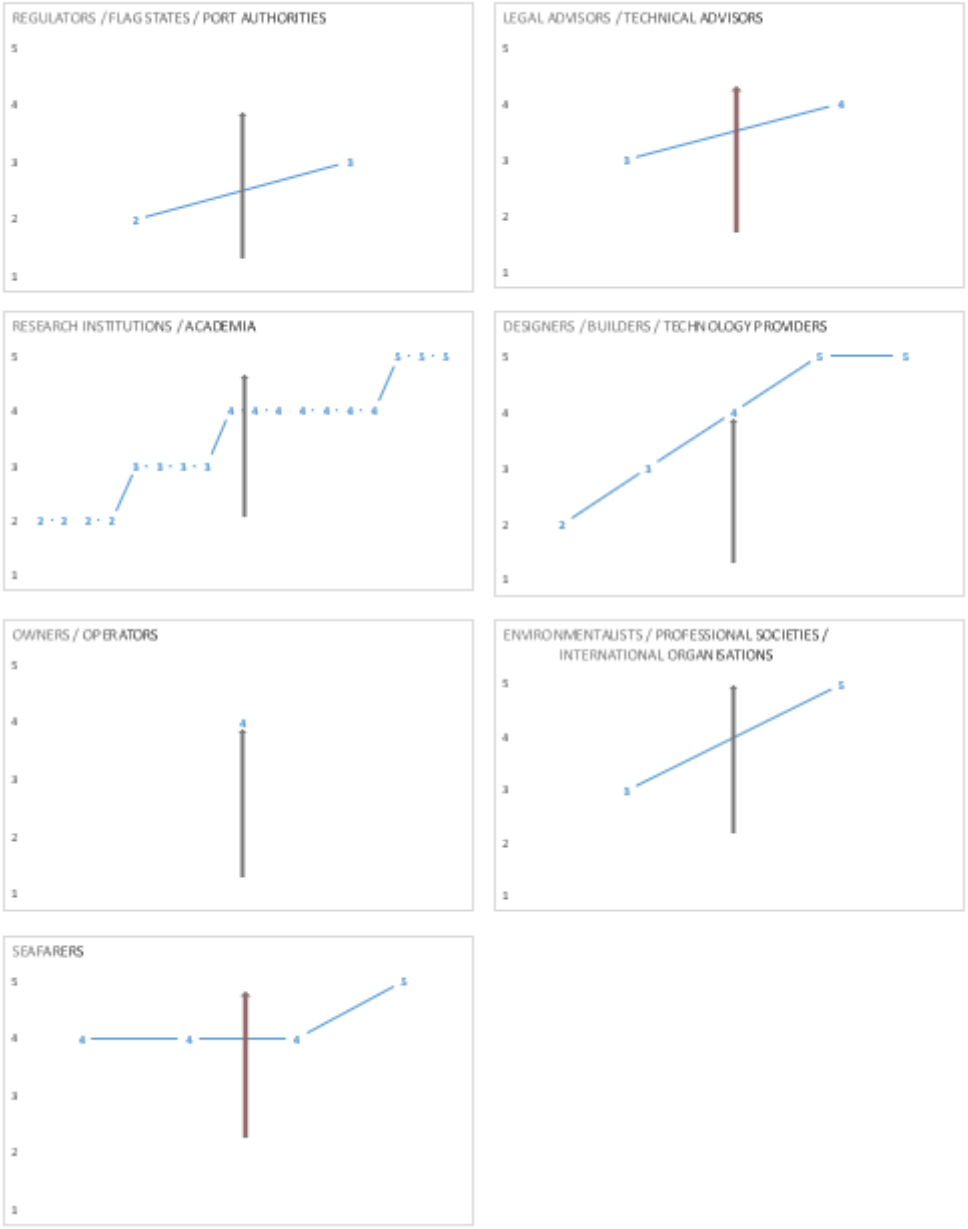

Q6.6 The transition to autonomous shipping will:
Render the use of smaller ships more attractive
LEGAL ADVISORS / TECHNICAL ADVISORS
SEAFARERS
RESEARCH INSTITUTIONS / ACADEMIA
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
REGULATORS / FLAG STATES / PORT AUTHORITIES
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
OWNERS / OPERATORS

Q7.1 Please assess the impact of the following barriers to the transition to autonomous shipping: Regulatory barriers (ships will not be allowed to sail until new regulations have been implemented)

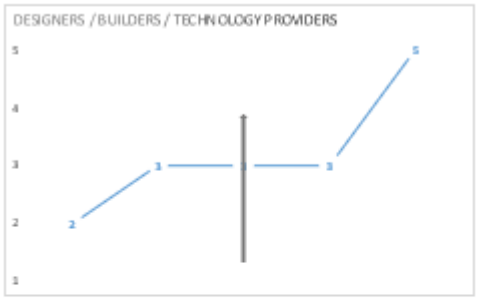


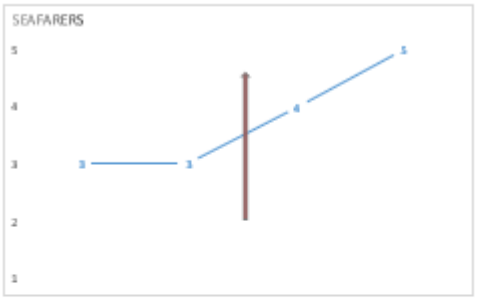


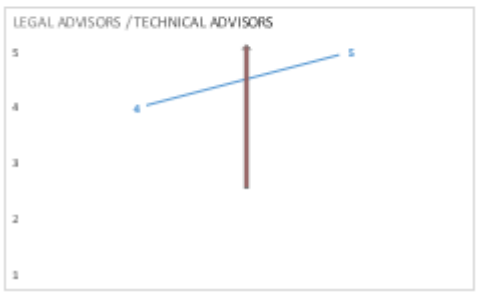
Q7.2 Please assess the impact of the following barriers to the transition to autonomous shipping: Technological limitations (technology not mature)



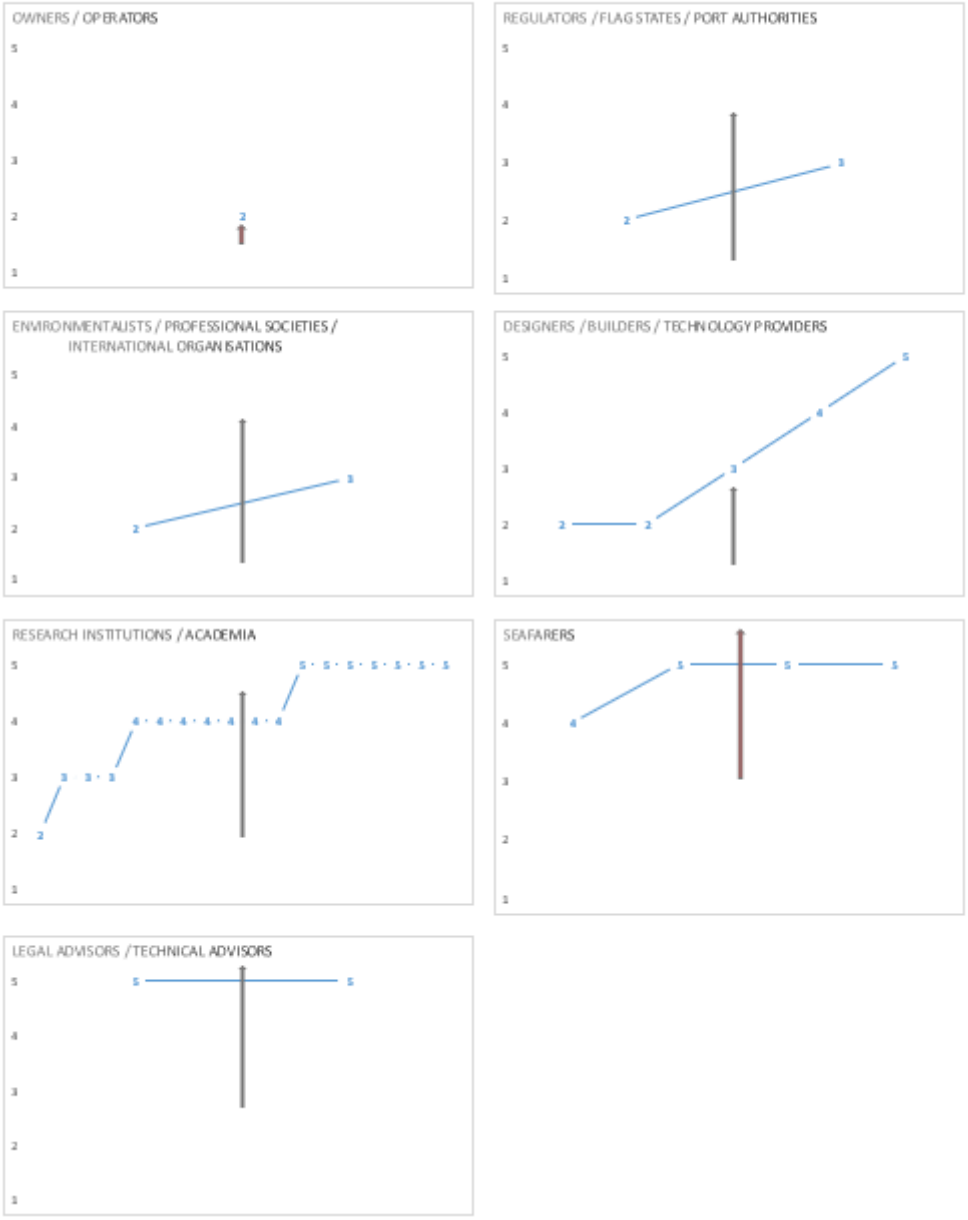
Q7.3 Please assess the impact of the following barriers to the transition to autonomous shipping: Social limitations (lack of expert skills)



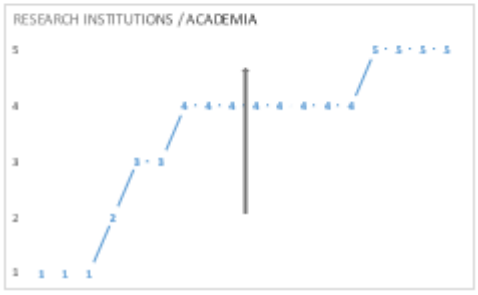


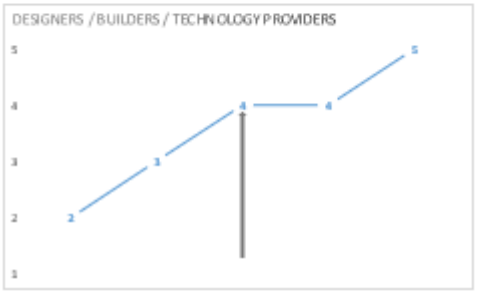


Q7.4 Please assess the impact of the following barriers to the transition to autonomous shipping: Safety and security issues

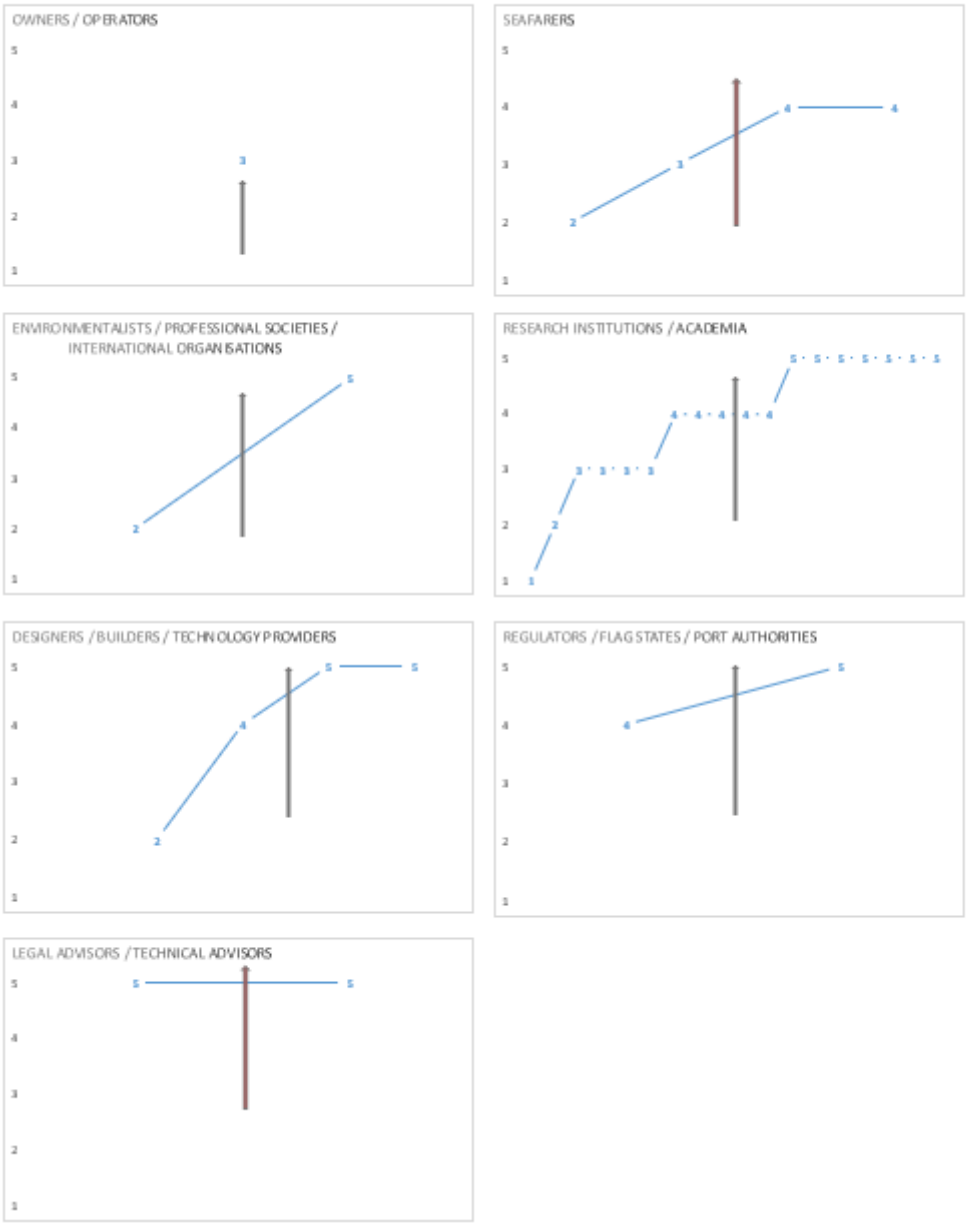


Q7.5 Please assess the impact of the following barriers to the transition to autonomous shipping: Economical barriers (question of profitability)

