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Individual Report of the International Mobilisation and Mutual Learning workshop R2

CNTI & XPRO

Larnaca

Cyprus

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MML WORKSHOP	DETAILS
Date	*11/04/2018*
Duration	09:00 to 17:00
Location	Cyprus, Larnaca
Title of workshop in English	What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030?
Title of workshop in native language	
Marine challenge that the workshop has tackled	Marine Transportation
Number of participants	14
Type of workshop (local or international)	International
Round (*first or second*)	Second
Selected methodology (*Focus Group, World Café, Science Café, Delphi, Structured Democratic Dialogue Process, Future Search, etc.*)	Structured Democratic Dialogue
Language of the workshop	English
Name of the organizing institution	CNTI
Name of the person in charge	Andreas Andreou
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2 Purpose of the report

The purpose of this report is to describe the International Mobilisation and Mutual Learning (MML) workshop "What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030?" which was hosted by CNTI and XPRO in Larnaca, Cyprus on 11th April 2018. The workshop addressed Responsible Research and Innovation (RRI) actions that should be put in place to enable the maritime industry to become resilient, responsible and sustainable in Cyprus and across Europe.

The report describes the results of the workshop and the feedback by the participants. It includes a general outline and international background of the MARINA pan-European MML process of stakeholder engagement in marine and maritime issues and Responsible Research and Innovation; the facilitation methodology; the participant recruitment and the follow-up actions.

The results of the workshop will provide input for the roadmap of Responsible Research and Innovation good practice as well as recommendations about embedding the RRI in the policy-making processes. They will be assembled with the outputs of other local and international MML workshops in a comprehensive report that will be submitted to the Directorate-General for Research and Innovation of the European Commission. Furthermore, the results of the workshop will be used for extracting lessons learned and identifying best practices for the MARINA RRI Roadmap.

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3   Executive Summary

The international Mobilisation and Mutual Learning (MML) workshop "What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030?" was organized by the MARINA partners CNTI and XPRO Consulting Limited with the support of the Maritime Institute of Eastern Mediterranean and the Municipality of Larnaca. The workshop was held on 11th April 2018 at the House of Arts and Literature in Larnaca, Cyprus.

The participants of the workshop discussed, in the perspective of the Responsible Research and Innovation approach, the development of a maritime industry in Cyprus and across Europe, which will be characterised by resilience, responsibility and sustainability. To facilitate this process, a Triggering Question was formulated as "What Responsible Research and Innovation (RRI) actions are needed for a resilient, responsible and sustainable maritime sector by 2030?". The Triggering Question was used and communicated with the participants prior to the implementation of the workshop. In response to it, they put forth proposals of participatory RRI-driven actions.

The main conclusions of the workshop could be summarised as follows:

1. Collaboration between policy makers, the academia and the industry is essential in order to (a) develop lesiglations to govern marine activities, (b) indicate the societal and industrial needs (c) produce results, products and technologies which are aligned with the needs of the industry.
2. Exploitation of the new technologies and the internet in order to develop tools, which foster open access to data, and raise awareness among the stakeholders about the marine environment.
3. Creation of physical infrastructure to host scientists is pivotal for the development of marine RTDI in Cyprus.
4. Introduction of marine related courses in all levels of the educational system, from primary school to Universities is urgent to cultivate marine culture among the citizens.
5. Establishment of funding schemes deriving from national and European funds to assist new research and start-up initiatives.

Responsible Research and Innovation (RRI) implies a transparent and interactive process where societal actors and innovators actively collaborate to co-create solutions, services and products that are socially acceptable, sustainable and resolve important societal issues. RRI focuses on how to make research and innovation more useful to the society and how to protect the environment at the same time. Regarding how Responsible Reseearch and Innovation (RRI) and its dimensions may enable maritime sector research and innovation actions, the actions focused on the following dimensions:

> Governance was the most common dimension that appeared in 30 actions, to be followed closely by Science Education (29 actions) and Public Engagement (23 actions). Ethics was related to 20 actions while Open Access and Gender Equality were connected with 18 actions and 6 actions respectively.

The event was held in the framework of the MARINA project and was part of the Mobilisation and Mutual Learning process composed of two phases of workshops at local and international levels. The workshops have been engaging European citizens, civil society, businesses, researchers and policy-makers in a participatory debate to examine how Responsible Research and Innovation can help to overcome the current marine societal challenges and unlock the potential for Blue Growth in marine and coastal areas of the European Union.

The daylong workshop was facilitated according to the Structured Democratic Dialogue methodology. This method allows for integrating contributions from individuals with diverse views, backgrounds and perspectives through a process that is structured, inclusive and collaborative. Fourteen participants were recruited based on their expertise and interest in maritime transportation and responsible research and innovation.

During the workshop, the participants produced a total number of 45 Responsible Research and Innovation actions and developed a roadmap of how the maritime industry could be resilient, responsible and sustainable. Furthermore, the participants related their actions to the RRI dimensions in priority order.

The workshop was video-recorded by CNTI. The video was not broadcasted but instead it is stored in the CNTI archives and explanations of the actions can be found on the digital dialogue of the workshop on the Idea Prism App as well as on the MARINA platform.

4 Engaging societal actors in Responsible Research and Innovation for smart sustainable and inclusive Blue Growth in Europe

4.1 Mobilisation and Mutual Learning Workshops

The local workshop "What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030?" (workshop information on the MARINA website) was held in the framework of the MARINA project. It was organised by Cyprus Neuroscience & Technology Institute (CNTI) and XPRO Consulting Limited (XPRO) in Larnaca, Cyprus on 11th April 2018. The worshop has been part of the second round of the Mobilisation and Mutual Learning Process composed of two phases of workshops at local and international levels and connected to the international Responsible Research and Innovation practitioner and policy-maker event. The process can be illustrated as follows:

Local MML workshops	International MML workshops	International RRI practitioner and policy maker workshop	Local MML workshops	International MML workshops	International RRI practitioner and policy maker workshops	High level policy conference

Figure 1 MARINA Mobilisation and Mutual Learning process

The workshop:

1. Engaged European societal actors in a multi-actor dialogue and in co-creating a participatory roadmap of actions for tackling the marine societal challenge of marine transportation and based on Responsible and Innovation principles;
2. Started the process of federating Civil Society Organisations (CSOs), citizens, businesses, industry, research, policy-makers and communicators face-to-face and on-line;
3. Set in motion inclusive mechanisms for sharing knowledge and best practice, building common understanding and co-creating solutions to marine societal challenges and based them on the principles of Responsible Research and Innovation;
4. Facilitated federation of communities and networks on the MARINA digital platform.

4.2 How can Responsible Research and Innovation ensure a smart, sustainable and inclusive Blue Growth in Europe?

Europe is facing "innovation emergency": it spends 0.8% of GDP less than the USA and 1.5% less than Japan on Research & Development (R&D) every year. Thousands of European best researchers and innovators have moved to countries where conditions are more favorable[1], despite the support by the European Union to foster research and innovation in terms of networking, funding[2], social business, start-up, dissemination and incubation[3]. Therefore, in 2018, the European Commission will increase the support of smart and inclusive growth with €76.5 billion in commitments and €66.4 billion in payments, i.e. up by 2.1% and 17.5% respectively compared to 2017.

Seas and oceans are drivers of the European economy and have great potential for innovation and growth. They can contribute to achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth.

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[1] http://ec.europa.eu/research/innovation-union
[2] Employment and Social Innovation Programme, Horizon 2020, SME Instrument, Collective Awareness Platforms, EU structural and investment funds - Guide to Social Innovation. Social Challenges Platform.
[3] https://ec.europa.eu/growth/industry/innovation/policy/social_it

Accordingly, the European Union has set out the Blue Growth[4] long-term strategy to support sustainable development in the marine and maritime sectors in Europe. This strategy aims to boost growth in areas such as aquaculture, coastal tourism, marine biotechnology, ocean energy and seabed mining. It puts forward three priorities to make Europe a smarter, more sustainable and more inclusive place to live:

- Smart growth, through the development of an economy based on knowledge, research and innovation;
- Sustainable growth, through the promotion of resource-efficient, green and competitive markets;
- Inclusive growth, through policies aimed at fostering job creation and poverty reduction[5].

At a global level, in the 2030 Agenda for Sustainable Development, social challenges are a priority for a sustainable growth[6].

Responsible Research and Innovation is a key cross-cutting instrument to reach these goals, an investment for our future. In practice, it is implemented as a package that includes multi-actor and public engagement in research and inovation, thanks to open access to scientific results, formal and informal science education and the take up of gender and ethics in the research and innovation content and process.

Responsible Research and Innovation (RRI) is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (Von Schomberg, 2011). The European Commission distinguishes 6 key dimensions of RRI: Public Engagement, Science Education, Open Access, Gender Equality, Governance and Ethics.[7]

Public and multistakeholder engagement is a societal commitment to provide encouragement, opportunities and competencies that will empower citizens and civil society organisations to participate in research and innovation. It is also about bringing together a diversity of actors from research community, policy-making, business and industry, who would not normally interact with each other, on matters of science and technology.[8]

Science Education aims at increasing society's appetite for innovation and interest in science, in particular among young people with a special emphasis on girls. It encourages innovative pedagogies to teach science, the involvement of institutions that organize such activities, promotes RRI in higher education curricula and eases access to scientific careers.[9]

Open access and open science intend to make research findings, data, scientific publications and information available free of charge for anyone.

Gender Equality aims at removing barriers that generate discrimination against women in scientific careers and decison-making. It fosters gender balance in research teams and integrates a gender dimension in research and innovation content in order to improve the scientific quality and societal relevance of the produced knowledge, technology and innovation.[10]

Ethics is given the highest priority in the European Union funded research and innovation. It implies the application of fundamental ethical principles and legislation to scientific research and innovation in all possible domains and includes the avoidance of any breach of research integrity and ethics dumping.[11]

Governance is the umbrella for all other dimensions. It addresses the responsibility of policy makers to prevent harmful or unethical developments in research and innovation and developing harmonious models for Responsible Research and Innovation that integrate Public and multistakeholder Engagement, Science Education, Open Access, Gender Equality and Ethics. [12]

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[4] https://ec.europa.eu/maritimeaffairs/policy/blue_growth_en
[5] http://ec.europa.eu/eurostat/statistics-explained/index.php/Smarter,_greener,_more_inclusive_-_indicators_to_support_the_Europe_2020_strategy
[6] "Sustained, inclusive and sustainable economic growth is essential for prosperity. […] We will work to build dynamic, sustainable, innovative and people-centred economies, promoting youth employment and women's economic empowerment, in particular, and decent work for all."
[7] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation
[8] https://ec.europa.eu/programmes/horizon2020/node/766
[9] https://ec.europa.eu/programmes/horizon2020/node/795
[10] https://ec.europa.eu/programmes/horizon2020/node/797
[11] https://ec.europa.eu/programmes/horizon2020/node/767
[12] https://ec.europa.eu/research/swafs/pdf/pub_public_engagement/responsible-research-and-innovation-leaflet_en.pdf

The Blue Growth strategy reflects policy priorities. It aims at bringing together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities by addressing the following challenges:

- Health, demographic change and wellbeing;
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy;
- Secure, clean and efficient energy;
- Smart, green and integrated transport;
- Climate action, environment, resource efficiency and raw materials;
- Europe in a changing world - inclusive, innovative and reflective societies;
- Secure societies - protecting freedom and security of Europe and its citizens.

4.3   The MARINA workshops and Sustainable Development Goals

The European Union's response to the 2030 agenda of the United Nations Organisation is "The new European consensus on development of 'our world, our dignity, our future". The document highlights that "the EU and its Member States will integrate the respect of human rights, democracy, the rule of law and gender equality into their political dialogue" and that "sustainable development requires a holistic and cross-sector policy approach and is ultimately an issue of governance which needs to be pursued in partnership with all stakeholders and on all levels"[13]. Accordingly, the topics addressed at the MARINA workshops have been related to Sustainable Development Goals [14]such as:

- SD Goal 1: End poverty in all its forms everywhere; [1 SEP]
- SD Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all;
- SD Goal 6: Ensure availability and sustainable management of water and sanitation for all;
- SD Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all;
- SD Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;
- SD Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;
- SD Goal 11: Make cities and human settlements safe, resilient and sustainable;
- SD Goal 12: Ensure sustainable consumption and production patterns;
- SD Goal 13: Take urgent action to combat climate change and its impacts;
- SD Goal 14: Conserve and sustainably use the oceans, seas and marine resources;
- SD Goal 17: Strengthen means of implementation and revitalise the global partnership for sustainable development.

4.4   The choice of the workshop marine topic

The marine challenges and the topics of the workshops in the second round stemmed from international and national agendas. They have been: marine biotechnologies, sea transportation, deep-sea mining, renewable energy (wind, wave and tidal) and marine changes caused by climate.

The participants of the workshop "What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030?" in Larnaca, Cyprus discussed the marine challenge of marine transportation in the perspective of Responsible Research and Innovation. The triggering question to address this issue was "What Responsible Research and Innovation (RRI) actions are needed for a resilient, responsible and sustainable maritime sector by 2030?" In response to it, they put forth proposals of participatory RRI–driven actions.

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13 https://ec.europa.eu/europeaid/sites/devco/files/european-consensus-on-development-final-20170626_en.pdf
14 https://sustainabledevelopment.un.org

5 "What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030?"

5.1 The current situation

It is crucial to notice that Cyprus has the 11th largest merchant fleet globally and the 3rd largest fleet in the European Union. Under the Cyprus flag there are more than 1800 ocean-going vessels with 21 million tons of gross volume. The marine industry contributes with about €1 billion per year to the Cypriot economy, accounting for over 7% of GDP (including auxiliary services) and directly employing 4,000 shore-based personnel and 55,000 seafarers from around the world. Moreover, Cyprus and its Limassol Port is the 3rd largest third-party ship management centre in EU and the 5th largest in the world. It is estimated that 5% of the world's fleet and about 25% of global third-party ship management activities are controlled from Cyprus[15]. This means at an EU level, that if the third-party ship management centres of Europe, collaborate responsibly, they can become stronger at better face the global competition.

Positioning itself as the world leader in shipping, shipbuilding and marine equipment, it is unquestionable that the economic value of the European shipping industry is not negligible. Drawing from the results of the most recent study in this area (Oxford Economics 2017[16]), the European shipping industry offered employment positions to 640,000 people while contributed €57 billion to GPD as for the end of 2015.

The strategic position of Cyprus, as the only island in Eastern Mediterranean and the most eastern border of the European Union, has made it a maritime centre since antiquity. Today, it concentrates more than 130 third-party shipping management companies including the headquarters of many international players. The third-party ship management is a line of business that concentrates economies of scale facilitating the ship owners' responsibilities with services such as commercial operations, organising insurance, purchasing stores, technical maintenance, crewing the ships, as well as regulatory assistance. Competition between Ship Management companies is strong and this encourages research and innovation to stay competitive in the field. Furthermore, it requires a vast array of education specialisations, where universities and technical higher education establishments must train a highly skilled workforce[17]. Therefore, science education and open access to research results are becoming important.

A large number of ship-owning, ship-management, chartering and shipping related companies maintain well-developed offices and conduct their international activities from Cyprus. The vast majority of these companies are located in Limassol and are Members of the Cyprus Shipping Chamber. It is not surprising that the headquarters of some of the largest ship-management companies in the world, such as COLUMBIA Shipmanagement Ltd. and Bernhard Schulte Shipmanagement (Cyprus) Ltd., are located in Limassol where they also run their operations. It is estimated that approximately 5% of the world's fleet is managed from Cyprus. Among the ship-owning and ship-management companies established and operating from Cyprus, 90% are controlled by European and Cypriot interests[18].

However, the development of a maritime related industry in Cyprus and across Europe comes with a joint set of challenges and barriers which call for an immediate proactive response in order to allow the smooth, responsible and sustainable expansion of the field. The list of challenges includes but is not limited to the following which are described in detail in the following section: larger and larger vessels, robotics, piracy, exploitation of results.

The Mediterranean Sea is amongst the world's busiest waterways accounting for 15% of global shipping activity by number of calls and 10% by vessel deadweight tons5. Nowadays the size of ships has become enormous and the dimensions of the widest ships that sail in the Eastern Mediterranean are based for example on the width of the Suez Canal[19]. Cyprus can handle vessels up to 340m in length. The multipurpose Limassol port terminal handles almost 1 million tonnes of general cargo traffic and welcomes approximately 300,000 passengers per year.

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[15] http://www.cyprusprofile.com/en/sectors/maritime-and-shipping
[16] http://www.ecsa.eu/images/NEW_Position_Papers/2017-02-27-Oxford-Economics-Update-2017---FINAL.pdf
[17] https://www.maritimeinfo.org/en/Careers-Guide/ship-manager-2
[18] http://csc-cy.org/cyprus-a-leading-maritime-center/
[19] http://maritime-connector.com/wiki/ship-sizes/

Overall, the Limassol port currently services on the order of 3,200 ships per year, including container, general cargo, cruise, ro-ro (roll-on, roll-off) and naval ships, using three tugs[20].

The size of the vessels, the complexity of shipping and the constantly upgraded regulations require strong and regularly updated third-party ship management in Cyprus to stay competitive. This does not only apply to Cyprus, but to the whole EU, as the Asian competitors are constantly up scaling. But what advancements are needed in research and technological development to stay competitive? How can these technological developments become innovations and useful for the maritime sector?

While the benefit of integrating new technologies and robots in the shipping industry is widely understood among stakeholders as a means to eliminate for example marine casualties, the recently announced plans to develop unmanned and autonomous vessels could possibly account for new challenges9. Despite the fact that the introduction of unmanned vessels could be a reality within this decade reducing the crew costs and thus boosting the economic growth of the industry, potential impediments should be taken into serious consideration before these vessels are launched. What will happen if an engine malfunction occurs in the middle of the ocean and the operation of the vessel terminates until a team of engineers arrives and handles the incidence?

Pirates and treasure hunts are not something of the past. Many vessels and ship-owners are facing piracy as a huge problem while at sea, as for example on the East coast of Africa. Safety at sea is a big issue for the maritime sector today. Piracy, illegal activities, illegal migrants are some of the more important safety issues that a ship owner and crew must face. Do you think that ships should be armed?

The health of oceans is threatened by human activities such as pollution from ships, oil spills, invasive species from ballast water, air pollution from ship emissions, toxic substances in the water due to antifouling paints. Many EU projects have worked on these issues in the past 14 years. But where are the results? Have they reached the market? How can we find these results and how can we use them? How can the Cypriot maritime industry become an example of reference for Europe?

5.2 The triggering question: "What Responsible Research and Innovation (RRI) actions are needed for a resilient, responsible and sustainable maritime sector by 2030?"

"Shipping Today" stresses that the maritime industry is undergoing and must undergo small and large changes. However, maritime actors meet these changes with scepticism and change is impaired. The main question is how can the maritime industry become resilient, responsible and sustainable? To successfully guide the discussion towards answering this pressing question, a new methodological perspective, namely, Responsible Research and Innovation (RRI), which promises to engage together all possible stakeholders, is vital to be considered. Through its six dimensions – Engagement, Science Education, Open Access, Gender Equality, Ethics and Governance, RRI can become a core framework to allow the growth of the maritime industry in Cyprus and beyond on the one hand, and the protection of the environment and the compliance with the national and European legislation on the other hand.

During the Cyprus international MML workshop, 45 ideas were generated by the 14 participants in the form of concise action-statements through the "*idea generation phase*". The participants were requested to state their "ideas" in the form of action statements in order to "push" them to think in practical terms. In fact, the facilitator from the start explained that the actions must follow the SMART principle: Specific, Measurable, Assingable, Realistic and Time-bound. Once all actions were defined, printed and displayed on the screen and on the boards in the room, the workshop passed to the *Clarification Phase* where one by one, the participants proceeded with the explanation of their actions. For this activity, sufficient time was allocated to the rest of the participants to ask explanatory questions. The premise of the clarification phase is to allow participants to gain the same understanding and interpretation of the action based on the meaning attributed to the action by its own author. Clarification is of the utmost importance for the *Clustering Phase* that followed, where participants were instructed to categorise the proposed ideas in clusters according to similarities and common characterestics. To achieve this clustering, the participants discussed and compared the ideas in pairs to identify whether they share enough characteristics to be clustered into the same category. The participants mutually and collaboratively identified eight clusters namely:

1. Environment / Monitoring,

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[20] https://gettingthedealthrough.com/area/81/jurisdiction/74/ports-terminals-cyprus

2. Technology Implementations,
3. Education / Culture,
4. Funding,
5. Governance,
6. Open Access,
7. Awareness and
8. Ethics.