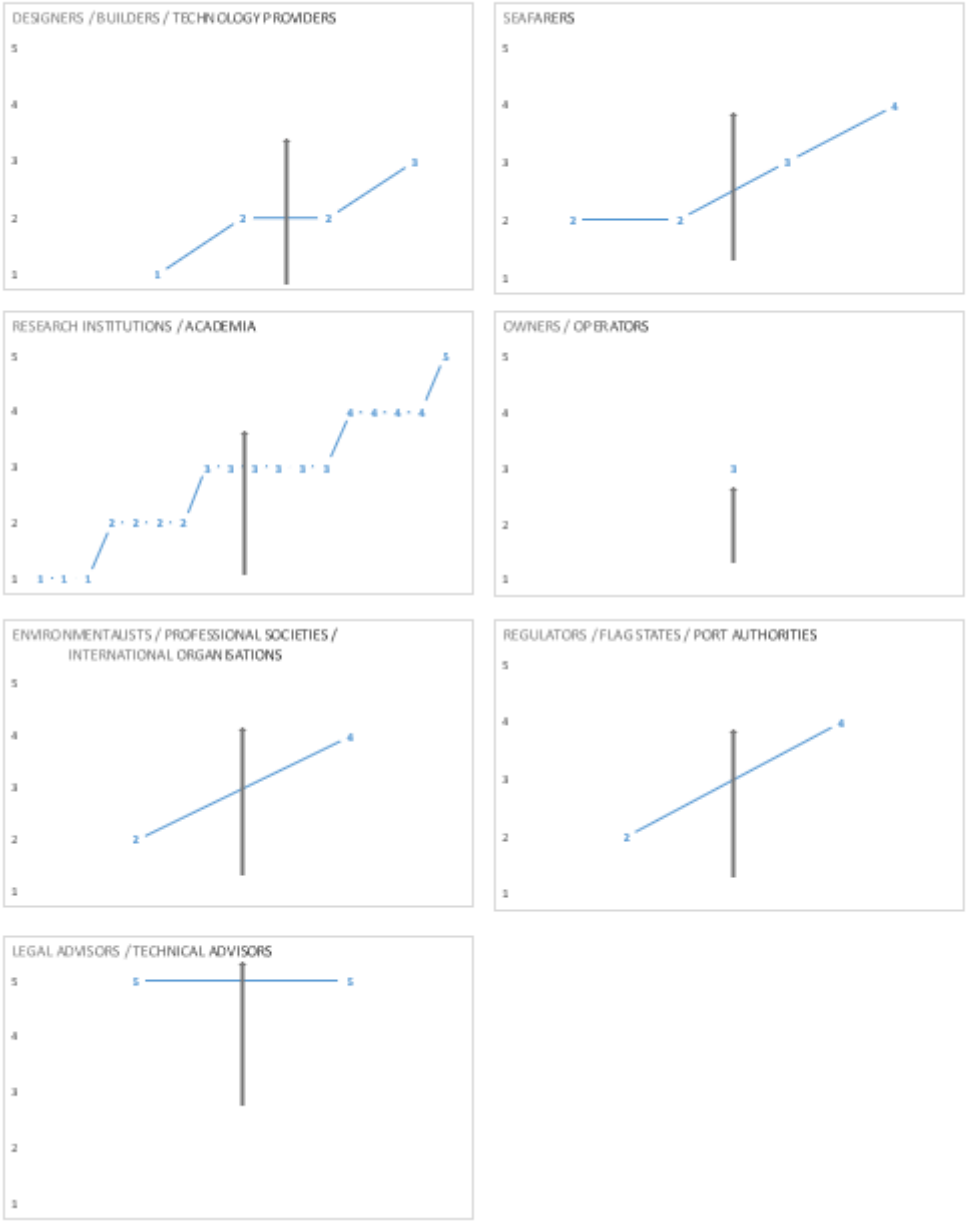




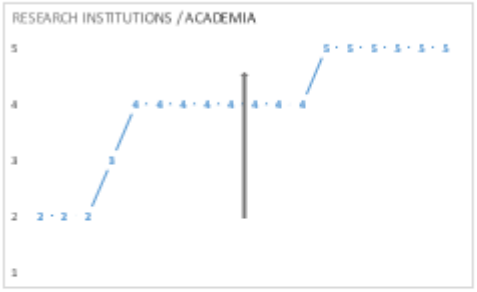
Q8.1 What do you think which are the biggest challenges for the development of autonomous shipping?: Investment cost

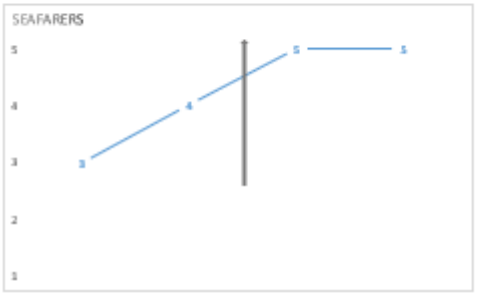


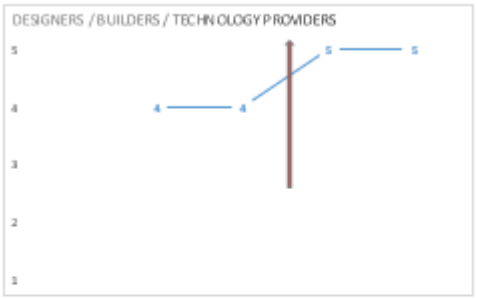
Q8.2 What do you think which are the biggest challenges for the development of autonomous shipping?: Operational costs



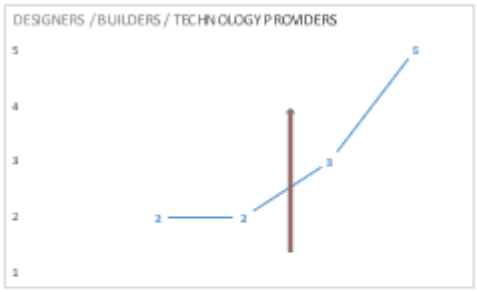
Q8.3 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of regulations

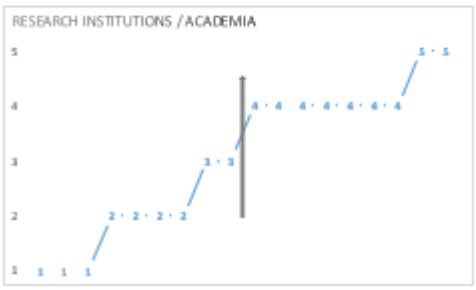


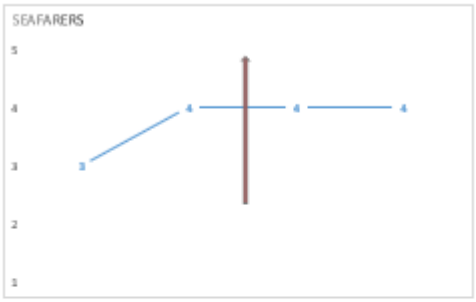




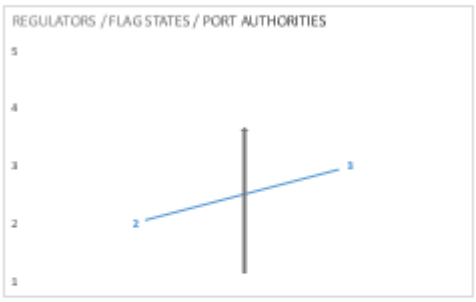
Q8.4 What do you think which are the biggest challenges for the development of autonomous shipping?: Political issues

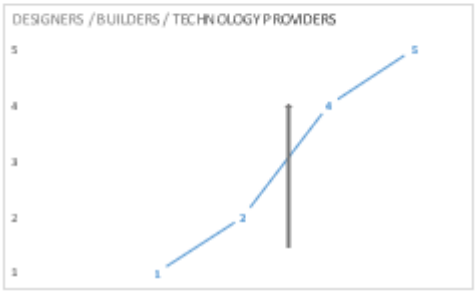


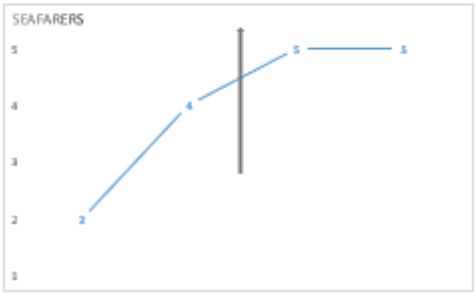




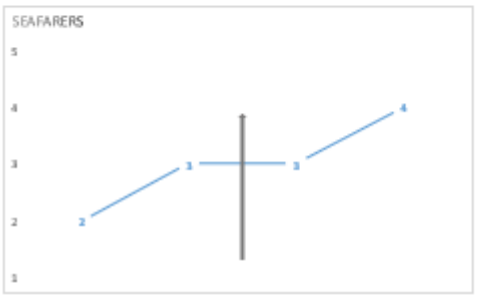
Q8.5 What do you think which are the biggest challenges for the development of autonomous shipping?: Technology maturity

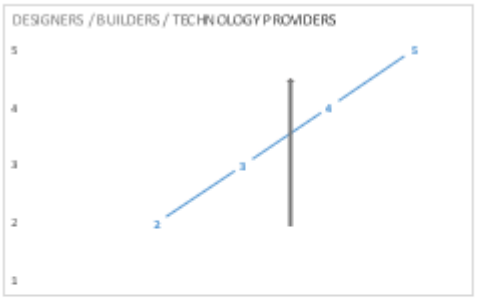




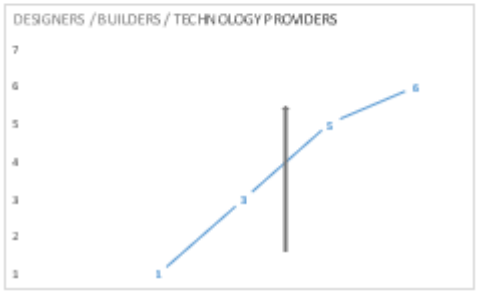


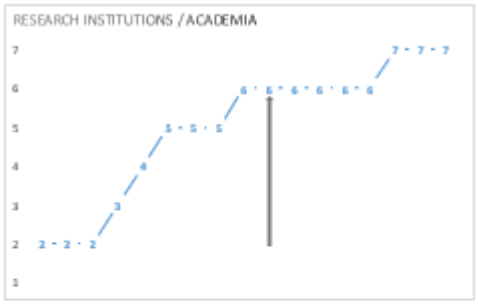
Q8.6 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of qualified workforce

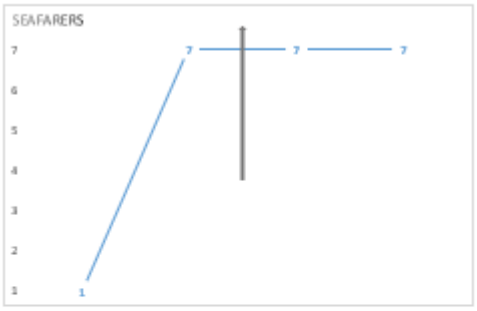




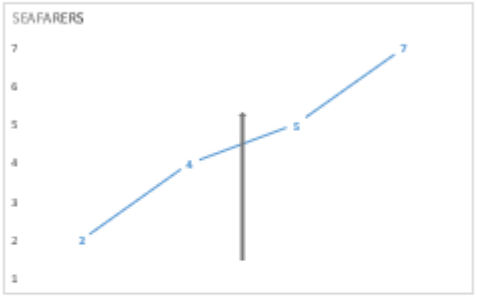
Q9.1 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Autonomous navigation (e.g. collision avoidance)

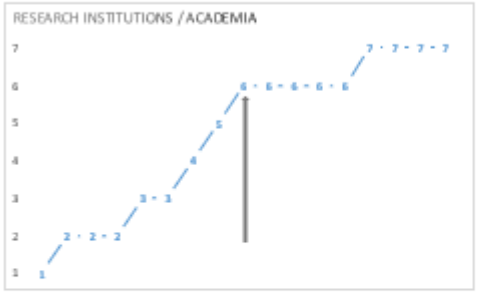


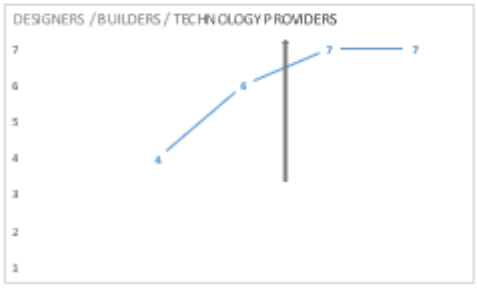




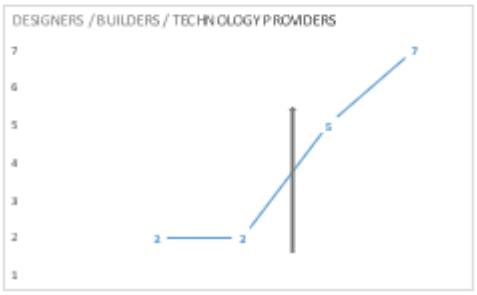
Q9.2 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Communication with the ship (including cyber-security issues and piracy)

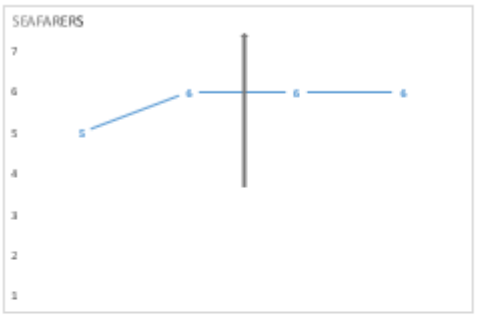




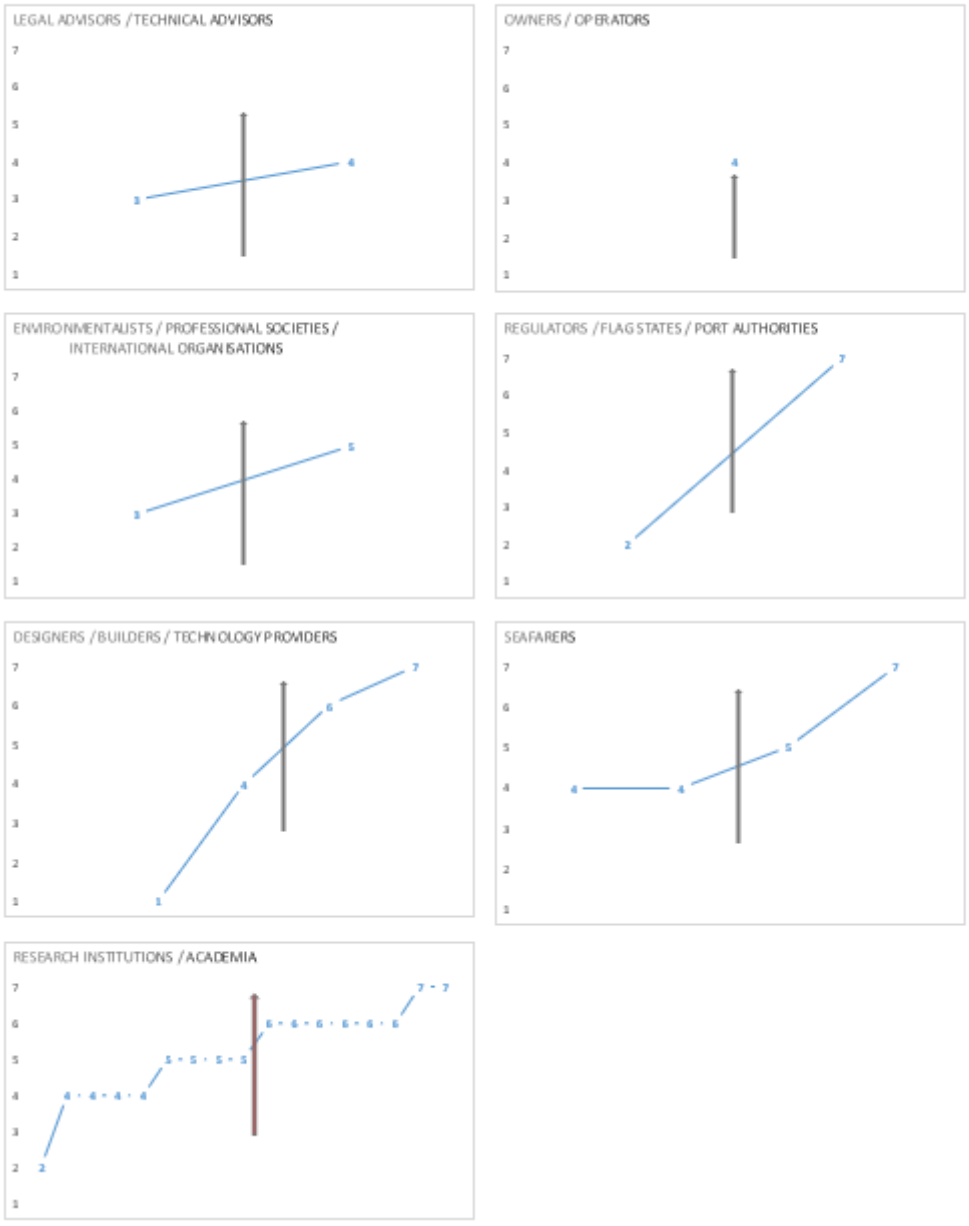


Q9.3 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Remote control centres (lack of operational experience)