The distribution of all the actions across the 8 clusters is demonstrated in the below Figures:
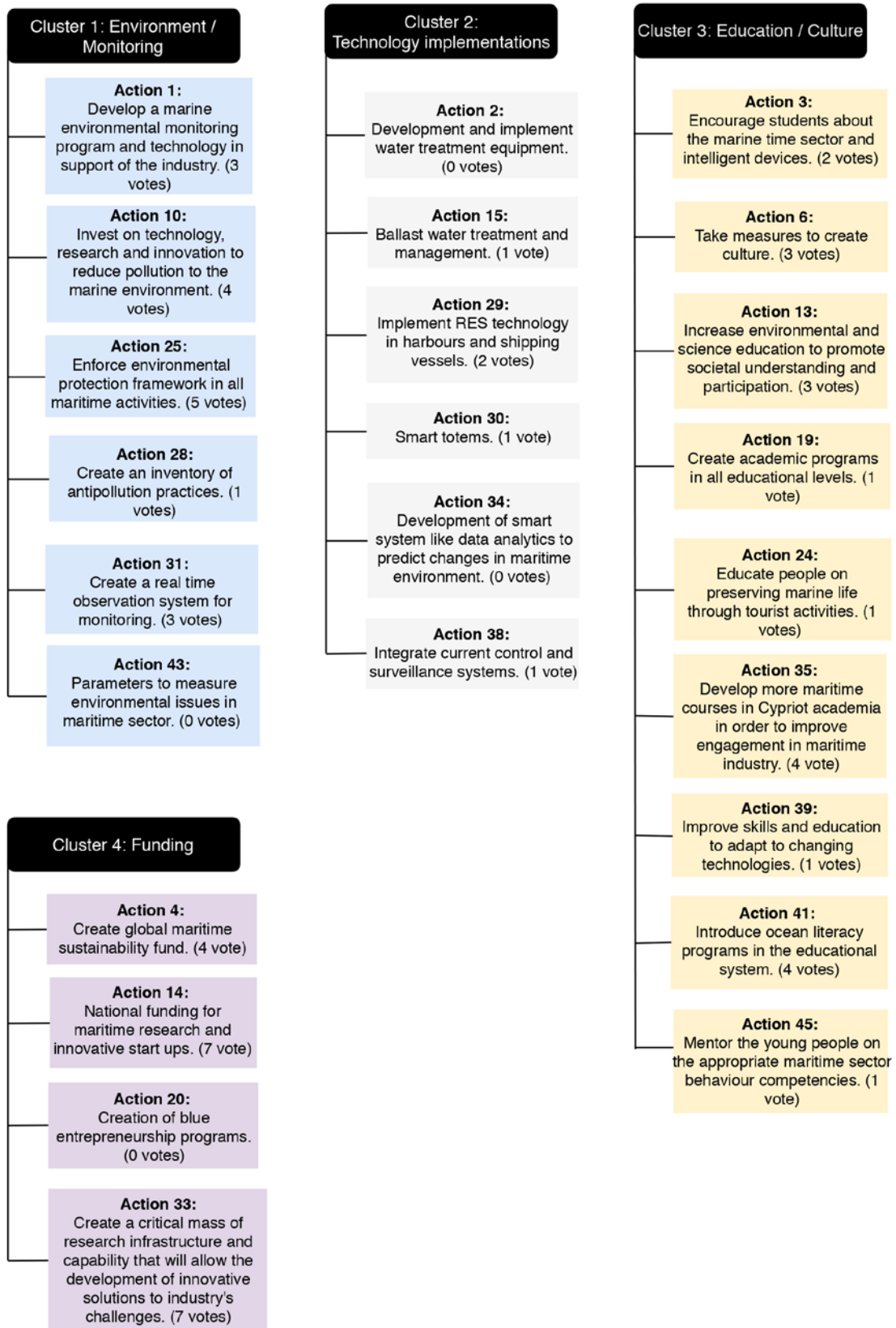
Cluster 1: Environment / Monitoring

Action 1:
Develop a marine environmental monitoring program and technology in support of the industry. (3 votes)

Action 10:
Invest on technology, research and innovation to reduce pollution to the marine environment. (4 votes)

Action 25:
Enforce environmental protection framework in all maritime activities. (5 votes)

Action 28:
Create an inventory of antipollution practices. (1 votes)

Action 31:
Create a real time observation system for monitoring. (3 votes)

Action 43:
Parameters to measure environmental issues in maritime sector. (0 votes)

Cluster 2: Technology implementations

Action 2:
Development and implement water treatment equipment. (0 votes)

Action 15:
Ballast water treatment and management. (1 vote)

Action 29:
Implement RES technology in harbours and shipping vessels. (2 votes)

Action 30:
Smart totems. (1 vote)

Action 34:
Development of smart system like data analytics to predict changes in maritime environment. (0 votes)

Action 38:
Integrate current control and surveillance systems. (1 vote)

Cluster 3: Education / Culture

Action 3:
Encourage students about the marine time sector and intelligent devices. (2 votes)

Action 6:
Take measures to create culture. (3 votes)

Action 13:
Increase environmental and science education to promote societal understanding and participation. (3 votes)

Action 19:
Create academic programs in all educational levels. (1 vote)

Action 24:
Educate people on preserving marine life through tourist activities. (1 votes)

Action 35:
Develop more maritime courses in Cypriot academia in order to improve engagement in maritime industry. (4 vote)

Action 39:
Improve skills and education to adapt to changing technologies. (1 votes)

Action 41:
Introduce ocean literacy programs in the educational system. (4 votes)

Action 45:
Mentor the young people on the appropriate maritime sector behaviour competencies. (1 vote)

Cluster 4: Funding

Action 4:
Create global maritime sustainability fund. (4 vote)

Action 14:
National funding for maritime research and innovative start ups. (7 vote)

Action 20:
Creation of blue entrepreneurship programs. (0 votes)

Action 33:
Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges. (7 votes)

Figure 2 Clusters 1-4 assembled by the participants of the international MML workshop in Larnaca, Cyprus

Cluster 5: Governance

Action 7:
Establishment of cooperation schemes between companies and academia. (2 vote)

Action 8:
Address climate change by placing suitable targets for the reduction of green house gases. (1 votes)

Action 12:
Create all inclusive coordination platform on maritime RTD. (0 votes)

Action 21:
Engage researchers with the industry for the development o appropriate technologies. (4 votes)

Action 22:
Establish a platform for exchange of experience in maritime management. (1 votes)

Action 26:
Promote ongoing dialogue between stakeholders and government regarding policies. (1 vote)

Action 27:
Trade Transparency Protection body. (0 votes)

Action 32:
Create RTDI driven ecosystem where all stakeholders will be involved. (3 votes)

Action 36:
Focus on SDGs. (0 votes)

Action 37:
Fines depending on pollution. (0 votes)

Cluster 6: Open Access

Action 9:
Introduce free access to data concerning maritime sector. (3 votes)

Action 16:
Development of information exchange systems between government, industry and universities. (7 votes)

Cluster 8: Ethics

Action 40:
Apply the integration of women in the maritime sector activities based on the international maritime organisation program. (4 votes)

Action 42:
maritime Ethics. (3 votes)

Cluster 7: Awareness

Action 5:
Use the media to inform people about maritime. (4 votes)

Action 11:
Connect lifestyle to maritime pollution. (2 vote)

Action 17:
Connect the impact on seafood. (0 votes)

Action 18:
Use the web to inform and educate stakeholders. (3 votes)

Action 23:
Increase awareness of the recent maritime challenges. (0 votes)

Action 44:
Broad public awareness raising campaigns on marine issues. (5 vote)
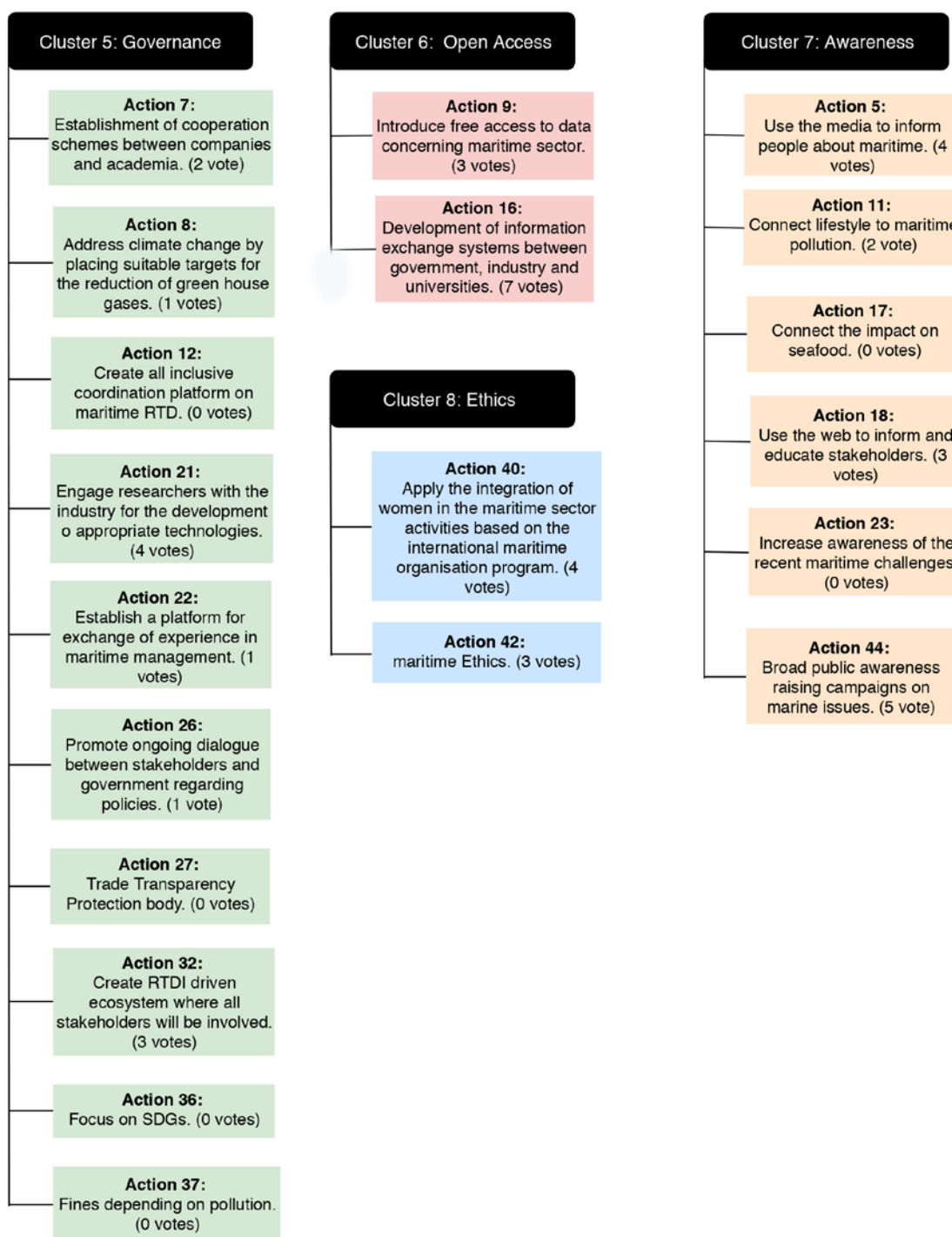
Figure 3 Clusters 5-8 assembled by the participants of the international MML workshop in Larnaca, Cyprus

Overall, "Governance" was the most populated cluster with ten actions closely followed by Education with nine actions. Three clusters, that is, Environment / Monitoring, Technology Implementations and Awareness had an equal number of actions (six actions each). Finally, three actions were categorised under the cluster Funding while only as many as two actions were connected with the Clusters of Open Access and Ethics.

5.3   Synthetic Analysis of the Clusters in order of total votes received

Education and Culture are considered pivotal

Cluster 3 entitled "Education / Culture" is considered the most important in terms of the number of votes received. In particular, 20 votes were distributed across the actions categorised under this cluster with an average of 2,22 votes/action and almost 1 RRI dimension/action in average. Three out of the eight actions from the Education / Culture Cluster have been included in the Influence Action-Map. The actions emphasised steps to be taken in order to greatly influence society and culture in the long term. Better education with accurate and insightful information will lead to more informed and conscious citizens. The cluster involved actions, which were primarily specific, measurable, assignable and realistic and were predominantly associated with the RRI dimension of "Science Education".

Action 35 "Develop more maritime courses in Cypriot academia in order to improve engagement in maritime industry" and Action 41 "Introduce ocean literacy programs in the educational system" both received four votes, the highest number of votes in this cluster. In particular, Action 35 urges the importance of investing in maritime courses at schools and universities with a purpose of maintaining and enhancing the competitive advantage within the maritime sector, which has an increasing demand. In a similar manner, Action 41 addresses the necessity of educating people on the influence of the ocean on citizens and the impact of citizens on the ocean. Action 13 "Increase environmental and science education to promote societal understanding and participation" and Action 6 "Take measures to create culture", both received three votes. The actions of the Education / Culture cluster addressed the SD Goal 4: Ensure inclusive and quality education for all and promote lifelong learning.

Source of Funding is needed to boost the development of the sector

Despite its low population with only four actions, Cluster 4 "Funding" received a total of 18 votes positioning itself as the second most important cluster of the Cyprus International MML workshop with 4.5 vote/action and mainly 1,25 RRI dimensions/action in average. Specific, measurable and realistic actions, mostly related to the RRI dimensions of Governance and Science Education were generated which aimed to advocate on the necessity of creating specific funding schemes to support the development of the maritime industry. Interestingly enough, two of the actions categorized under this cluster received the highest number of votes (seven votes each) among all actions together with Action 16 on Cluster Open Access. In particular, Action 14: "National funding for maritime research and innovative start ups" acknowledges that funding should not be an exclusive responsibility of the EU, but the national government should also provide incentives to the public to allow the development of research institutes for projects in non-profit organizations and start-ups. A unique perspective is projected through the Action 33: Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges through the creation of centers of excellence capable of hiring competent people and enchancing the development of new technologies. The cluster mainly addressed the SD Goal 12: Ensure sustainable consumption and production patterns and targets a wide spectrum of stakeholders from business, academia and policy makers to civic society.

Protection measures for the environment are needed

Cluster 1 related to the Environment / Monitoring received sixteen votes, which were distributed across its six actions, that is, an average of 2.7 vote/action. The cluster was comprised of specific, measurable and realistic actions suggesting ideas on how to better protect the marine environment by exploiting the new technologies and introducing monitoring activities. As an example, consider Action 10 (four votes) on the investment in technology, research and innovation to reduce pollution to the marine environment and Action 25 (five votes) on the enforcement of environmental protection framework in all maritime activities. In particular, Action 10 suggests that the pollution in the sea can be reduced, if the technology involved in maritime activities, such as fuel efficiency and the size of ship vessels, is improved; while Action 25 raises the issue of broadening the implementation of current marine regulations in a way that all societal actors become legally liable to the protection of the marine environment. The actions of this cluster addressed the SD Goal 14: Conserve and sustainably use the oceans, seas and marine resources.

Public Awareness and focused governance are needed for RRI in the maritime sector

Cluster 7 on Awareness and Cluster 5 on Governance received fourteen and twelve votes respectively. While cluster 7 illustrated the urgency of increasing public awareness campaigns in order to inform citizen of their daily impact, cluster 5 shifted the emphasis to the measures to be taken in order to develop and further enchance the engagement and cooperation between different stakeholders. With regards to the Awareness cluster, a number of actions strictly associated with the RRI dimension of Public Engagement mainly discuss outlets and platforms in which industry and academic leaders can disseminate accurate and influential information which can be accessible

by the general public. Action 44 "Broad public awareness raising campaigns on marine issues" received five votes out of the total 14 cluster votes, highlighting the importance of informing and keeping society in the front mind in every marine activity. There should be a broad public awareness campaign that includes local communities, cities, governments and international organizations. The actions of this cluster mainly addressed the SD Goal 12 Ensure sustainable consumption and production patterns and targets a wide spectrum of stakeholders from business, academia and policy makers to civic society.

Action 21 entitled "Engage researchers with the industry for the development of appropriate technologies" was the most voted action of the cluster with four votes highlighting the discrepancy between the academia and the industry needs. As clarified, numerous researchers are involved in research at universities producing results and publications, which are unfruitful to both the society and the industry due to their inaccessibility; and thus, a shift in the way researchers publish science is pivotal in order to address what society and industry need. This shift will allow researchers to produce products, solutions and innovation which can be acceptable and useful to the society. This cluster mainly addressed the SD Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation.

Open Access to data for a proactive response to marine challenges
With an average of five votes per action, the Open Access cluster encompasses two specific actions, which aim at enchancing open access to the produced data regarding the marine environment. In particular, Action 16 "Development of information exchange systems between government, industry and the universities" receiving seven votes suggests that in order to develop a resilient, responsible and sustainable maritime sector by 2030, the three core stakeholders, namely, the government, the industry and the universities, should collaborate effectively in order for the industry to identify new issues to be addressed on a political and policy level by the government and on a scientific and technical level by the universities responsible of developing new technologies to respond to these issues. Introducing free access to data concerning maritime sector is suggested by Action 9, which calls for an exchange of data and information on a national and international level as a means to achieve sustainability of the maritime sector. This cluster mainly addresses the SD Goal 14: Conserve and sustainably use the oceans, seas and marine resources.

Towards a more ethical industry
Finally, Cluster 8: Ethics and Cluster 2: Technology implementations were the least popular receiving seven and eight votes respectively. The Ethics cluster consisted of 2 actions and addressed SD Goal 5 Gender Equality. As an example consider Action 40 "Apply the integration of women in the maritime sector activities based on the international maritime organisation program" (four votes) which decries that the maritime sector is one of the most sexist industries on the planet considering the extremely low representation of women in this field and calls for drastic changes in the educational system in order to alter and improve the current situation. Cluster 2 "Technology Implementations" gained a total of five votes distributed between six actions proposing ideas on how to successfully protect and monitor the marine environment through the exploitation of new technologies. To this vein, specific technologies can be implemented for sustainable maritime RTDI, such as Smart Totems as mentioned in Action 30 (one vote) or Renewable Energy Source technologies in harbours and shipping vessels as suggested in Action 29 (two votes).

5.4   Building a roadmap

In order to develop the Roadmap of the Cyprus International MML workshop, the participants were provided with five votes and were asked to vote five actions in terms of their importance. The actions, which received more than two votes during the voting phase were randomly compared in pairs to identify whether the implementation of one action could have a significant influence on the implementation of another action. The phase required a thorough discussion from the participants in order to analyse the actions and determine relations of influence between them. The completion of this phase resulted to the creation of a very simple roadmap of actions because the participants could not agree on evident influences among the actions. This could be possibly explained by two factors. According to the rules of the SDD Methodology, the influence relationship is only granted if there is a great majority in agreement between the participants, that is a percentage of at least 75%. The group however was unable to persuade each other, partly due to shortage of time. The second reason relates to the Spread Think that is the percentage of ideas that received votes relative to the total number of ideas and votes per person, which was comparatively high. This spreadthink was 60% meaning that the participants found many of the ideas important, and therefore were unable to come to an easy consensus. As a result, the generated roadmap was very

simple and could not allow further analysis and the extraction of valuable recommendations to achieve a sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030.