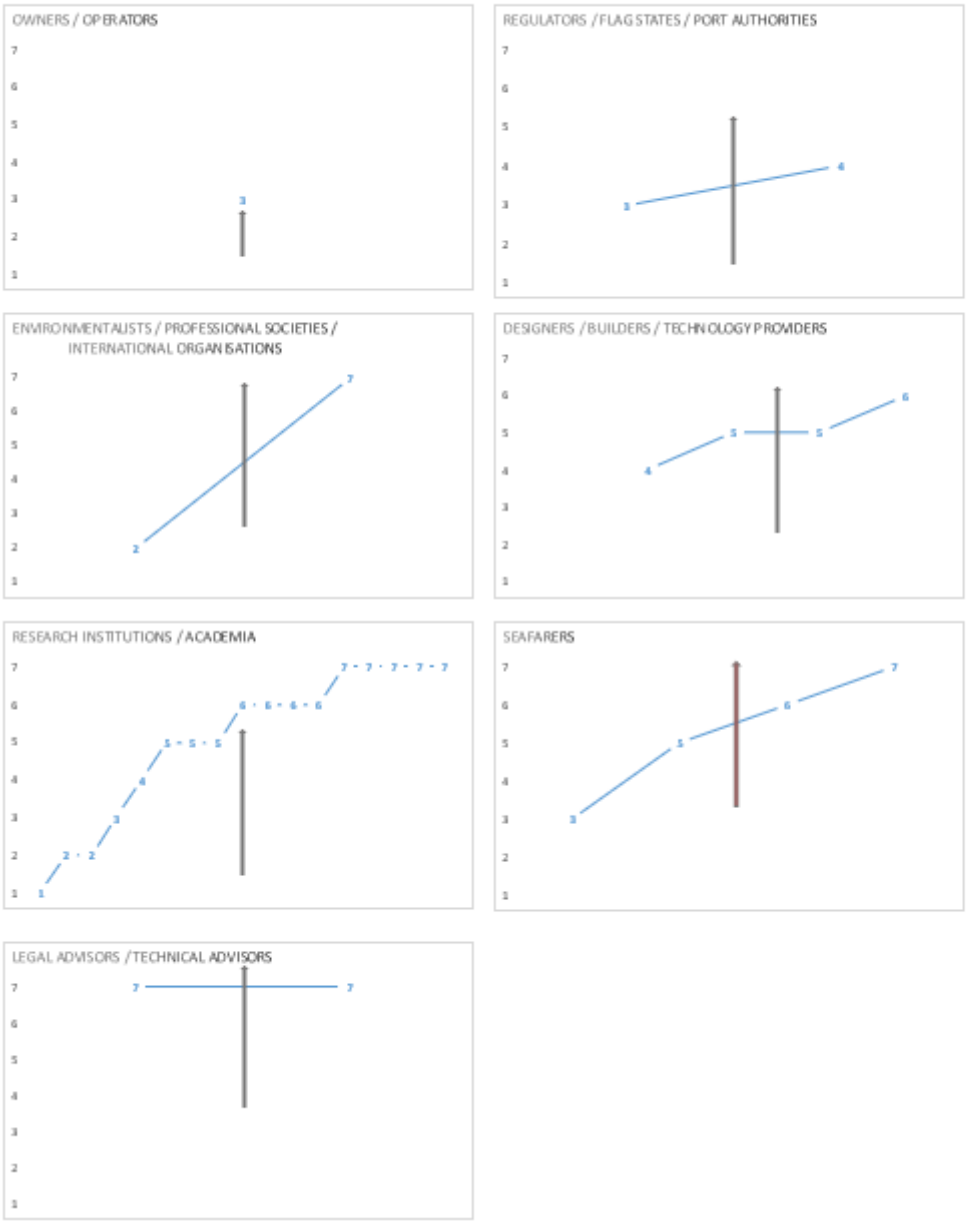


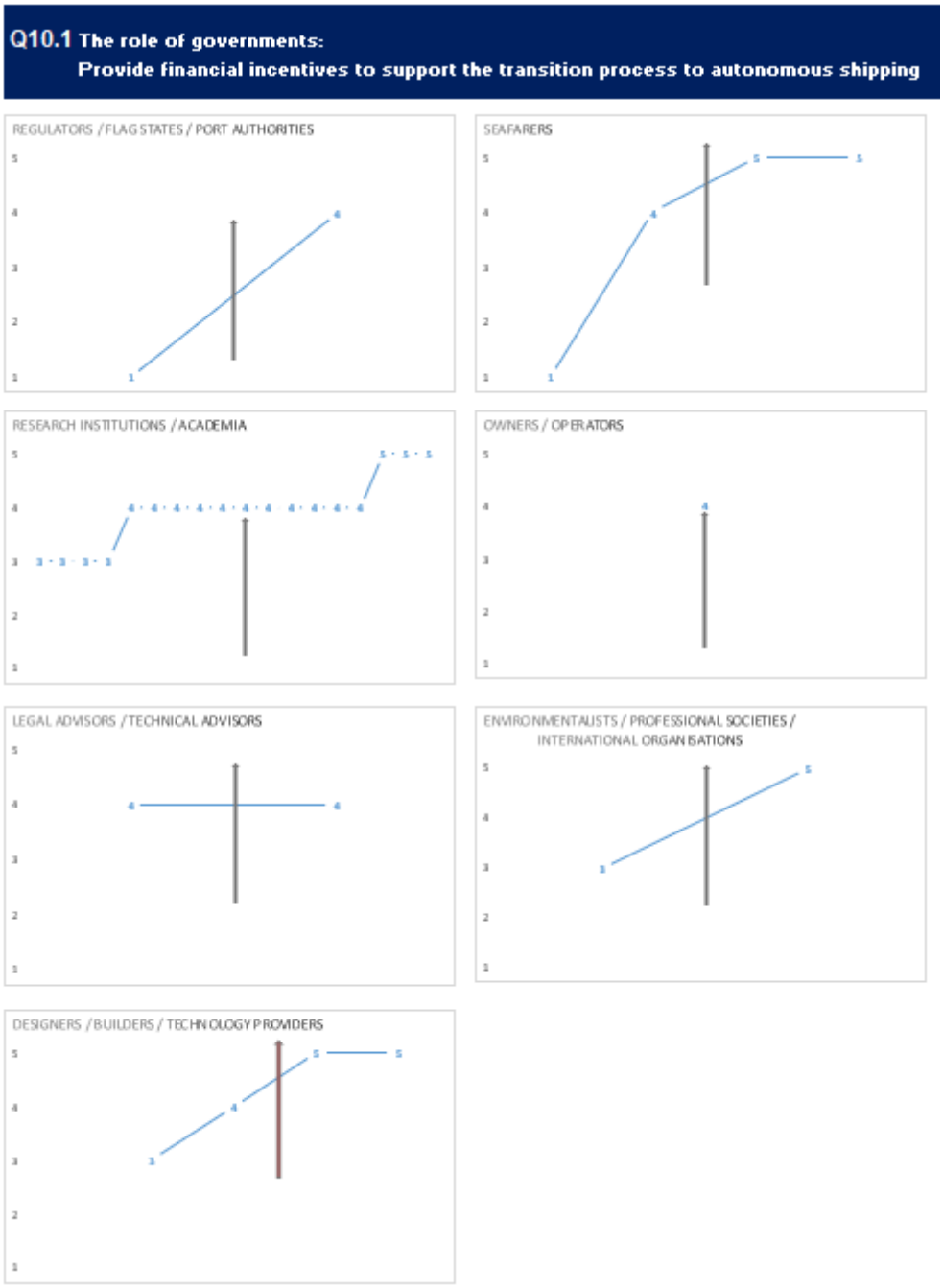


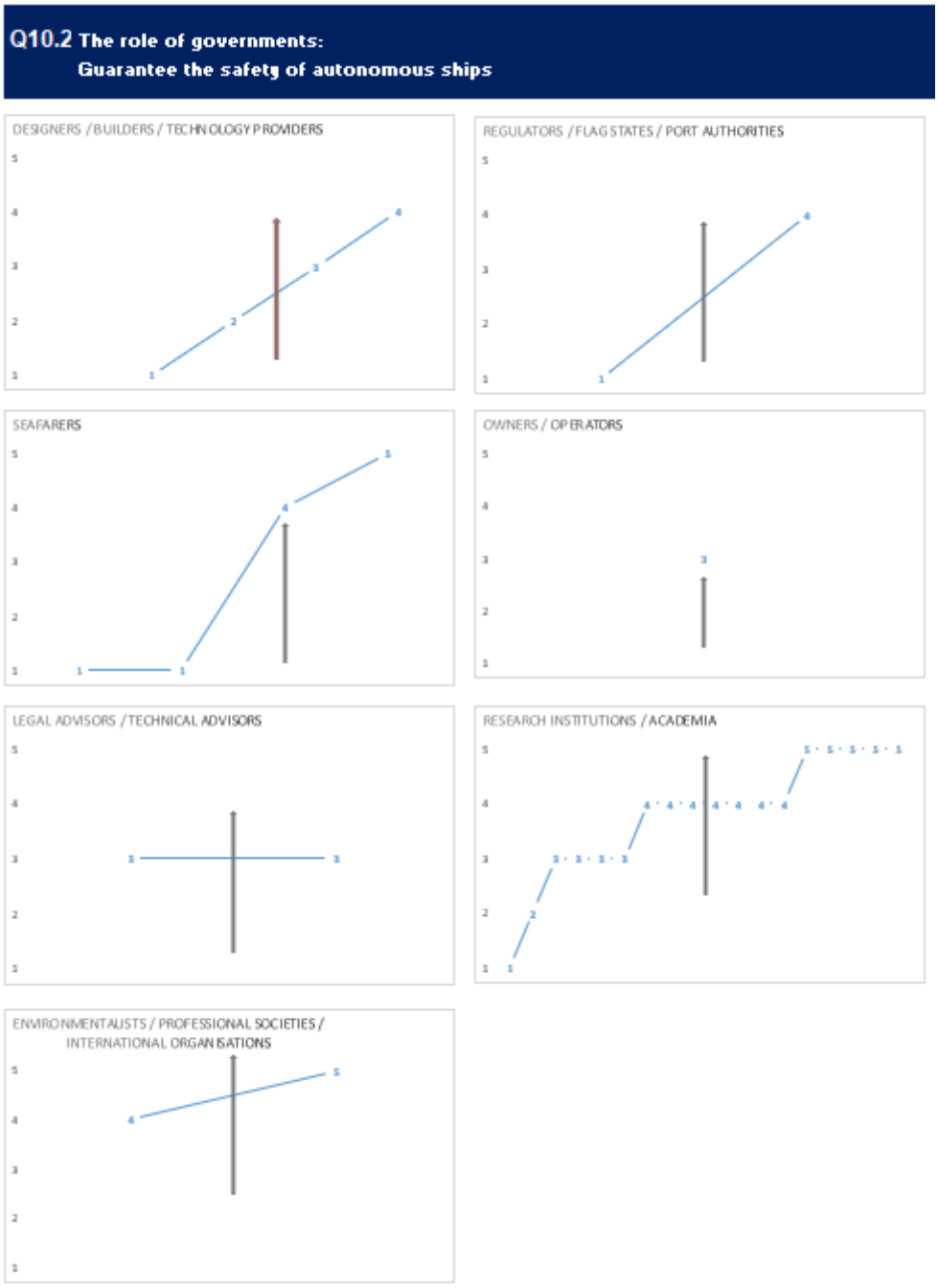
Q9.4 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: There are no procedures for testing, verification and validation

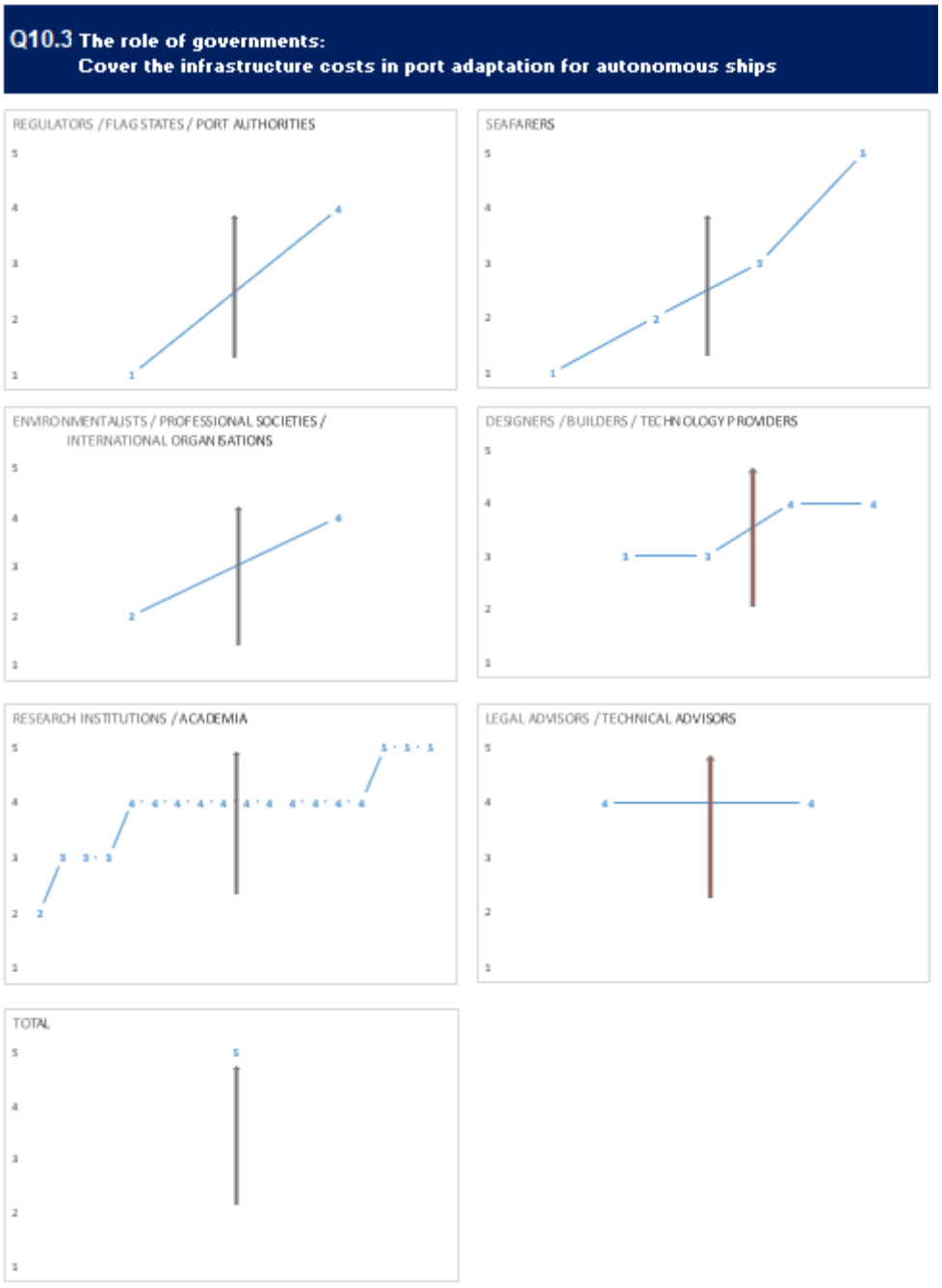


Q9.5 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Ship reliability and maintenance/repair requirements, especially during long voyages

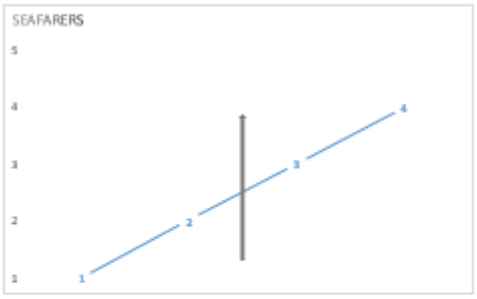


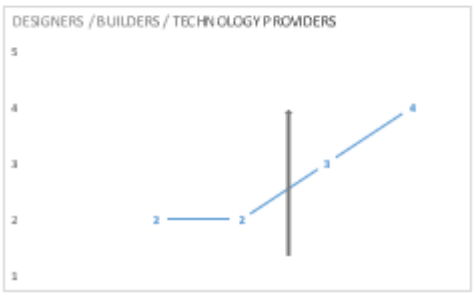

Q10.1 The role of governments:
Provide financial incentives to support the transition process to autonomous shipping
REGULATORS / FLAG STATES / PORT AUTHORITIES
SEAFARERS
RESEARCH INSTITUTIONS / ACADEMIA
OWNERS / OPERATORS
LEGAL ADVISORS / TECHNICAL ADVISORS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS


Q10.2 The role of governments:
Guarantee the safety of autonomous ships
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
REGULATORS / FLAG STATES / PORT AUTHORITIES
SEAFARERS
OWNERS / OPERATORS
LEGAL ADVISORS / TECHNICAL ADVISORS
RESEARCH INSTITUTIONS / ACADEMIA
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS


Q10.3 The role of governments:
Cover the infrastructure costs in port adaptation for autonomous ships
REGULATORS / FLAG STATES / PORT AUTHORITIES
SEAFARERS
ENVIRONMENTALISTS / PROFESSIONAL SOCIETIES / INTERNATIONAL ORGANISATIONS
DESIGNERS / BUILDERS / TECHNOLOGY PROVIDERS
RESEARCH INSTITUTIONS / ACADEMIA
LEGAL ADVISORS / TECHNICAL ADVISORS
TOTAL

Q10.4 The role of governments:
Cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships





APPENDIX G – (SURVEY NO. 2) OVERVIEW METRICS ANALYSIS PER SUB-QUESTION

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q2	The benefits from the transition to autonomous shipping (Range 1-7)		Characterisation	Agree	Agree	Agree	Strongly Agree	Agree	Agree	Somewhat Agree	Strongly Agree	Somewhat Agree
			Mean	5.7	5.7	6.2	6.5	6.0	6.0	4.5	6.8	5.3
			Median	6	6	6	7	6	6	5	7	5
			Standard Deviation	1.20	0.77	0.84	0.71	0.00	-	0.71	0.50	1.30
Q3	The benefits from the transition to autonomous shipping (Range 1-5)		Characterisation	Likely	Likely	Likely	Likely	Likely	Likely	Unlikely	Unlikely	Likely
			Mean	3.7	3.7	4.0	4.0	3.7	4.8	3.0	3.2	3.7
			Median	4	4	4	4	4	5	3	4	4
			Standard Deviation	0.12	0.25	0.29	0.39	0.32	-	0.59	0.20	0.10
	1	Financial benefits	Characterisation	Likely	Likely	Likely	Likely	Likely	Likely	Neutral	Neutral	Likely
			Mean	4.0	4.0	4.4	4.5	4.5	4.0	3.0	3.3	4.0
			Median	4	4	4	5	5	4	3	4	4
			Standard Deviation	1.00	0.61	0.55	0.71	0.71	-	1.41	1.71	0.92
	2	Environmental benefits	Characterisation	Likely	Likely	Likely	Likely	Likely	Extremely Likely	Unlikely	Likely	Likely
			Mean	3.8	3.8	4.0	4.0	4.0	5.0	2.0	3.5	3.9
			Median	4	4	4	4	4	5	2	4	4
			Standard Deviation	1.06	0.90	1.00	0.00	0.00	-	1.41	1.91	0.85
	3	Social benefits	Characterisation	Neutral	Neutral	Likely	Likely	Unlikely	Extremely Likely	Extremely Likely	Neutral	Neutral
			Mean	3.3	3.3	3.6	3.5	2.0	5.0	4.5	2.8	3.2
			Median	3	4	4	4	2	5	5	3	3
			Standard Deviation	1.13	1.02	1.14	0.71	0.00	-	0.71	1.71	0.99

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q3	4	Increased safety	Characterisation	Likely	Likely	Likely	Likely	Likely	Extremely Likely	Likely	Neutral	Likely
			Mean	3.9	3.9	4.4	4.0	4.0	5.0	4.0	3.3	3.9
			Median	4	4	4	4	4	5	4	4	4
			Standard Deviation	0.83	0.53	0.55	0.00	0.00	-	0.00	1.50	0.79
	5	Added resilience in case of major worldwide disruptions	Characterisation	Likely	Likely	Likely	Likely	Likely	Extremely Likely	Unlikely	Neutral	Likely
			Mean	3.5	3.5	3.8	4.0	4.0	5.0	1.5	3.0	3.6
			Median	4	4	4	4	4	5	2	4	4
			Standard Deviation	1.13	1.09	1.10	0.00	0.00	-	0.71	1.41	1.05
		Impact to the shipping industry as a consequence of the transition to autonomous shipping (Range 1-5)	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
			Mean	3.2	3.2	3.6	3.2	2.9	2.4	2.9	2.7	3.3
			Median	4	3	4	4	3	2	3	3	3
			Standard Deviation	0.08	0.24	0.17	0.39	0.39	-	0.68	0.19	0.06
Q4	1	Increase the income	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
			Mean	3.4	3.4	3.8	3.5	3.5	4.0	3.0	2.8	3.5
			Median	4	4	4	4	4	4	3	3	3
			Standard Deviation	0.94	0.43	1.10	0.71	0.71	-	1.41	1.26	0.89
	2	Increase the profitability	Characterisation	Agree	Agree	Agree	Agree	Agree	Disagree	Agree	Neither Agree nor Disagree	Agree
			Mean	3.5	3.5	4.0	4.0	4.0	2.0	3.5	2.8	3.6
			Median	4	4	4	4	4	2	4	3	4
			Standard Deviation	0.96	0.76	1.22	0.00	0.00	-	0.71	1.26	0.89

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q 4	3	Increase the number of employees	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Disagree	Disagree	Agree	Neither Agree nor Disagree	Disagree	Neither Agree nor Disagree
			Mean	2.6	2.6	3.2	2.0	2.0	4.0	3.0	2.0	2.5
			Median	3	3	3	2	2	4	3	2	3
			Standard Deviation	0.92	0.77	0.84	0.00	0.00	-	0.00	1.41	0.84
	4	Improve the access to financing	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Strongly Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree
			Mean	3.1	3.1	3.2	3.0	2.5	1.0	3.0	3.8	3.2
			Median	3	3	3	3	3	1	3	4	3
			Standard Deviation	0.96	0.88	0.84	0.00	0.71	-	0.00	0.96	1.01
	5	Improve the access to financing	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Strongly Disagree	Disagree	Disagree	Agree
			Mean	3.3	3.3	4.0	3.5	2.5	1.0	2.0	2.0	3.6
			Median	4	3	4	4	3	1	2	2	4
			Standard Deviation	1.11	1.08	1.00	0.71	0.71	-	-	1.00	0.92
Q 5	I expect the autonomous shipping will be a viable option for the following shipping sectors (Range 1-7)		Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Somewhat Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Somewhat Agree
			Mean	4.8	4.8	4.7	5.0	5.9	3.0	4.2	4.4	4.9
			Median	5.5	5.0	5.0	5.0	6.0	1.0	4.5	5.5	5.0
			Standard Deviation	0.19	0.49	0.42	0.89	0.29	-	0.81	0.96	0.20

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q5	1	Ocean-going vessels	Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Agree	Strongly Disagree	Neither Agree nor Disagree	Somewhat Agree	Somewhat Agree
			Mean	5.1	5.1	5.2	6.5	6.0	1.0	4.0	5.0	5.2
			Median	6.0	5	6	7	6	1	4	6	5
			Standard Deviation	1.71	1.81	1.92	0.71	0.00	-	1.41	2.83	1.40
	2	Short-sea shipping	Characterisation	Agree	Agree	Agree	Somewhat Agree	Agree	Strongly Agree	Agree	Agree	Agree
			Mean	5.7	5.7	5.8	5.0	6.0	7.0	5.5	5.5	5.7
			Median	6	6	6	5	6	7	6	6	6
			Standard Deviation	1.25	0.62	1.64	2.83	0.00	-	0.71	1.91	1.03
	3	Inland shipping	Characterisation	Agree	Agree	Somewhat Agree	Somewhat Agree	Agree	Strongly Agree	Somewhat Agree	Agree	Agree
			Mean	5.6	5.6	5.0	4.5	6.0	7.0	5.0	6.0	5.7
			Median	6	6	5	5	6	7	5	6	6
			Standard Deviation	1.33	0.84	1.58	2.12	0.00	-	2.83	1.15	1.19
	4	Working ships (tugs, dredgers)	Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Agree	Strongly Disagree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree
			Mean	4.7	4.7	5.0	4.0	6.0	1.0	4.5	3.8	4.9
			Median	5	5	5	4	6	1	5	5	5
			Standard Deviation	1.68	1.58	2.12	1.41	0.00	-	2.12	1.89	1.43

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q5	5	Cruisers	Characterisation	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Disagree	Disagree	Disagree	Somewhat Disagree
			Mean	3.1	3.1	2.8	4.5	5.5	1.0	2.0	1.8	3.4
			Median	3	3	2	5	6	1	2	2	3
			Standard Deviation	1.64	1.59	1.64	0.71	0.71	-	1.41	0.50	1.58
	The transition to autonomous shipping will: (Range 1-5)		Characterisation	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree
			Mean	3.9	3.9	4.0	4.1	3.7	4.0	4.2	3.6	3.8
			Median	4	4	4	4.5	4	5	4.5	3.5	4
			Standard Deviation	0.19	0.32	0.34	0.29	0.58	-	0.63	0.63	0.22
Q6	1	Solve the deficit of seafarers	Characterisation	Agree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree
			Mean	3.6	3.6	3.8	3.5	4.0	3.0	4.0	3.8	3.4
			Median	4	4	4	4	4	3	4	4	4
			Standard Deviation	0.82	0.36	0.45	0.71	0.00	-	1.41	0.50	0.98
	2	Improve the quality of life for the employees in the shipping sector	Characterisation	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Strongly Agree	Strongly Agree	Neither Agree nor Disagree	Agree
			Mean	3.7	3.7	4.0	3.5	2.5	5.0	5.0	3.0	3.7
			Median	4	4	4	4	3	5	5	3	4
			Standard Deviation	1.06	0.94	0.71	0.71	0.71	-	0.00	1.83	0.89
	3	Require the modification of the current training framework for seafarers	Characterisation	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
			Mean	4.6	4.6	4.4	4.5	5.0	5.0	5.0	4.5	4.6
			Median	5	5	5	5	5	5	5	5	5

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q6	4	Result in the loss of the existing knowledge, skills and experience of seafarers	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Strongly Agree	Neither Agree nor Disagree	Strongly Agree	Neither Agree nor Disagree
			Mean	3.4	3.4	3.2	3.5	3.5	1.0	3.0	4.5	3.3
			Median	4	3	4	4	4	1	3	5	3
			Standard Deviation	1.12	1.06	1.10	0.71	0.71	-	1.41	0.58	1.13
	5	Contribute to the transportation modal shift	Characterisation	Agree	Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Neither Agree nor Disagree	Agree
			Mean	3.8	3.8	4.4	5.0	4.0	5.0	3.5	2.8	3.7
			Median	4	4	4	5	4	5	4	3	4
			Standard Deviation	0.98	0.82	0.55	0.00	0.00	-	0.71	1.26	0.92
	6	Contribute to the transportation modal shift	Characterisation	Agree	Agree	Agree	Strongly Agree	Neither Agree nor Disagree	Strongly Agree	Strongly Agree	Neither Agree nor Disagree	Agree
			Mean	4.0	4.0	4.4	4.5	3.0	5.0	4.5	3.0	4.0
			Median	4	4	5	5	3	5	5	3	4
			Standard Deviation	1.14	0.78	0.89	0.71	1.41	-	0.71	1.83	1.03
Q7		Impact of the following barriers to the autonomous shipping transition: (Range 1-5)	Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Neutral	Moderate Effect	Neutral	Neutral	Moderate Effect	Moderate Effect
			Mean	3.7	3.7	3.6	3.2	4.4	2.6	3.2	4.3	3.7
			Median	4	4	4	3	5	2	3	4	4
			Standard Deviation	0.25	0.38	0.31	0.42	0.39	-	0.39	0.35	0.24
	1	Regulatory barriers	Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Major Effect	Major Effect	Major Effect	Moderate Effect
			Mean	4.4	4.4	4.4	4.0	4.0	5.0	5.0	4.8	4.4
			Median	5	4	4	4	4	5	5	5	5
			Standard Deviation	0.66	0.43	0.55	0.55	0.00	-	0.00	0.50	0.78

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q7	2	Technological limitations	Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect	Neutral	Moderate Effect	Moderate Effect
			Mean	3.6	3.6	3.8	4.0	3.5	4.0	2.5	4.3	3.5
			Median	4	4	4	4	4	4	3	4	4
			Standard Deviation	1.02	0.58	1.30	1.41	0.71	-	0.71	0.50	1.04
	3	Social limitations	Characterisation	Neutral	Neutral	Neutral	Neutral	Major Effect	No Effect	Minor Effect	Moderate Effect	Neutral
			Mean	3.1	3.1	3.2	2.5	4.5	1.0	2.0	3.8	3.0
			Median	3	3	3	3	5	1	2	4	3
			Standard Deviation	1.20	1.15	1.10	0.71	0.71	-	0.00	0.96	1.24
	4	Safety and security issues	Characterisation	Moderate Effect	Moderate Effect	Neutral	Neutral	Major Effect	Minor Effect	Neutral	Major Effect	Moderate Effect
			Mean	3.9	3.9	3.2	2.5	5.0	2.0	2.5	4.8	4.1
			Median	4	3	3	3	5	2	3	5	4
			Standard Deviation	1.13	1.19	1.30	0.71	0.00	-	0.71	0.50	0.90
	5	Economic barriers	Characterisation	Moderate Effect	Moderate Effect	Moderate Effect	Neutral	Major Effect	No Effect	Moderate Effect	Moderate Effect	Moderate Effect
			Mean	3.6	3.6	3.6	3.0	5.0	1.0	4.0	3.8	3.5
			Median	4	4	4	3	5	1	4	4	4
			Standard Deviation	1.31	1.23	1.14	1.41	0.00	-	0.00	1.26	1.38
Q8	The challenges for the development of autonomous shipping (Range 1-5)		Characterisation	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree
			Mean	3.5	3.5	3.3	3.3	4.2	3.8	3.6	3.5	3.4
			Median	4	4	3.5	3.5	4	3.5	3.5	4	4
			Standard Deviation	0.11	0.16	0.45	0.74	0.00	-	0.38	0.29	0.10

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q8	1	Investment cost	Characterisation	Agree	Agree	Agree	Agree	Strongly Agree	Neither Agree nor Disagree	Strongly Agree	Neither Agree nor Disagree	Agree
			Mean	3.9	3.9	4.0	3.5	5.0	3.0	4.5	3.3	3.9
			Median	4	4	5	4	5	3	5	4	4
			Standard Deviation	1.17	0.70	1.41	2.12	0.00	-	0.71	0.96	1.18
	2	Operational costs	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
			Mean	2.8	2.8	2.0	3.0	5.0	3.0	3.0	2.8	2.8
			Median	3	3	2	3	5	3	3	3	3
			Standard Deviation	1.18	0.92	0.82	1.41	0.00	-	1.41	0.96	1.17
	3	Lack of regulations	Characterisation	Agree	Agree	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree	Agree	Agree
			Mean	4.1	4.1	4.5	3.5	4.0	5.0	5.0	4.3	3.9
			Median	4	4	5	4	4	5	5	5	4
			Standard Deviation	0.93	0.56	0.58	0.71	0.00	-	-	0.96	1.06
	4	Political issues	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Neither Agree nor Disagree	Strongly Agree	Agree	Agree	Neither Agree nor Disagree
			Mean	3.3	3.3	3.0	4.0	3.0	5.0	3.5	3.8	3.1
			Median	4	4	3	4	3	5	4	4	4
			Standard Deviation	1.18	0.73	1.41	0.00	0.00	-	0.71	0.50	1.35
	5	Technology maturity	Characterisation	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Neither Agree nor Disagree	Agree	Agree
			Mean	3.5	3.5	3.0	3.0	4.0	4.0	2.5	4.0	3.5
			Median	4	4	3	3	4	4	3	5	4
			Standard Deviation	1.18	0.61	1.83	1.41	0.00	-	0.71	1.41	1.10