Therefore, the organisers of the workshops provided the participants with an additional number of three votes with clear instructions to vote only those actions that had received one or zero votes in the first voting round in order to identify whether the rest of the non-discussed actions had mutual influences. Action 14 "National funding for maritime research and innovative start-ups" received the most votes, six, in the second round of voting. After the second voting, the discussion of influences among action was restarted. However, again the participants did not agree that the actions had any mutual influence. The newly generated influence map (roadmap) is shown in Figure below.
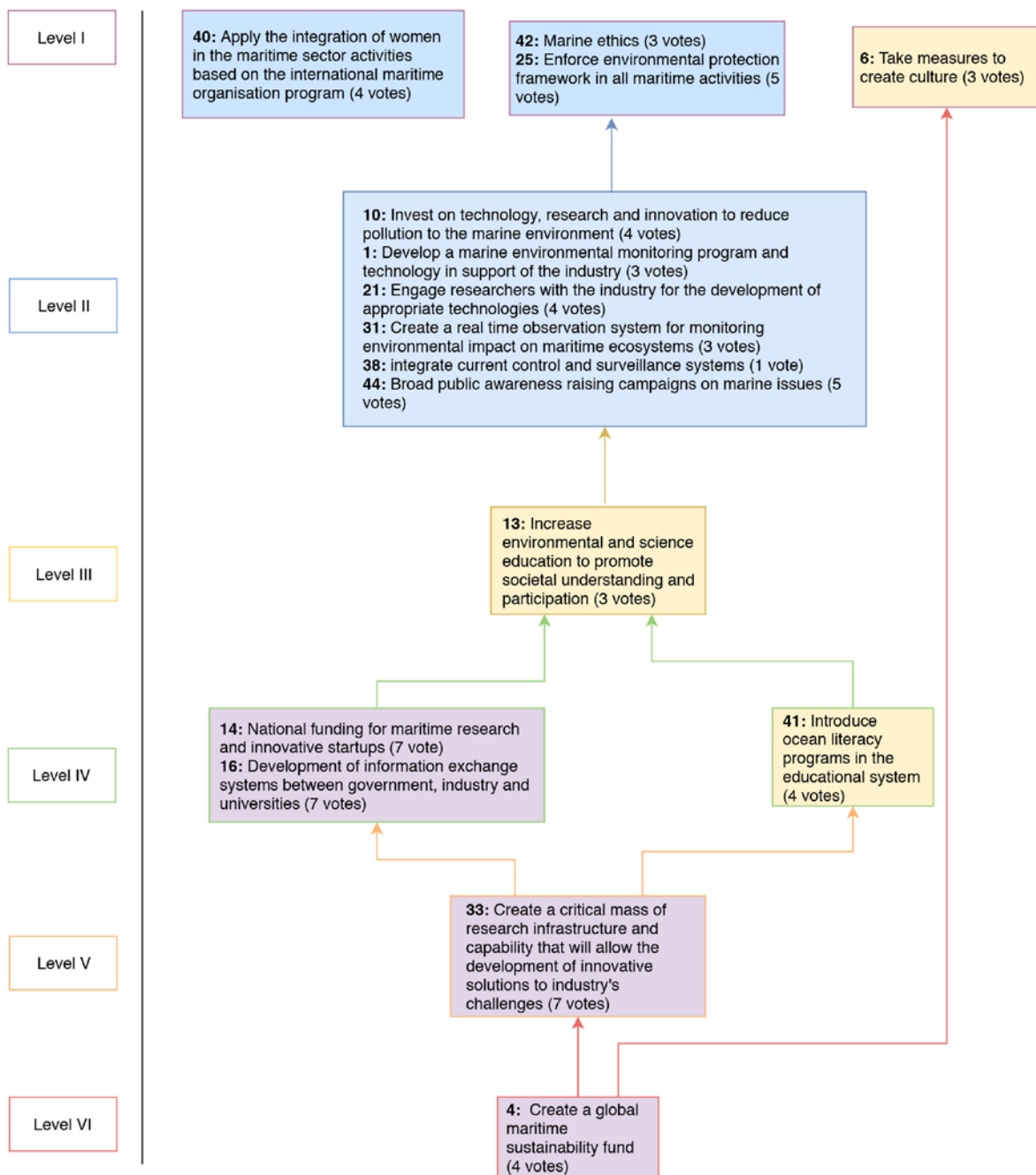
Figure 4 Final influence map produced by the participants of the international MML workshop in Larnaca, Cyprus.

As demonstrated in Figure 4, the roadmap incorporates six different levels. The most influential actions are considered the root actions, which are the *drivers*, and similarly those, which must be implemented first to stimulate the implementation of the subsequent actions considering that the latter rely on the former. These root actions are located at the lower levels of the roadmap and in particular at the Levels VI and V as they have the greatest influence among all other actions. This means that the implementation of action 4, which is located at the base of the map, would significantly influence or ease the implementation of action 33. The implementation of action 33, which is found on the Level V of the map, would significantly influence the implementation of Actions 41, 14 and 16 identified on Level IV and so on. Therefore, to enable sustainable maritime research, technological development and innovation, it is pivotal that the following actions [shown as (Action no, Cluster no, no. of Votes)] are implemented firstly:

- Level 6: Create a global maritime sustainability fund (A4, V4, C4).
- Level 5: Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges (A33, C4, V7). This action (tied with actions 16 and 14) was considered the most important action during the voting phase.

Level IV has three actions. Introduce ocean literacy programs in the educational system (A41, C3, V4), National funding for maritime research and innovative startups (A14, C4, V7) and Development of information exchange systems between government, industry and universities (A16, C6, V7). Actions 14 and 16 were also two of actions with the highest number of votes.

It is important to observe that the actions 14 and 16 on Level IV share the same box unlike other actions, as for example action 41 and they have a box to themselves. This means that the actions 14 and 16 are equally influencing each other and that these actions are also influencing the actions positioned at the higher levels of the roadmap. In particular, the participants agreed that the implementation of Action 14 could significantly influence the implementation of Action 16 and that the implementation of Action 16 could significantly influence the implementation of Action 14. However, the participants answered that the implementation of Action 41 could not significantly influence the implementation of Action 16, therefore Action 41 is not together with Action 16.

Level III is comprised of only one action, that is, Action 13: Increase environmental and science education to promote societal understanding and participation (C3, V3) which suggests that in order to achieve a sustainable change in the marine and maritime industry, there should be greater focus on primary and secondary education which will enable the creation of environmentally conscious citizens and intrigue the participation and integration of more women into this field of science.

There are six actions positioned at the Level II. Action 10: Invest on technology, research and innovation to reduce pollution to the marine environment (C1, V4), Action 1: Develop a marine environmental monitoring program and technology in support of the industry (C1, V3), Action 21: Engage researchers with the industry for the development of appropriate technologies (C5, V4), Action 31: Create a real time observation system for monitoring environmental impact on maritime ecosystems (C1, V3), Action 38: Integrate current control and surveillance systems (C2, V1), and Action 44: Broad public awareness raising campaigns on marine issues (C7, V5). These action are influenced by the previous levels, which implies that in order to have a great advancement on these specific actions, the implementation of the actions identified in the previous levels must precede.

Again, note how all of these actions share one box. This means that the actions 10, 1, 21, 31, 38 and 44 are equally influencing each other and that these actions are also influencing the actions positioned at the higher levels of the roadmap. This could possible be explained by the fact that half of the actions on this level come from the same cluster (Cluster 1: Environment / Monitoring), therefore they seem to be similar in goal and influence.

The highest level of the roadmap, Level I, has four actions: "Apply the integration of women in the maritime sector activities based on the international maritime organisation program" (A40, C8, V4), "Maritime ethics" (A42, C8, V3), "Enforce environmental protection framework in all maritime activities" (A25, C1, V5) and finally, "Take measures to create culture" (A6, C3, V3).

5.5   *Developing SMART action plans*

To facilitate the implementation of the final roadmap of RRI actions, the participants were requested to define action plans in response to how we could achieve significant advancement in the implementation of the **Action 4**: "Create a global maritime sustainability fund",

Action 33: "Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges" and

Action 41: "Introduce ocean literacy programs in the educational system".

In particular, their suggestions should be SMART, namely, **Specific:** How this action could be implemented?, **Measurable:** Which indicators could be used to measure the progress of the action?, **Assignable:** Who is responsible for the implementation of the action?, **Realistic:** What would the results of the action be? and **Time-related:** When the result(s) can be achieved?

The selection of the Actions 4, 33 and 41 was made on the basis of how influential are considered for the implementation of the roadmap. As demonstrated in Figure 4 and explained previously, all these actions are located at the lower levels of the roadmap signifying their great influence towards the actions of the upper levels of the map. In other words, in order to achieve the implementation of the actions identified on Level 1, the participants should primarily elaborate on identifying SMART actions which will facilitate the implementation of those actions at the lower levels of the map, as is the case of Action 4, 33 and 41. The demonstration of the SMART actions plans is provided as Appendix 2: SMART Action Plans.

6 Sea transportation and Responsible Research and Innovation

6.1 How do the results relate to the RRI dimensions?

This section will analyse the actions suggested by the workshop participants in the framework of six priority dimensions of Responsible Research and Innovation: Public and Multi-stakeholder Engagement, Science Education, Open Access/Open Science, Gender Equality, Governance and Ethics as they have been defined by the European Commission[21].

The participants had generated 45 RRI actions. These actions were classified according to the RRI dimensions. Most of them related to several RRI dimensions. The graph below illustrates the number of actions related to each of the six RRI dimensions.
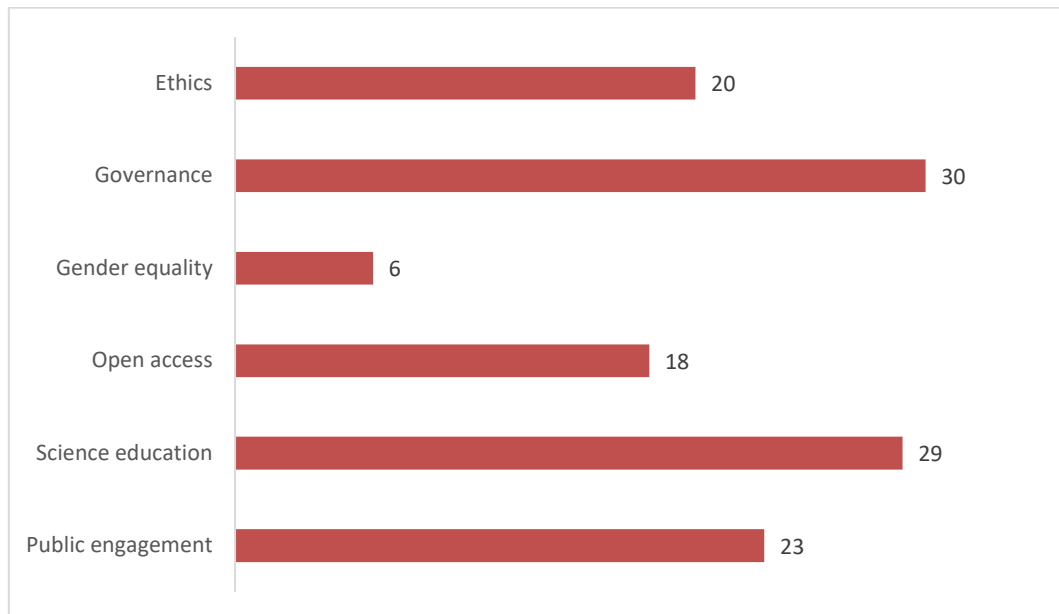
Figure 5 Number of actions per RRI dimension

Governance was the most important dimension, which appeared in 30 actions, that is a percentage of 67% in the total number of actions, followed closely by Science Education (29 actions), Public Engagement (23 actions) and Ethics (20 actions). As evident, Open access was connected to 18 actions while Gender equality seems to be the least important RRI dimension in the workshop considering that only six actions, a percentage of only 13% of all the actions generated, were associated with this particular dimension.

In fact, it is not suprising that Governance relates to most actions, since Governance is an "umbrella" RRI dimension covering all other five dimensions. This is because, according to the European Commission, without Governance no other RRI dimension can be really considered.

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[21] EU, Regulation No 1291/2013

N°	Action Title	Public engagement	Science education	Open access	Gender equality	Governance	Ethics
1	Develop a marine environmental monitoring program and technology in support of the industry	■		■		■	
2	Develop and implement water treatment equipment			■		■	
3	Encourage student about the maritime sector and intelligent devices		■			■	
4	Create a global maritime sustainability fund					■	
5	Use the media to inform people about maritime	■				■	
6	Take measures to create culture	■					
7	Establishment of cooperation schemes between companies and academia	■	■	■	■	■	■
8	Address climate change by placing suitable targets for the reduction of green house gases					■	■
9	Introduce free access to data concerning maritime sector			■			■
10	Invest on technology, research and innovation to reduce pollution to the marine environment			■		■	
11	Connect lifestyle to maritime pollution	■			■		
12	Create an all inclusive coordination platform on maritime RTD	■				■	
13	Increase enviromental and science education to promote societal understanding and participation	■	■			■	
14	National funding for maritime research and innovative start ups					■	
15	Ballast water treatment and management					■	
16	Development of information exchange system between government industry and univeristies			■		■	
17	Connect the impact on seafood	■					■
18	Use the web to inform and educate all stakeholders	■	■			■	
19	Create academic programs in all educational levels		■			■	
20	Creation of blue entrepreneurship programs				■		
21	Engage researchers with the industry for the development of appropriate technologies	■				■	
22	Establish a platform for exchange of experience in maritime management			■		■	
23	Increase awareness of the recent maritime challenges	■					■
24	Educate people on preserving marine life through tourist activities	■	■				
25	Enforce environmental protection framework in all maritime activities					■	
26	Promote ongoing dialogue between stakeholders and government regarding policies	■				■	
27	Trade Transparency Protection body					■	
28	Create an inventory of antipollution practices					■	
29	Implement RES technology in harbours and shipping vessels						
30	Smart totem					■	
31	Create a real time observation system for monitoring environmental impact on maritime ecosystem	■	■	■			
32	Create RTDI driven ecosystem where all stakeholders will be involved	■				■	
33	Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges		■			■	
34	Development of a smart system like data analytics to predict changes in maritime environment		■				
35	Develop mare maritime courses in Cypriot academia in order to improve engagement in maritime industry	■					
36	Focus on SDGs				■	■	■
37	Fines depending on pollution					■	
38	Integrate current control and surveillance systems					■	
39	Improve skills and education to adapt to changing technologies		■				
40	Apply the integration of women in the maritime sector activities based on the international maritime organization program				■		
41	Introduce ocean literacy programs in the educational system	■					
42	Maritime ethics					■	■
43	Parameters to measure environmental issues in maritime sector	■	■	■			
44	Broad public awareness raising campaigns on marine issues	■					
45	Mentor the young people on the appropriate for the maritime sector behaviour competencies		■				■

Figure 6 Actions and their RRI dimensions

The figure above shows that most of the actions, 41 in total, are associated with more than one RRI dimension highlighting the multidisciplinary nature of those actions which necessite a broader engagement of different stakeholders in order to be materialized. As demonstrated, a group of 26 actions is either linked to two or three RRI dimensions and in particular, 11 actions are connected to two RRI dimensions while another number of 15 actions to three RRI dimensions. A relationship with only one RRI dimension is evident in four actions while seven actions are associated with four dimensions. Finally, while there is only one action which is characterised by all six RRI dimensions, that is Action 7: Establishment of cooperation schemes between companies and academia, Action 29: Implement RES technology in harbours and shipping vessels, nevertheless, is not connected to any of the dimensions.

6.2 Who are the main target stakeholder groups of the actions?

Figure 7 below shows the number of actions in percentages that called for the involvement of each stakeholder group: the civil society (citizens/CSOs/NGOs), business/industry, researchers/academia and policy-makers. The engagement of the policy makers and implementers (31%) was the most important to develop sustainable Maritime Research, Technological Development and Innovation (RTDI) followed closely by Research and

Academia (28%) and Business/Industry (27%). Drawing from the analysis of this figure, a close collaboration between the three aforementioned main pillars is needed in order to allow the smooth and sufficient implementation of the suggested actions.
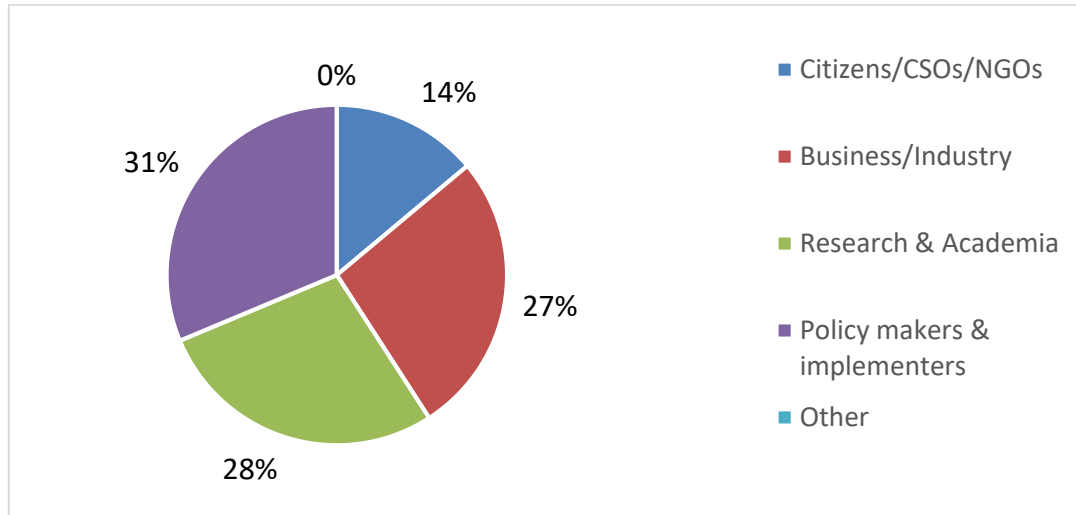

Figure 7 Number of actions per stakeholder group

Figure 8 below presents the percentage of engagement of the stakeholder groups in the clusters and the influence map (roadmap). It confirms the equally predominant roles of the societal stakeholders: "researchers and academia", "business and industry" and "policy makers and implementers" in the development of Maritime Research, Technological Development and Innovation (RTDI) in Cyprus and beyond. On the other hand, the group of "Citizens/CSOs/NGOs" is ranked as the least important in most of the clusters and in the final roadmap of actions while is determined as the most important stakeholder group only in one cluster, that is Cluster 7: Awareness.
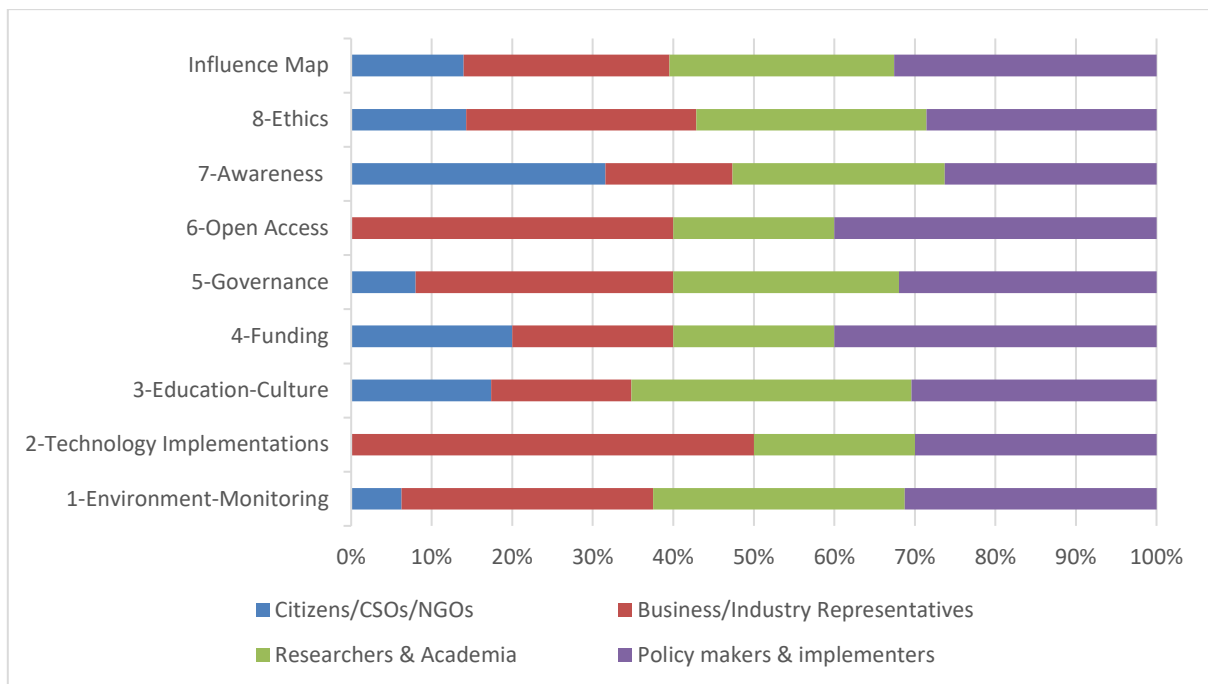
Figure 8 Stakeholder groups per cluster and influence map (roadmap)

6.3   Engagement (public and multi-stakeholder)

With more than 400 million sea passengers a year travelling through European ports, passenger ships and ferry services have a direct impact on the quality of life of citizens in islands and peripheral regions. Therefore, the maritime industry and its activities have major societal impacts, where citizens and civil societies should be involved. The question is how.