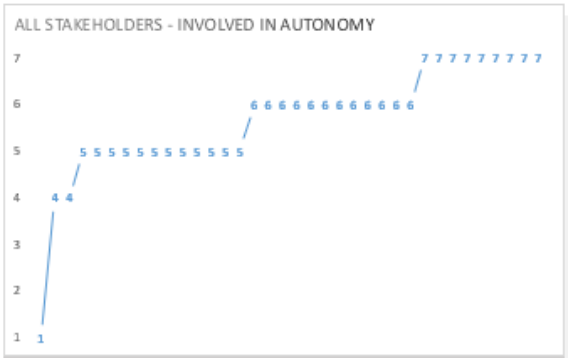
#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q8	6	Lack of qualified workforce	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
			Mean	3.2	3.2	3.5	2.5	4.0	3.0	3.0	3.0	3.2
			Median	3	3	4	3	4	3	3	3	3
			Standard Deviation	1.01	0.47	1.29	0.71	0.00	-	1.41	0.82	1.10
Q9		Technical limitations as the biggest challenge when designing and operating autonomous ships (Range 1-7)	Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Somewhat Agree	Somewhat Agree
			Mean	4.9	4.9	4.7	4.9	6.3	3.8	3.7	5.2	5.0
			Median	5	5	5	5	7	4	4	6	6
			Standard Deviation	0.24	0.49	0.77	1.46	0.32	-	1.47	0.92	0.37
	1	Autonomous navigation	Characterisation	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Strongly Disagree	Somewhat Disagree	Agree	Somewhat Agree
			Mean	4.8	4.8	3.8	4.5	7.0	1.0	3.0	5.5	5.0
			Median	6	5	4	5	7	1	3	7	6
			Standard Deviation	2.14	1.92	2.22	3.54	0.00	-	0.00	3.00	1.77
	2	Communication with the ship	Characterisation	Somewhat Agree	Somewhat Agree	Agree	Agree	Strongly Agree	Strongly Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree
			Mean	5.2	5.2	6.0	6.0	7.0	7.0	5.0	4.5	4.7
			Median	6	6	7	6	7	7	5	5	6
			Standard Deviation	1.97	1.04	1.41	-	0.00	-	2.83	2.08	2.11
	3	Remote Control Centres	Characterisation	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Agree	Strongly Agree	Neither Agree nor Disagree	Somewhat Disagree	Agree	Somewhat Agree
			Mean	4.8	4.8	4.0	5.5	7.0	4.0	2.5	5.8	4.8
			Median	5	5	4	6	7	4	3	6	5
			Standard Deviation	1.62	1.46	2.45	0.71	0.00	-	2.12	0.50	1.35

#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q9	4	There are No. procedures for testing, verification and validation	Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Somewhat Agree	Somewhat Agree	Somewhat Agree
			Mean	4.8	4.8	4.5	4.0	3.5	4.0	4.5	5.0	5.2
			Median	5	5	5	4	4	4	5	5	5
			Standard Deviation	1.57	0.59	2.65	1.41	0.71	-	3.54	1.41	1.29
	5	Ship reliability and maintenance/repair requirements, especially during long voyages	Characterisation	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Strongly Agree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Somewhat Agree
			Mean	5.0	5.0	5.0	4.5	7.0	3.0	3.5	5.3	5.1
			Median	5	5	5	5	7	3	4	6	6
			Standard Deviation	1.83	1.30	0.82	3.54	0.00	-	0.71	1.71	1.98
Q10		The role of governments (Range 1-5)	Characterisation	Agree	Agree	Neither Agree nor Disagree	Agree	Agree	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
			Mean	3.6	3.6	3.3	3.6	3.8	4.3	2.5	3.0	3.9
			Median	4	3.5	3.5	3.5	4	4.5	3	3	4
			Standard Deviation	0.14	0.16	0.29	0.35	0.00	-	0.00	0.33	0.20
	1	Provide financial incentives to support the transition process to autonomous shipping	Characterisation	Agree	Agree	Agree	Agree	Agree	Agree	Neither Agree nor Disagree	Agree	Agree
			Mean	3.9	3.9	4.3	4.0	4.0	4.0	2.5	3.8	3.9
			Median	4	4	5	4	4	4	3	5	4
			Standard Deviation	0.99	0.58	0.96	1.41	0.00	-	2.12	1.89	0.64
	2	Guarantee the safety of autonomous ships	Characterisation	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Strongly Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
			Mean	3.4	3.4	2.5	4.5	3.0	3.0	2.5	2.8	3.8
			Median	4	3	3	5	3	3	3	3	4
			Standard Deviation	1.32	0.74	1.29	0.71	0.00	-	2.12	2.06	1.11

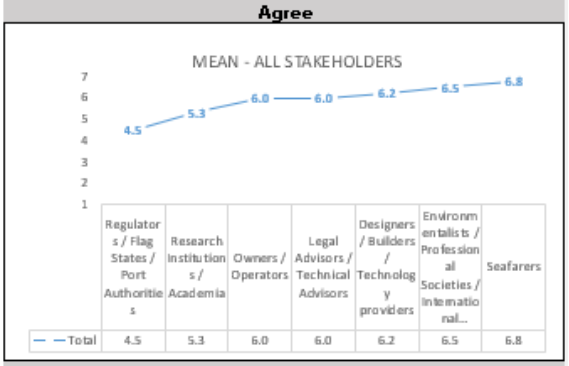
#	#	QUESTIONS	METRICS	STAKEHOLDERS								
				ALL	Groups	Designers	Environmentalists	Legal Advisors	Owners	Regulators	Seafarers	Research Institutions
						Builders	Professional Societies	Technical Advisors	Operators	Flag States		
						Technology Providers	International Organisations			Port Authorities		Academia
Q10	3	Cover the infrastructure costs in port adaptation for autonomous ships	Characterisation	Agree	Agree	Agree	Neither Agree nor Disagree	Agree	Strongly Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
			Mean	3.6	3.6	3.5	3.0	4.0	5.0	2.5	2.8	3.9
			Median	4	4	4	3	4	5	3	3	4
			Standard Deviation	1.06	0.86	0.58	1.41	0.00	-	2.12	1.71	0.76
	4	Cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships	Characterisation	Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Neither Agree nor Disagree	Neither Agree nor Disagree	Agree
			Mean	3.5	3.5	2.8	3.0	4.0	5.0	2.5	2.5	3.9
			Median	4	3	3	3	4	5	3	3	4
			Standard Deviation	1.12	0.94	0.96	1.41	0.00	-	2.12	1.29	0.83

APPENDIX H – (SURVEY NO. 2) MEAN DIAGRAMS PER SUB-QUESTION

Q2. In my opinion, there is a need for the transition from the conventional to the autonomous shipping

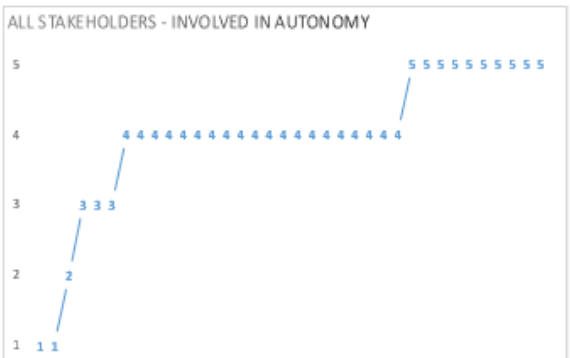


MEAN 5.7
Agree

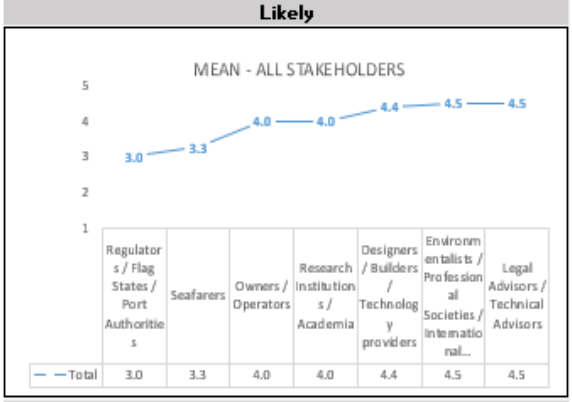


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q3.1 Which would be the benefits from the transition to autonomous shipping?: Financial benefits (reduced fuel consumption, optimized routing, reduced manning cost etc.)

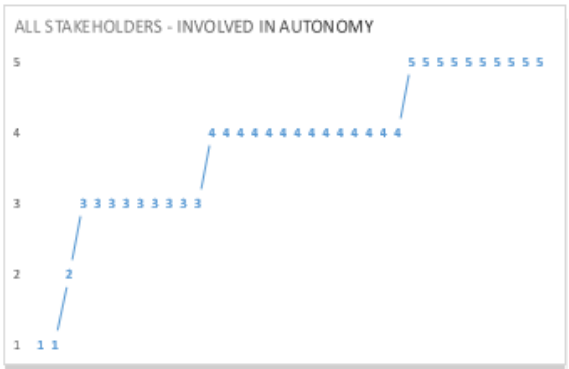


MEAN 4.0
Likely

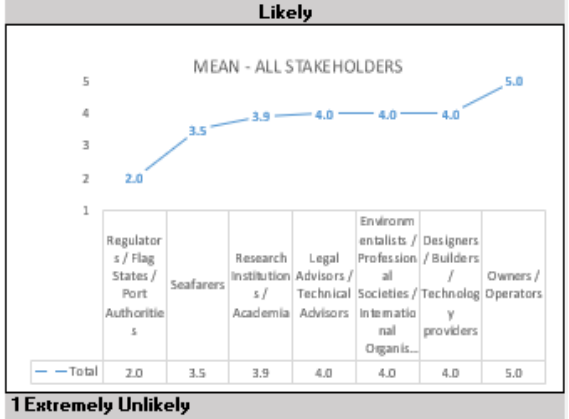


1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

Q3.2 Which would be the benefits from the transition to autonomous shipping?: Environmental benefits (reduced environmental footprint)

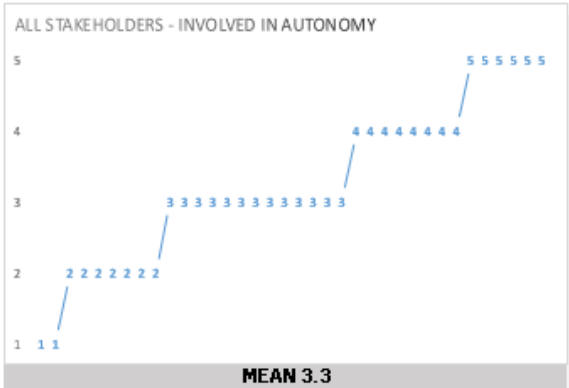


MEAN 3.8
Likely

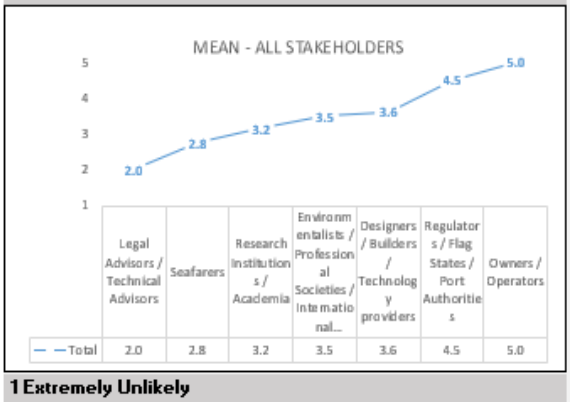


1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

Q3.3 Which would be the benefits from the transition to autonomous shipping?: Social benefits (increased job opportunities onshore - especially for women, better working conditions for seafarers)

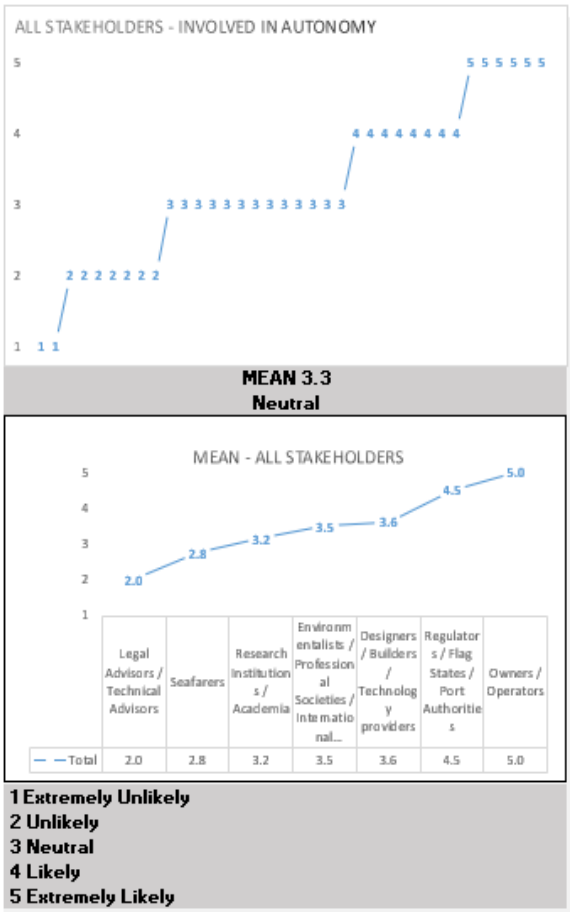


MEAN 3.3
Neutral



1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

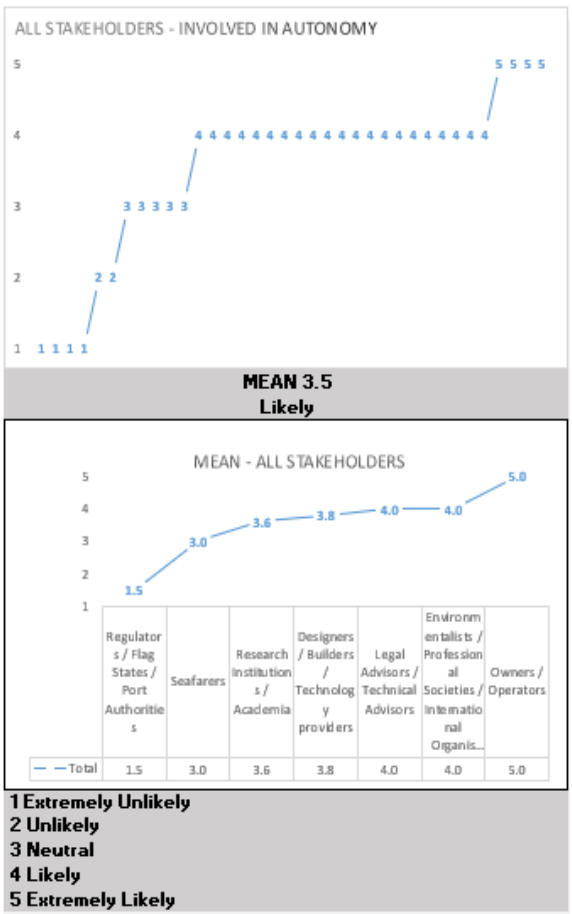
Q3.4 Which would be the benefits from the transition to autonomous shipping?: Increased safety (due to system automation)



MEAN 3.3
Neutral

1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

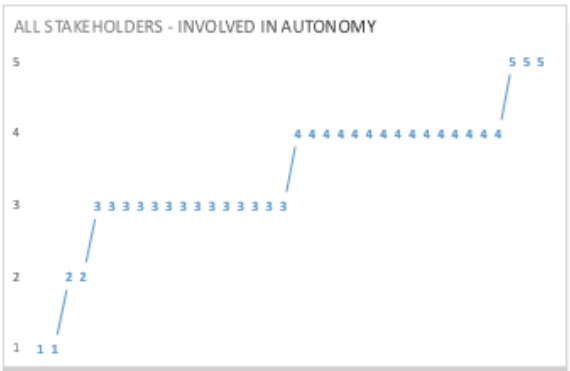
Q3.5 Which would be the benefits from the transition to autonomous shipping?: Added resilience in case of major worldwide disruptions (diseases, wars, piracy...)



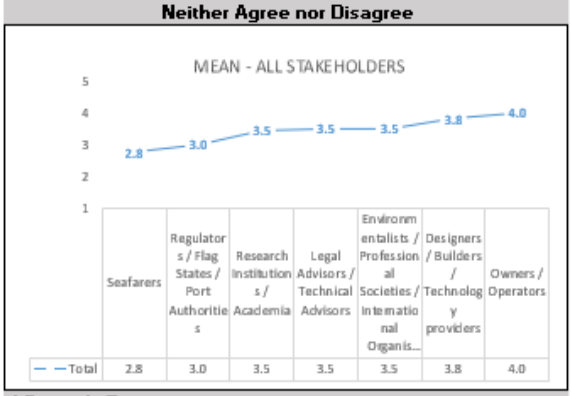
MEAN 3.5
Likely

1 Extremely Unlikely
2 Unlikely
3 Neutral
4 Likely
5 Extremely Likely

Q4.1 How would the transition to autonomous shipping impact the shipping industry?: Increase the income

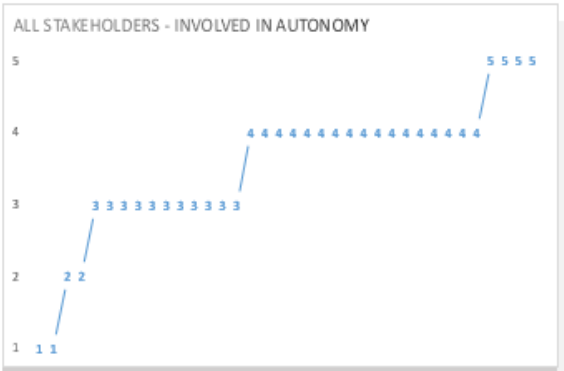


MEAN 3.4
Neither Agree nor Disagree

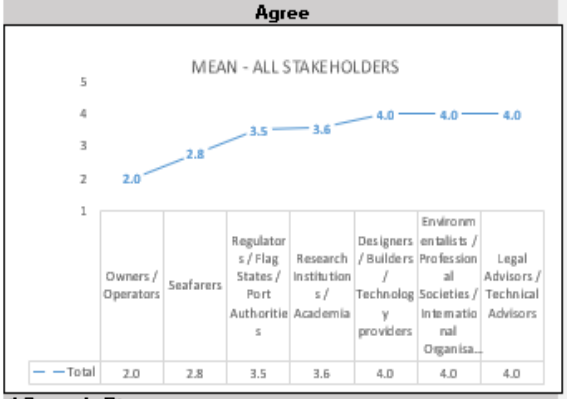


1 Strongly Disagree
2 Disagree
3 Neither Agree nor Disagree
4 Agree
5 Strongly Agree

Q4.2 How would the transition to autonomous shipping impact the shipping industry?: Increase the profitability

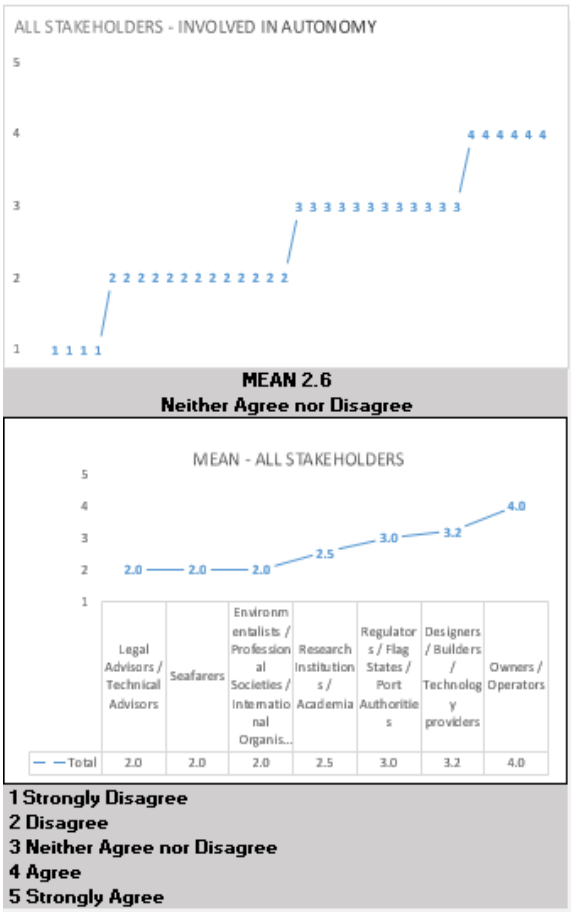


MEAN 3.5
Agree

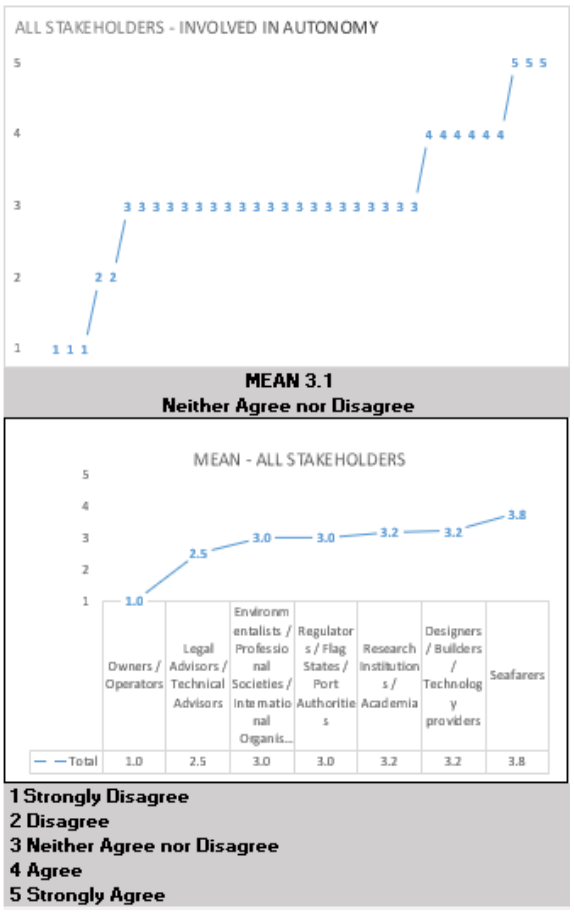


1 Strongly Disagree
2 Disagree
3 Neither Agree nor Disagree
4 Agree
5 Strongly Agree

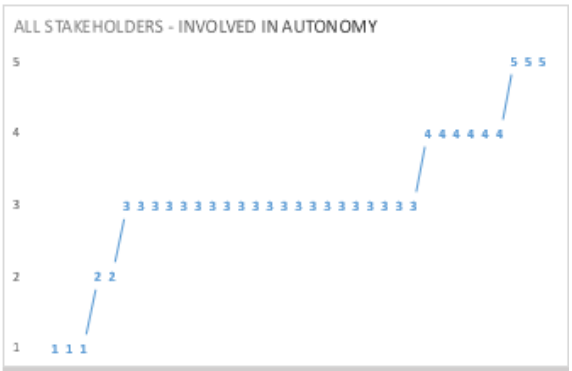
Q4.3 How would the transition to autonomous shipping impact the shipping industry?: Increase the number of employees



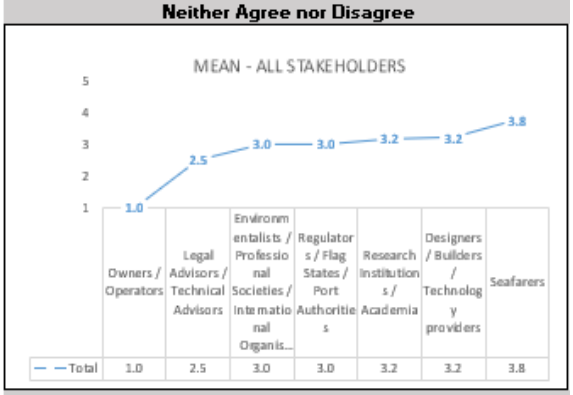
Q4.4 How would the transition to autonomous shipping impact the shipping industry?: Improve the access to financing (easier access to loans)



Q4.5 How would the transition to autonomous shipping impact the shipping industry?: Improve crisis resilience (reduce the risk of company exposure to disturbance in the market)

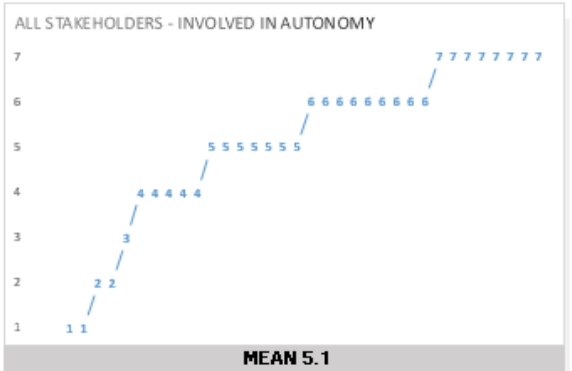


MEAN 3.1
Neither Agree nor Disagree

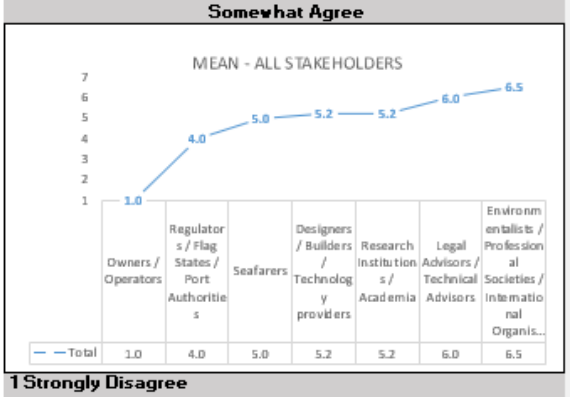


1 Strongly Disagree
2 Disagree
3 Neither Agree nor Disagree
4 Agree
5 Strongly Agree

Q5.1 I expect the autonomous shipping will be a viable option for the following shipping sectors: Ocean-going vessels

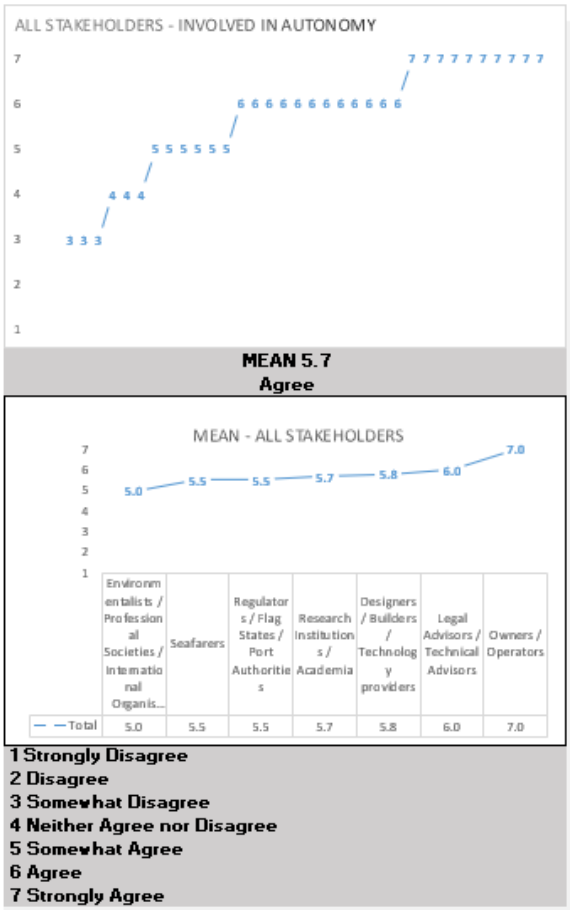


MEAN 5.1
Somewhat Agree

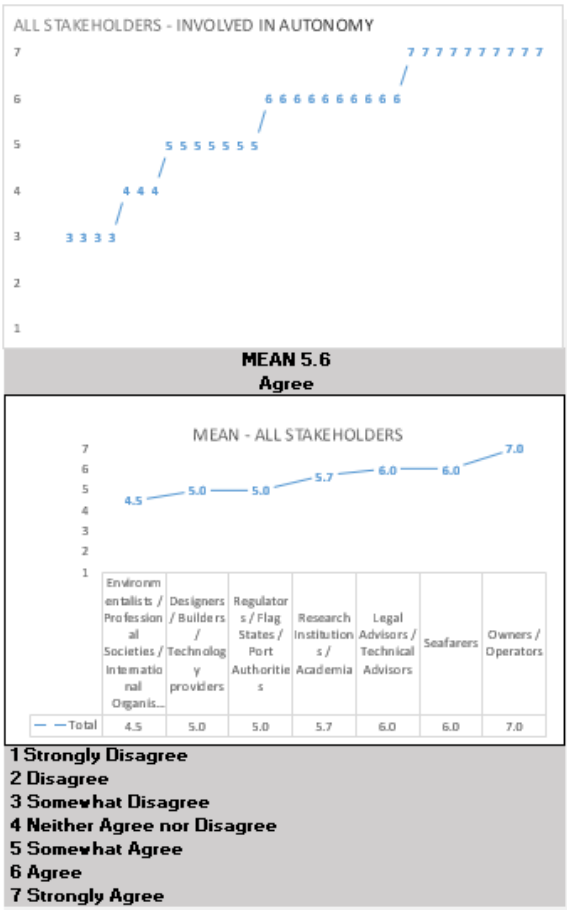


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

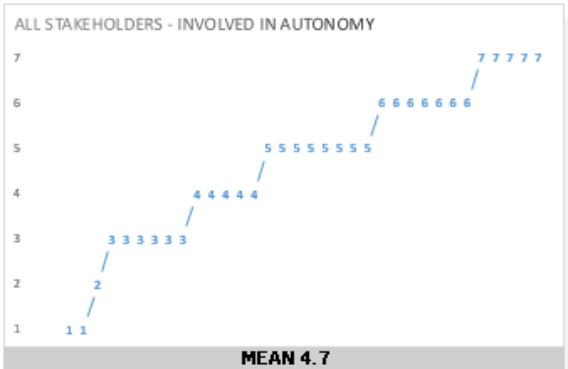
Q5.2 I expect the autonomous shipping will be a viable option for the following shipping sectors: Short-sea shipping



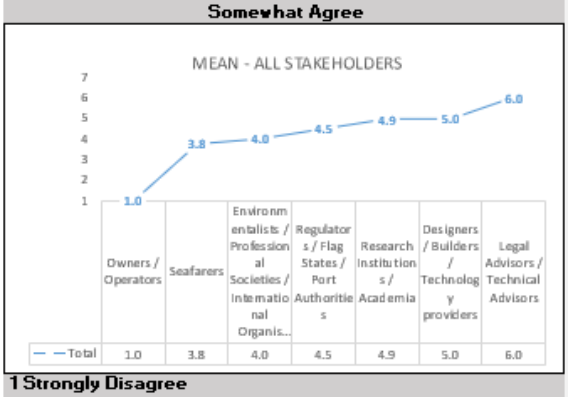
Q5.3 I expect the autonomous shipping will be a viable option for the following shipping sectors: Inland shipping



Q5.4 I expect the autonomous shipping will be a viable option for the following shipping sectors: Working ships (tugs, dredgers)

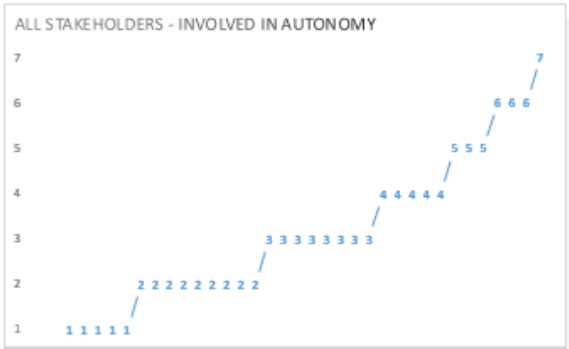


MEAN 4.7
Somewhat Agree

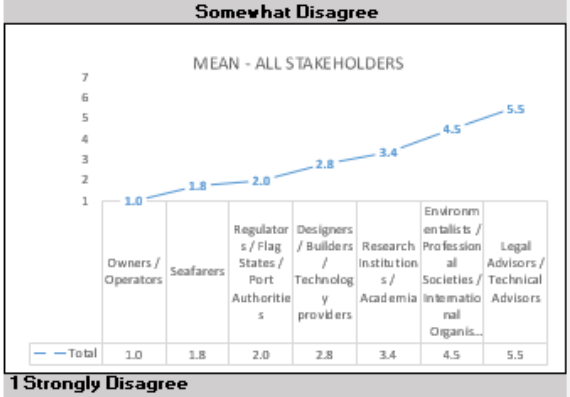


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q5.5 I expect the autonomous shipping will be a viable option for the following shipping sectors: Cruisers