To this angle, 23 of the suggested actions were related to the RRI dimension of Public Engagement. The importance of this particular dimension is also evident on the final roadmap given that nine out of the 16 actions on the map of influence are associated with Public Engagement. As demonstrated below, these 23 actions underline the need for collaborations between different societal stakeholders, which will facilitate the smooth development of a sustainable and resilient maritime RTDI through specific activities, such as:

(a) Information exchange system between stakeholders (A16, C6, V7; A18, C7, V3; A12, C5, V0)
(b) Raising awareness campaigns (A44, C7, V5; A5, C7, V4)
(c) Innovative technologies (A21, C5, V4; A1, C1, V3)
(d) Marine literacy as part of the curriculum in all levels of the educational system (A41, C3, V4; A13, C3, V3; A35, C3, V4)
(e) Strenthgening collaborations between stakeholders (A7, C5, V1; A26, C5, V1)

N°	CLUSTER	ACTION	VOTES
ACTIONS ON THE ROADMAP			
16	6	Development of information exchange system between government, industry and univeristies	7
44	7	Broad public awareness raising campaigns on marine issues	5
10	1	Invest on technology, research and innovation to reduce pollution to the marine environment	4
21	5	Engage researchers with the industry for the development of appropriate technologies	4
41	3	Introduce ocean literacy programs in the educational system	4
1	1	Develop a marine environmental monitoring program and technology in support of the industry	3
13	3	Increase enviromental and science education to promote societal understanding and participation	3
6	3	Take measures to create culture	2
31	1	Create a real time observation system for monitoring environmental impact on maritime ecosystem	3
OTHER ACTIONS			
5	7	Use the media to inform people about maritime	4
35	3	Develop mare maritime courses in Cypriot academia in order to improve engagement in maritime industry	4
18	7	Use the web to inform and educate all stakeholders	3
32	5	Create RTDI driven ecosystem where all stakeholders will be involved	3
7	5	Establishment of cooperation schemes between companies and academia	1
8	5	Address climate change by placing suitable targets for the reduction of green house gases	1
11	7	Connect lifestyle to maritime pollution	1
24	3	Educate people on preserving marine life through tourist activities	1
26	5	Promote ongoing dialogue between stakeholders and government regarding policies	1
2	2	Develop and implement water treatment equipment	0
12	5	Create an all inclusive coordination platform on maritime RTD	0
17	7	Connect the impact on seafood	0
23	7	Increase awareness of the recent maritime challenges	0
27	5	Trade Transparency Protection body	0

Table 1 Actions related to Public Engagement

6.4 Science education

For EU and Cyprus to stay competitive, a strong workforce for tomorrow's marine and maritime industry, policy and research fields are needed. Thus, the European educational programmes and training in marine science and technology are important. Currently, dedicated marine science programmes account for less than 10% of higher educational (degree) programmes in Europe, although training relevant to marine scientific fields or applications are also included in broader disciplinary training programmes, e.g. environmental courses[22].

The marine and maritime sciences have a significant role to play in supplying high-quality graduates through training and initiatives designed to address the needs of industry, science and policy. In order to facilitate the envisioned growth and job expansion anticipated by the EU Blue Growth initiative, a skilled workforce will be required, comprised of graduates from many different levels of the educational system. Education and research are, therefore, central components of the blue growth strategy and it is recognized that training itself, and the delivery of high-quality graduate programmes, is part of the engine which drives innovation and technology development in maritime sectors.

As illustrated on the below figure, 29 of the generated actions, including eight on the roadmap, are connected with the RRI dimension of Science Education. It is notable that two of the actions that received the highest number of votes, A16 and A33, are associated with this dimension. While A16 stresses the need of strengthening the collaboration between the government, the industry and the universities to allow the development of new technologies which will comply with EU regulations and tackle marine related issues, A33 focuses on the establishment of a marine center of excellence which will offer the opportunity to marine scientists to work on the production of results, technologies and innovations which can be useful to both the society and the industry. In addition, specific actions related to the RRI dimension of Science Education and target all levels of the educational system were suggested with the view to educate students and citizens on marine issues as well as establishing the fundamentals for the development of marine science in Cyprus which can be achieved through (a) awareness raising campaigns (A44, C7, V5; A5, C7, V4; A18, C7, V3), the introduction of marine courses and initiatives in the educational system (A41, C3, V4; A13, C3, V3; A35, C3, V4; A3, C3, V2; A19, C3, V1, A39, C3, V1; A20, C4, V0) and the development of marine infrastructure and technologies (A33, C4, V7; A21, C5, V4).

N°	CLUSTER	ACTION	VOTES
ACTIONS ON THE ROADMAP			
16	6	Development of information exchange system between government industry and univeristies	7
33	4	Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges	7
44	7	Broad public awareness raising campaigns on marine issues	5
21	5	Engage researchers with the industry for the development of appropriate technologies	4
41	3	Introduce ocean literacy programs in the educational system	4
13	3	Increase enviromental and science education to promote societal understanding and participation	3
6	3	Take measures to create culture	2
31	1	Create a real time observation system for monitoring environmental impact on maritime ecosystem	3
OTHER ACTIONS			
5	7	Use the media to inform people about maritime	4
35	3	Develop mare maritime courses in Cypriot academia in order to improve engagement in maritime industry	4
18	7	Use the web to inform and educate all stakeholders	3
32	5	Create RTDI driven ecosystem where all stakeholders will be involved	3
3	3	Encourage students about the maritime sector and intelligent devices	2
4	4	Create a global maritime sustainability fund	1

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[22] http://www.marineboard.eu/marine-graduate-training

7	5	Establishment of cooperation schemes between companies and academia	1
11	7	Connect lifestyle to maritime pollution	1
19	3	Create academic programs in all educational levels	1
22	5	Establish a platform for exchange of experience in maritime management	1
24	3	Educate people on preserving marine life through tourist activities	1
26	5	Promote ongoing dialogue between stakeholders and government regarding policies	1
39	3	Improve skills and education to adapt to changing technologies	1
45	3	Mentor the young people on the appropriate for the maritime sector behaviour competencies	1
2	2	Develop and implement water treatment equipment	0
12	5	Create an all inclusive coordination platform on maritime RTD	0
17	7	Connect the impact on seafood	0
20	4	Creation of blue entrepreneurship programs	0
23	7	Increase awareness of the recent maritime challenges	0
34	2	Development of a smart system like data analytics to predict changes in maritime environment	0
43	1	Parameters to measure environmental issues in maritime sector	0

Table 2 Actions related to Science Education

6.5 Open access

The EU has a wealth of marine data that is currently unexplored. Small and Medium-Sized Enterprises could take advantage of the public marine data resources and generate value delivering specific services for their customers. The European Commission recognises the Blue Growth opportunities offered by the wealth of publicly-funded marine observation and data initiatives. To this end, the European Union has supported the establishment of several valuable marine data portals, freely providing marine data on a wide range of parameters as well as a range of data products (e.g. maps) covering all European maritime regions. However, a gap exists between what is available in those open marine data portals and what maritime users need in terms of types of data and data products[23].

The participants suggested 17 actions favouring Open Access to data and included five of them in the map of influence. The participants emphasized on the exploitation of the internet and new technologies which will allow the development of tools to share data among interested societal stakeholders. As example, consider A6 on the development of information exchange system between government, industry and universities, A9 on the introduction of free access to data concerning maritime sector which calls for an international agreement scheme in which each country will be liable of sharing its produced data from the maritime sector, A18 on the use of the internet to inform and educate all stakeholders and finally, A22 and A12 which both focus on the development of online platforms for exchange of experience in maritime management and for inclusive coordination on maritime RTD respectively.

N°	CLUSTER	ACTION	VOTES
ACTIONS ON THE ROADMAP			
16	6	Development of information exchange system between government industry and univeristies	7
33	4	Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges	7
1	1	Develop a marine environmental monitoring program and technology in support of the industry	3
13	3	Increase enviromental and science education to promote societal understanding and participation	3
31	1	Create a real time observation system for monitoring environmental impact on maritime ecosystem	3
OTHER ACTIONS			
9	6	Introduce free access to data concerning maritime sector	3
18	7	Use the web to inform and educate all stakeholders	3

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[23] http://eurogoos.eu/2016/07/18/marine-information-workshop-industry-publicly-available-resources-innovation-blue-economy/

32	5	Create RTDI driven ecosystem where all stakeholders will be involved	3
3	3	Encourage student about the maritime sector and intelligent devices	2
7	5	Establishment of cooperation schemes between companies and academia	1
19	3	Create academic programs in all educational levels	1
22	5	Establish a platform for exchange of experience in maritime management	1
26	5	Promote ongoing dialogue between stakeholders and government regarding policies	1
28	1	Create an inventory of antipollution practices	1
12	5	Create an all inclusive coordination platform on maritime RTD	0
27	5	Trade Transparency Protection body	0
34	2	Development of a smart system like data analytics to predict changes in maritime environment	0
43	1	Parameters to measure environmental issues in maritime sector	0

Table 3 Actions related to Open Access

6.6   Gender equality

Gender inequality is deep in the traditionally male-dominated maritime industry, where women make up a mere 2% of the workforce. Although the maritime industry has adopted initiatives towards closing the existing gender gap, the integration of women into the maritime industry has been at a sluggish rate due to various impediments. Some of the factors for gender imbalance are due to historical roots but also to unique issues of the maritime industry towards achieving gender equality in its workforce.

The International Maritime Organisation (IMO)'s programme on the Integration of Women in the Maritime Sector (IWMS) has a primary objective to encourage IMO Member States to open the doors of their maritime institutes to enable women to train alongside men and so acquire the high-level of competence that the maritime industry demands. The IWMS programme includes but is not limited to, strengthening national and regional capacities through gender-specific fellowships; facilitating access to high-level technical training for women in the maritime sector in developing countries; and facilitating the identification and selection of women by their respective authorities for career development opportunities in maritime administrations, ports and maritime training institutes. The program is called "SDG 5: Strengthening the maritime sector" nowadays, signalling the compromise of IMO with the post-2015 agenda and the SDGs. The main objective of the program is to facilitate access to high-level technical training for women maritime officials (IMO, 2016a).