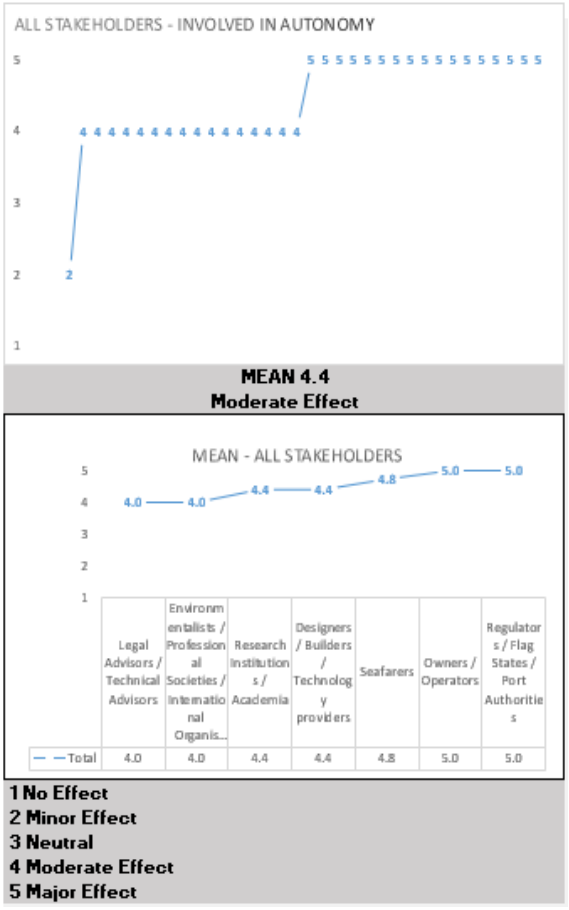


MEAN 3.1
Somewhat Disagree

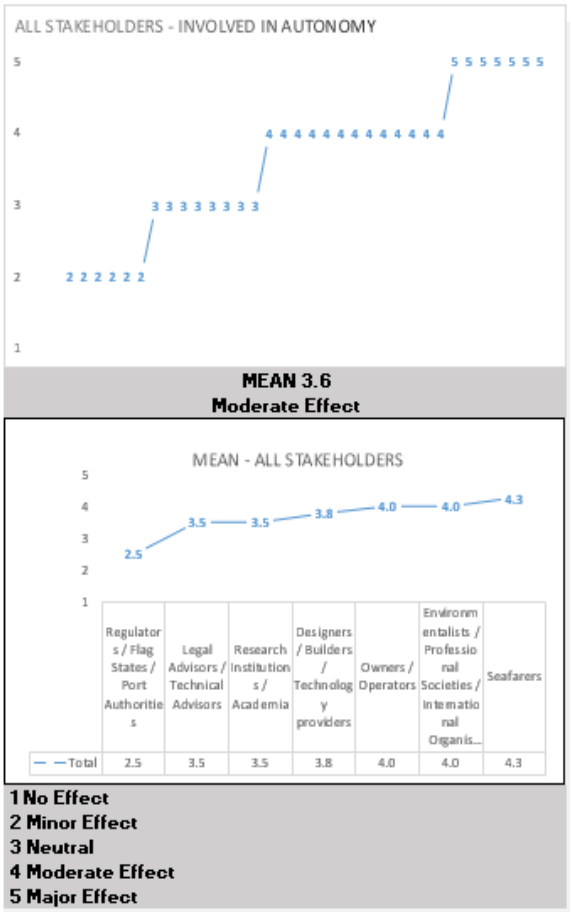


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

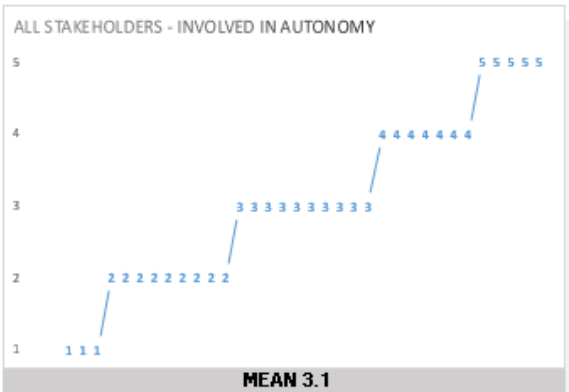
Q7.1 Please assess the impact of the following barriers to the transition to autonomous shipping: Regulatory barriers (ships will not be allowed to sail until new regulations have been implemented)



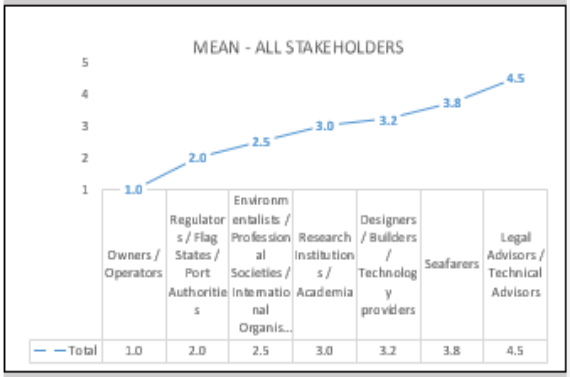
Q7.2 Please assess the impact of the following barriers to the transition to autonomous shipping: Technological limitations (technology not mature)



Q7.3 Please assess the impact of the following barriers to the transition to autonomous shipping: Social limitations (lack of expert skills)

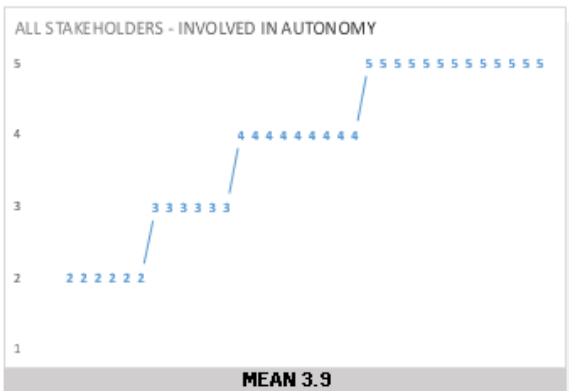


MEAN 3.1
Neutral

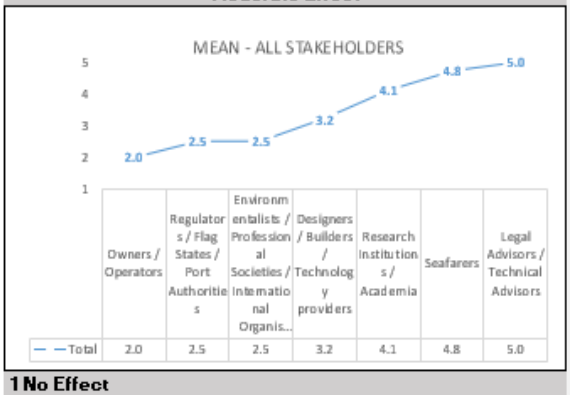


1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

Q7.4 Please assess the impact of the following barriers to the transition to autonomous shipping: Safety and security issues

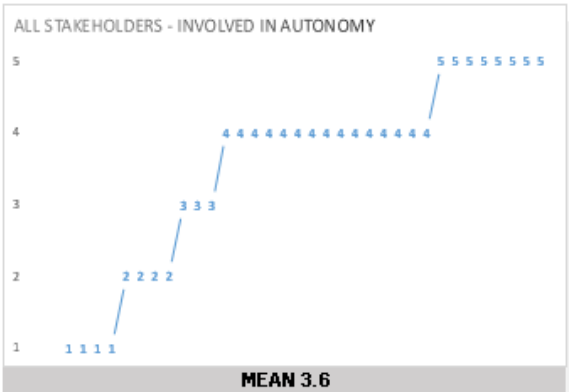


MEAN 3.9
Moderate Effect

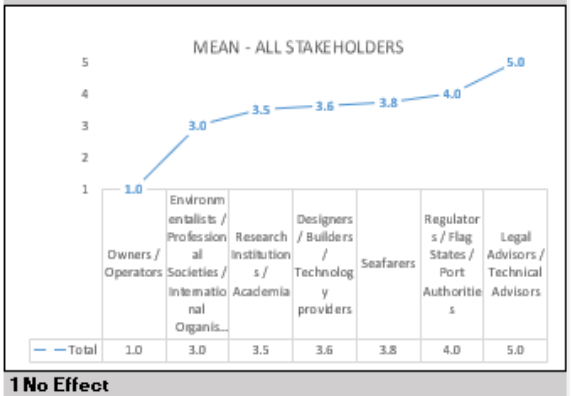


1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

Q7.5 Please assess the impact of the following barriers to the transition to autonomous shipping: Economic barriers (a question of profitability)

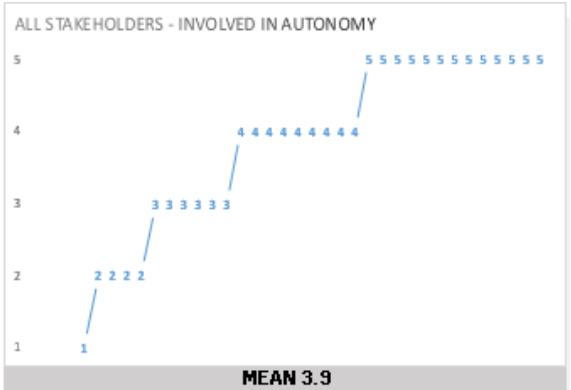


MEAN 3.6
Moderate Effect

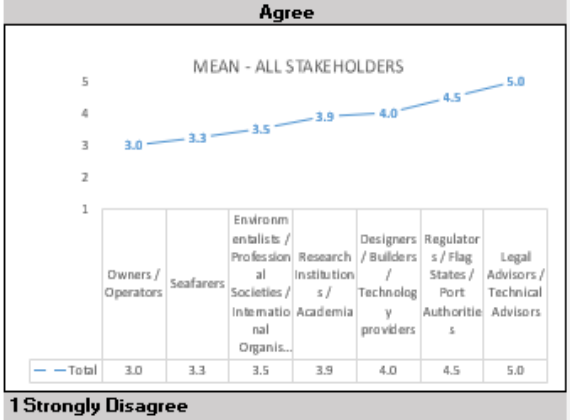


1 No Effect
2 Minor Effect
3 Neutral
4 Moderate Effect
5 Major Effect

Q8.1 What do you think which are the biggest challenges for the development of autonomous shipping?: Investment cost

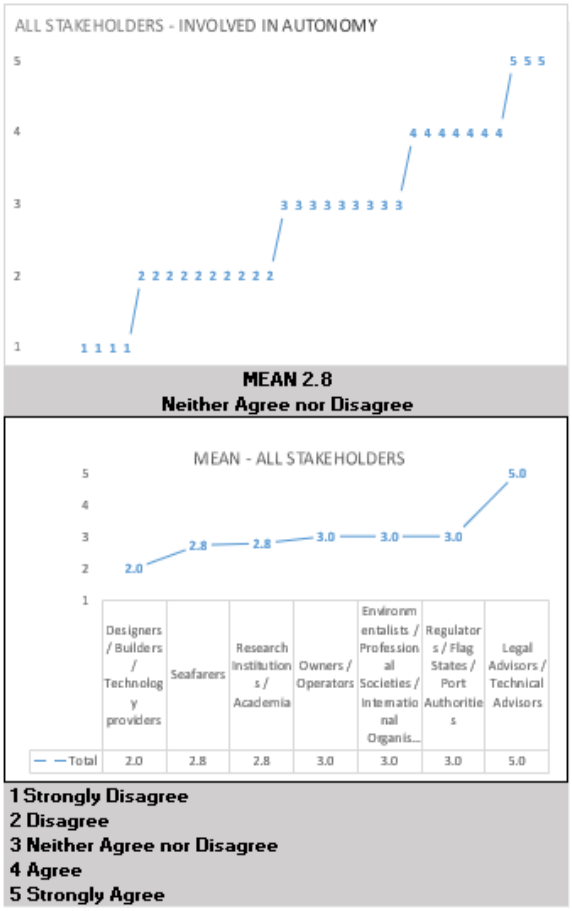


MEAN 3.9
Agree

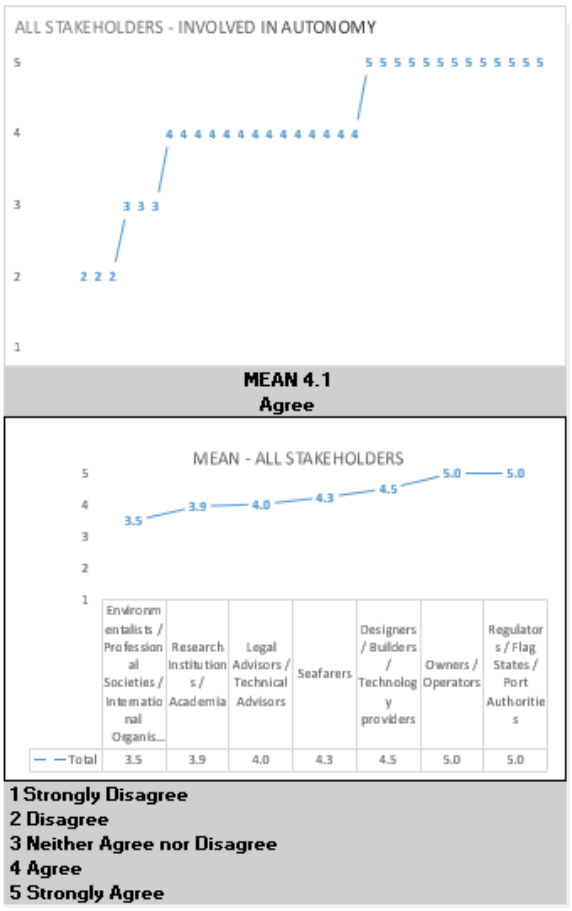


1 Strongly Disagree
2 Disagree
3 Neither Agree nor Disagree
4 Agree
5 Strongly Agree

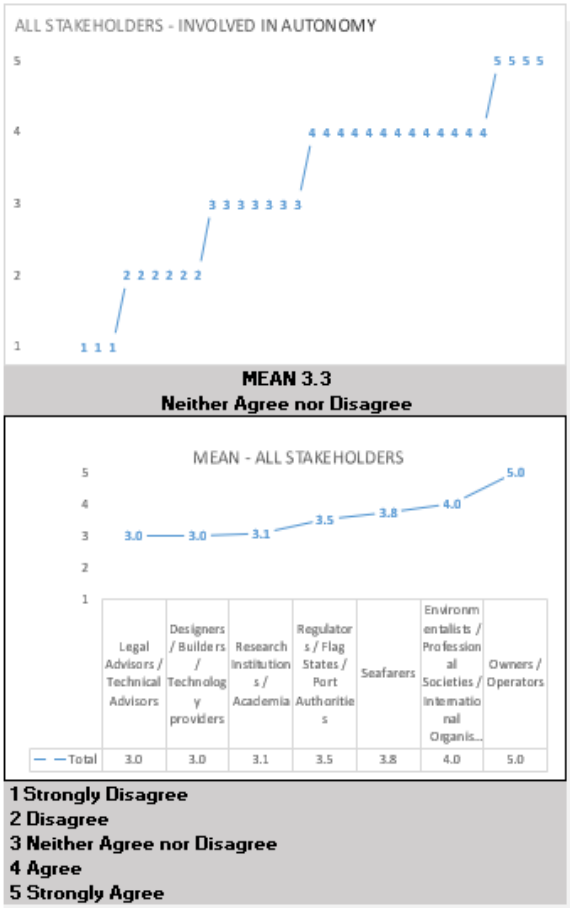
Q8.2 What do you think which are the biggest challenges for the development of autonomous shipping?: Operational costs



Q8.3 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of regulations



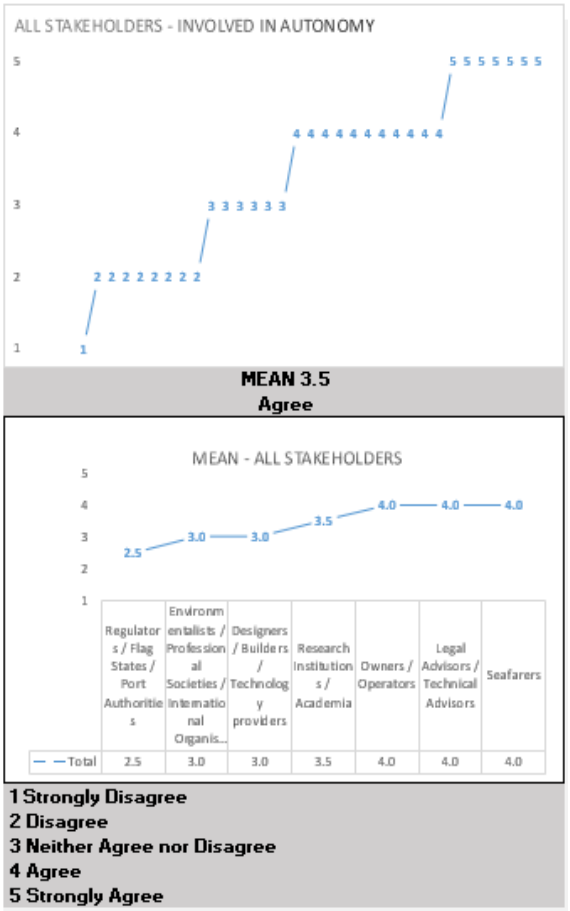
Q8.4 What do you think which are the biggest challenges for the development of autonomous shipping?: Political issues



MEAN 3.3
Neither Agree nor Disagree

1 Strongly Disagree
2 Disagree
3 Neither Agree nor Disagree
4 Agree
5 Strongly Agree

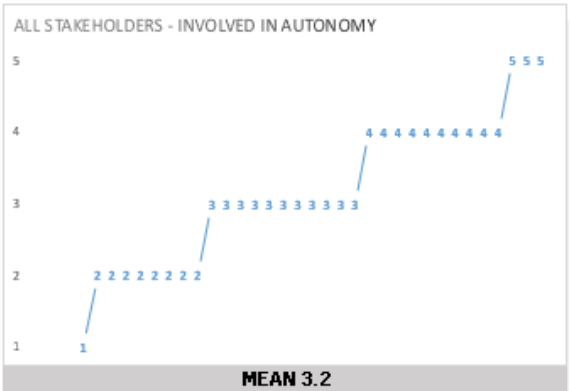
Q8.5 What do you think which are the biggest challenges for the development of autonomous shipping?: Technology maturity



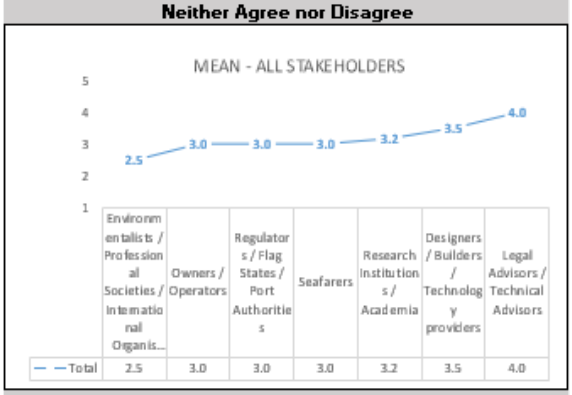
MEAN 3.5
Agree

1 Strongly Disagree
2 Disagree
3 Neither Agree nor Disagree
4 Agree
5 Strongly Agree

Q8.6 What do you think which are the biggest challenges for the development of autonomous shipping?: Lack of qualified workforce

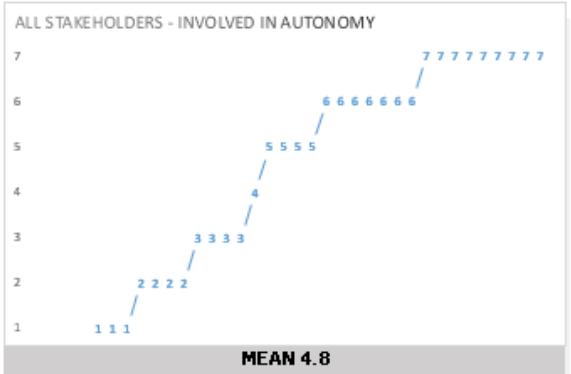


MEAN 3.2
Neither Agree nor Disagree

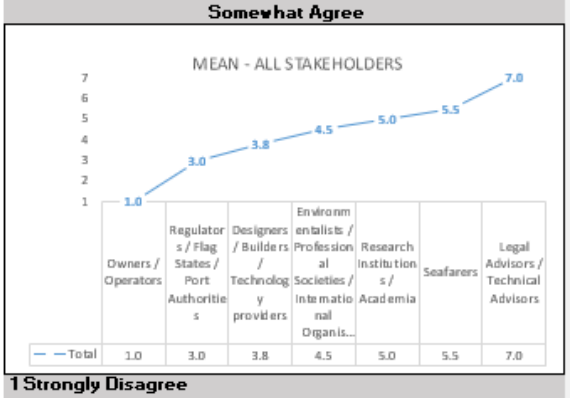


1 Strongly Disagree
2 Disagree
3 Neither Agree nor Disagree
4 Agree
5 Strongly Agree

Q9.1 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Autonomous navigation (e.g. collision avoidance)

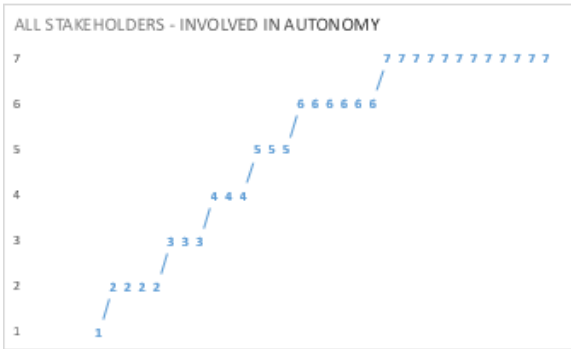


MEAN 4.8
Somewhat Agree

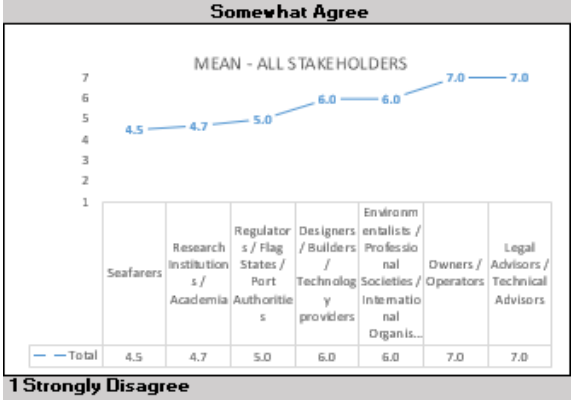


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q9.2 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Communication with the ship (including cyber-security issues and piracy)

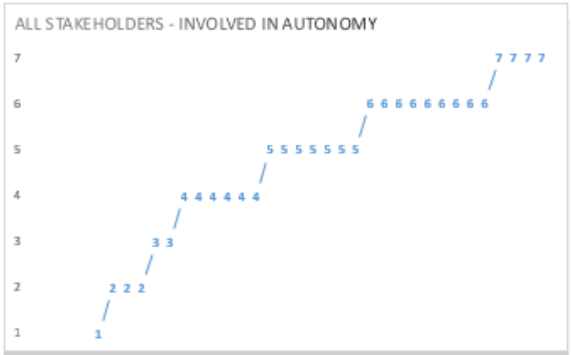


MEAN 5.2
Somewhat Agree

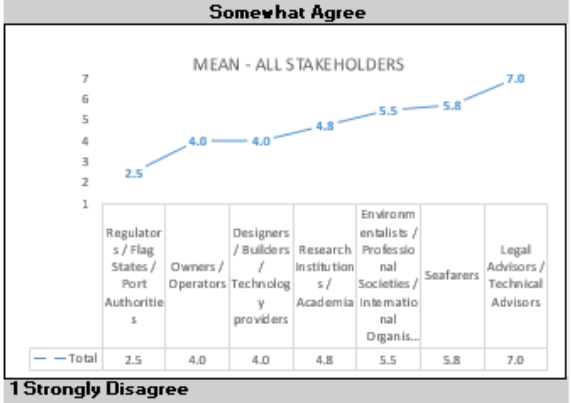


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q9.3 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Remote control centres (lack of operational experience)

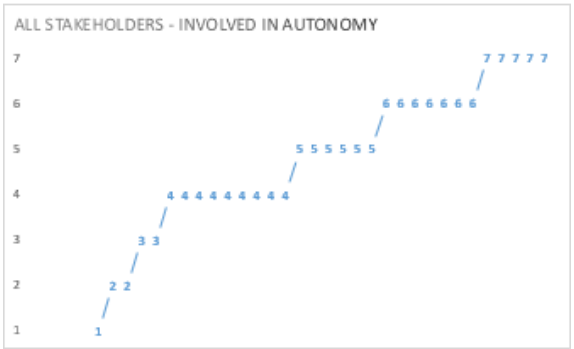


MEAN 4.8
Somewhat Agree

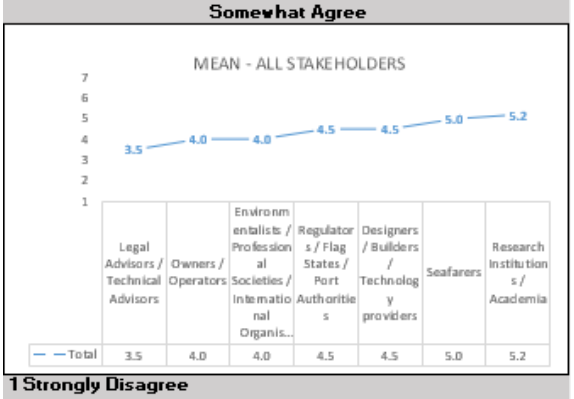


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q9.4 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: There are no procedures for testing, verification and validation

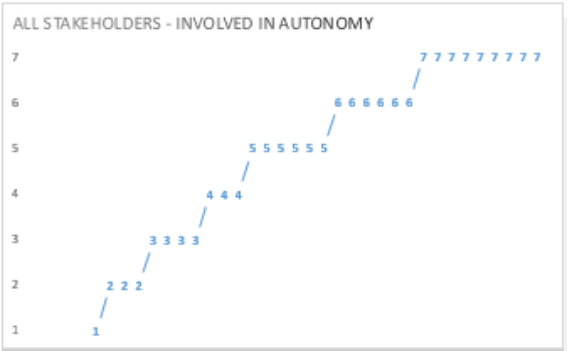


MEAN 4.8
Somewhat Agree

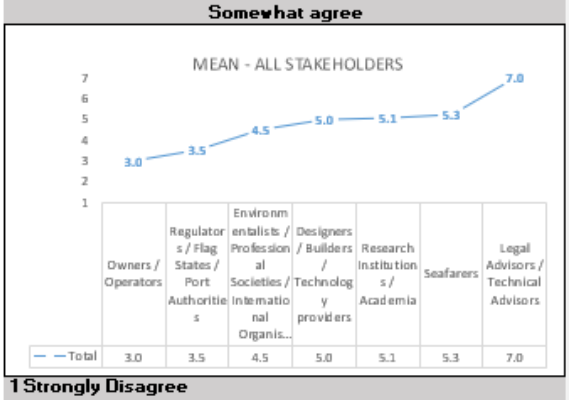


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

Q9.5 Which technical limitations do you consider to be the biggest challenge when designing and operating autonomous ships?: Ship reliability and maintenance/repair requirements, especially during long voyages

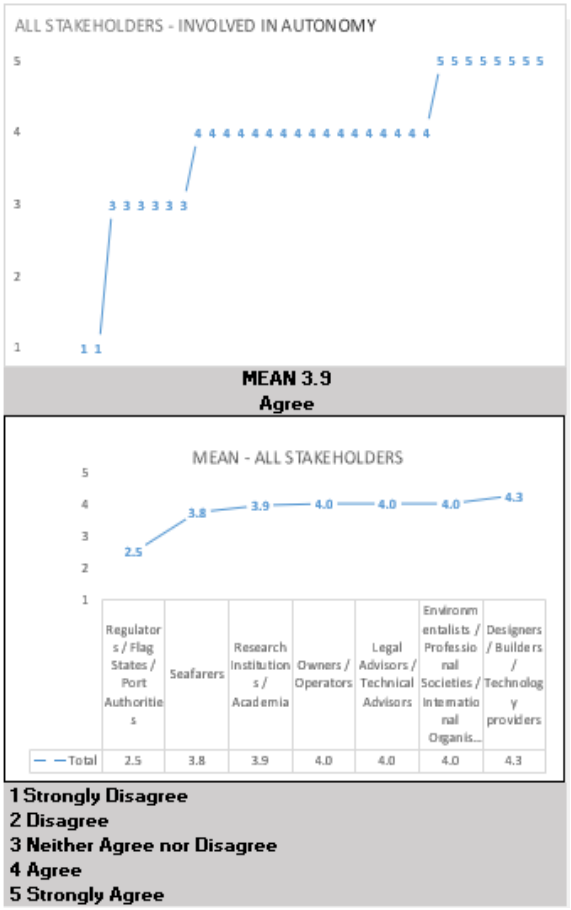


MEAN 5.0
Somewhat agree

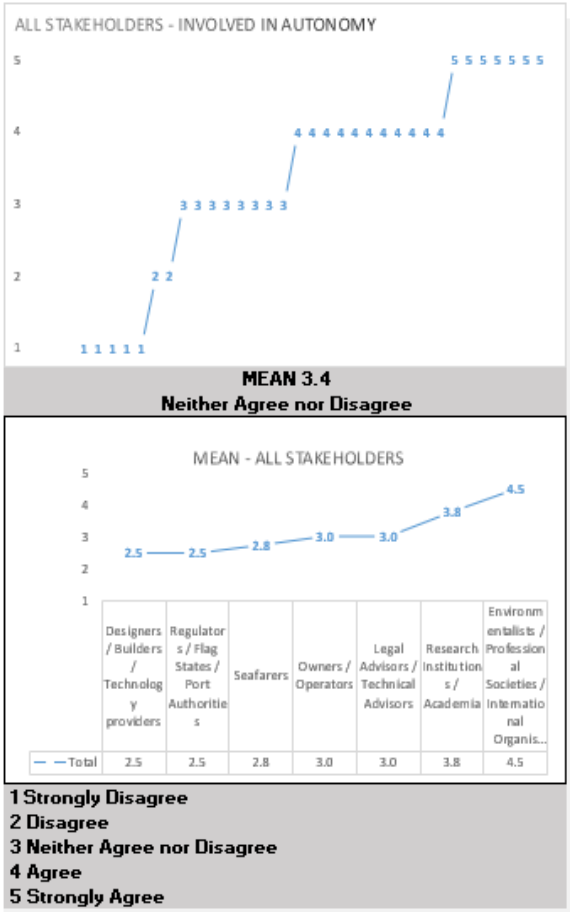


1 Strongly Disagree
2 Disagree
3 Somewhat Disagree
4 Neither Agree nor Disagree
5 Somewhat Agree
6 Agree
7 Strongly Agree

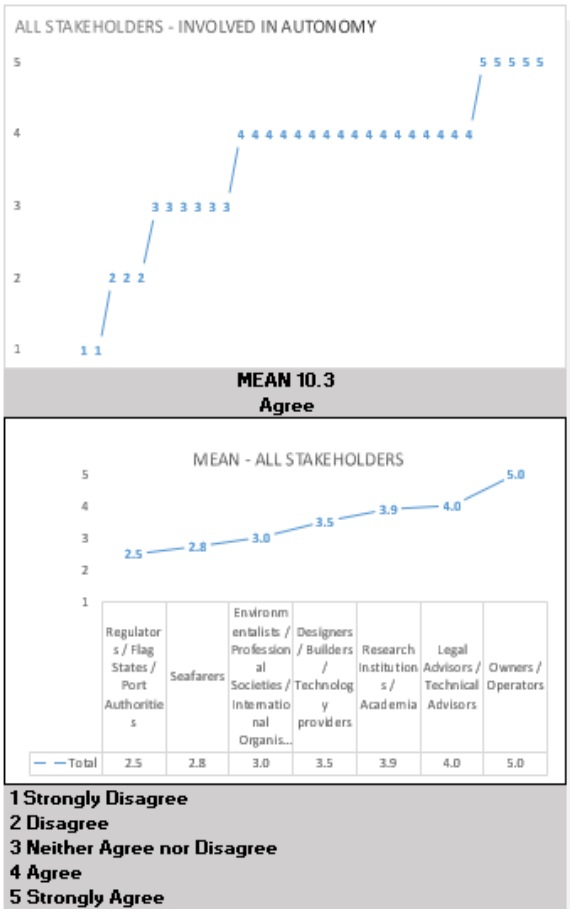
Q10.1 The role of governments: Provide financial incentives to support the transition process to autonomous shipping



Q10.2 The role of governments: Guarantee the safety of autonomous ships



Q10.3 The role of governments: Cover the infrastructure costs in port adaptation for autonomous ships



Q10.4 The role of governments: Cover the infrastructure costs in inland waterway infrastructure adaptation for autonomous ships