As evident in the below given figure, Gender equality was not indicated as an important dimension in most of the actions. In particular, only six actions, including no action from the map of influence, marked an association with Gender equality. However, one action, namely A40, focused directly on the integration of women in the maritime sector activities drawing from international initiatives which aim at creating educational programs fostering the participation of women in the marine industry.

N°	CLUSTER	ACTION	VOTES
OTHER ACTIONS			
40	8	Apply the integration of women in the maritime sector activities based on the international maritime organization program	4
18	7	Use the web to inform and educate all stakeholders	3
7	5	Establishment of cooperation schemes between companies and academia	1
11	7	Connect lifestyle to maritime pollution	1
20	4	Creation of blue entrepreneurship programs	0
36	5	Focus on SDGs	0

Table 4 Actions related to Gender equality

6.7   Governance

Evidence for systemic failure in the governance of the maritime sector is clear from the widespread inability of many shipping policies to address the problems of environmental, security, safety and economic concerns central to the sector. The causes for this failure in governance and policy-making stem to a larger extent from the unstoppable spread of globalisation, which has accelerated in recent decades and aggravated the shortfalls of the shipping industry. In particular, the substantially changed role of the nation-state as a maritime authority and

policy-maker has generated friction between shipping as a truly globalised industry and the nationally defined legislative and governance authorities.

In Europe, the Integrated Maritime Policy seeks to provide a more coherent approach to maritime issues, with increased coordination between different policy areas. It focuses on issues that do not fall under a single sector-based policy e.g. "blue growth" (economic growth based on different maritime sectors). Issues that require the coordination of different sectors and actors e.g. marine knowledge. Specifically it covers these cross-cutting policies:

- Blue growth
- Marine data and knowledge
- Maritime spatial planning
- Integrated maritime surveillance
- Sea basin strategies

Situating itself as the most significant RRI dimension, Governance was connected to 29 actions including ten on the influence-map as demonstrated on the below given table.

N°	CLUSTER	ACTION	VOTES
ACTIONS ON THE ROADMAP			
16	6	Development of information exchange system between government industry and univeristies	7
33	4	Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges	7
25	1	Enforce environmental protection framework in all maritime activities	5
10	1	Invest on technology, research and innovation to reduce pollution to the marine environment	4
21	5	Engage researchers with the industry for the development of appropriate technologies	4
1	1	Develop a marine environmental monitoring program and technology in support of the industry	3
42	8	Maritime ethics	3
6	3	Take measures to create culture	2
14	4	National funding for maritime research and innovative start ups	1
38	2	Integrate current control and surveillance systems	1
OTHER ACTIONS			
5	7	Use the media to inform people about maritime	4
32	5	Create RTDI driven ecosystem where all stakeholders will be involved	3
4	4	Create a global maritime sustainability fund	1
7	5	Establishment of cooperation schemes between companies and academia	1
8	5	Address climate change by placing suitable targets for the reduction of green house gases	1
15	2	Ballast water treatment and management	1
19	3	Create academic programs in all educational levels	1
22	5	Establish a platform for exchange of experience in maritime management	1
24	3	Educate people on preserving marine life through tourist activities	1
26	5	Promote ongoing dialogue between stakeholders and government regarding policies	1
28	1	Create an inventory of antipollution practices	1
30	2	Smart totem	1
39	3	Improve skills and education to adapt to changing technologies	1
2	2	Develop and implement water treatment equipment	0
12	5	Create an all inclusive coordination platform on maritime RTD	0
27	5	Trade Transparency Protection body	0
34	2	Development of a smart system like data analytics to predict changes in maritime environment	0
36	5	Focus on SDGs	0
37	5	Fines depending on pollution	0
43	1	Parameters to measure environmental issues in maritime sector	0

Table 5 Actions related to Governance

Some of these actions are directly related to initiatives that need to be taken by different societal actors, including policy makers, researchers and the industry in order to either prevent harmful or unethical developments in research and innovation or initiate new legislations to protect the environment as for example: "Development of information exchange system between government industry and univeristies" (A16, C6, V7); Enforce environmental protection framework in all maritime activities (A25, C1, V5); Develop a marine environmental monitoring program and technology in support of the industry (A1, C1, V3); Maritime Ethics (A42, C8, V3); Integrate current control and surveillance systems (A38, C2, V1); Address climate change by placing suitable targets for the reduction of green house gases (A8, C5, V1); and Fines depending on pollution (A37, C5, V0).

6.8 Ethics

Ethics in the maritime industry spans over several areas from fair employment, human rights at sea and on shore to the "right practices" for sustainability. An interesting view to be discussed is viewing Ethics together with sustainability. As sustainability has expanded into a concern for social and economic justice as essential factors in a stable and vital web of life. As a consequence, there are increasing connections between the fields of ethics and sustainability. In general, there is lack of focus on ethics in maritime university programmes. Only about 27% of universities offering maritime related course contain ethics as such[24].

20 actions including five on the roadmap were associated with the RRI dimension of Ethics. Some of these actions were directly focusing on ethical principles that should govern the maritime activities in order to achieve a sustainable and resilient maritime RTDI as for example A42 on "Maritime ethics" which suggests the development of an international code of ethics which will establish the procedures and the limits for marine operations across the globe in order to ensure that the competing interests of different stakeholders will not harm the marine environment.

N°	CLUSTER	ACTION	VOTES
ACTIONS ON THE ROADMAP			
16	6	Development of information exchange system between government industry and univeristies	7
25	1	Enforce environmental protection framework in all maritime activities	5
10	1	Invest on technology, research and innovation to reduce pollution to the marine environment	4
1	1	Develop a marine environmental monitoring program and technology in support of the industry	3
42	8	Maritime ethics	3
OTHER ACTIONS			
9	6	Introduce free access to data concerning maritime sector	3
7	5	Establishment of cooperation schemes between companies and academia	1
11	7	Connect lifestyle to maritime pollution	1
15	2	Ballast water treatment and management	1
24	3	Educate people on preserving marine life through tourist activities	1
26	5	Promote ongoing dialogue between stakeholders and government regarding policies	1
28	1	Create an inventory of antipollution practices	1
45	3	Mentor the young people on the appropriate for the maritime sector behaviour competencies	1
12	5	Create an all inclusive coordination platform on maritime RTD	0
17	7	Connect the impact on seafood	0
23	7	Increase awareness of the recent maritime challenges	0
27	5	Trade Transparency Protection body	0
36	5	Focus on SDGs	0
37	5	Fines depending on pollution	0
43	1	Parameters to measure environmental issues in maritime sector	0

Table 6 Actions related to Ethics

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[24] https://www.polyu.edu.hk/lms/icms/research_maritimeInsight/2013-Dec-en/MARITIME%20INSIGHT_DECEMBER%20ISSUE(11).pdf

7   Workshop impact and implications for the future

7.1   Emerging topics

During the workshop discussion the following topics emerged:

1. Collaboration between policy makers, the academia and the industry is essential in order to (a) develop lesiglations to govern marine activities, (b) indicate the societal and industrial needs (c) produce results, products and technologies which are aligned with the needs of the industry
2. Exploitation of the new technologies and the internet in order to develop tools which foster open access to data and raise awareness among the stakeholders about the marine environment
3. Creation of physical infrastructure to host scientists is pivotal for the development of marine RTDI in Cyprus
4. Introduction of marine related courses in all levels of the educational system, from primary school to Universities is urgent to cultivate marine culture among the citiznes
5. Establishment of funding schemes deriving from national and European funds to assist new research and start-up initiatives

7.2   Policy implications resulting from the workshop

The main marine subjects discussed during the workshop were related to the lack of cooperation between the stakeholders involved as well as the need to introduce marine courses in all levels of the educational system which will ease to raise awareness among citizens regarding the protection of the marine environment. Specific actions that call for the active engagement of the policy makers and the government in order to initiate new lesiglations have been suggested allowing the smooth development of the maritime RTDI in Cyprus and beyond.

8 Participants of the MARINA local workshop

8.1 Participant profile

14 participants attended the International MML workshop in Larnaca, Cyprus. At the end of the workshop they were given a workshop evaluation questionnaire. 11 participants completed the questionnaire. The results of this survey are presented in the graphs here below.

- Participants per stakeholder group and gender
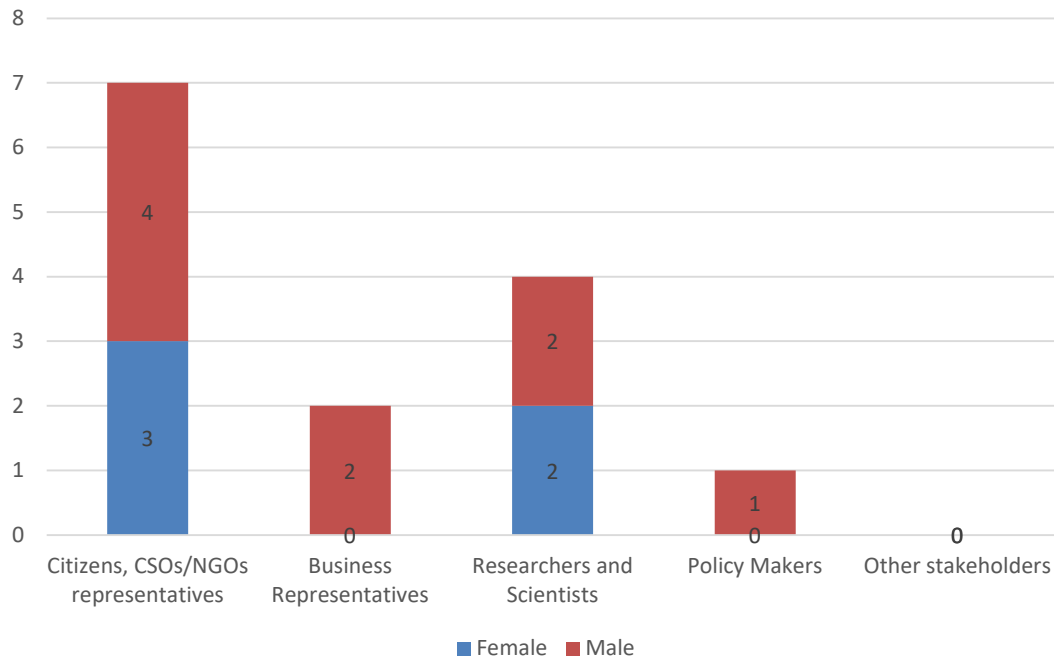
Figure 9 Participant profile breakdown

- Participant activity sector
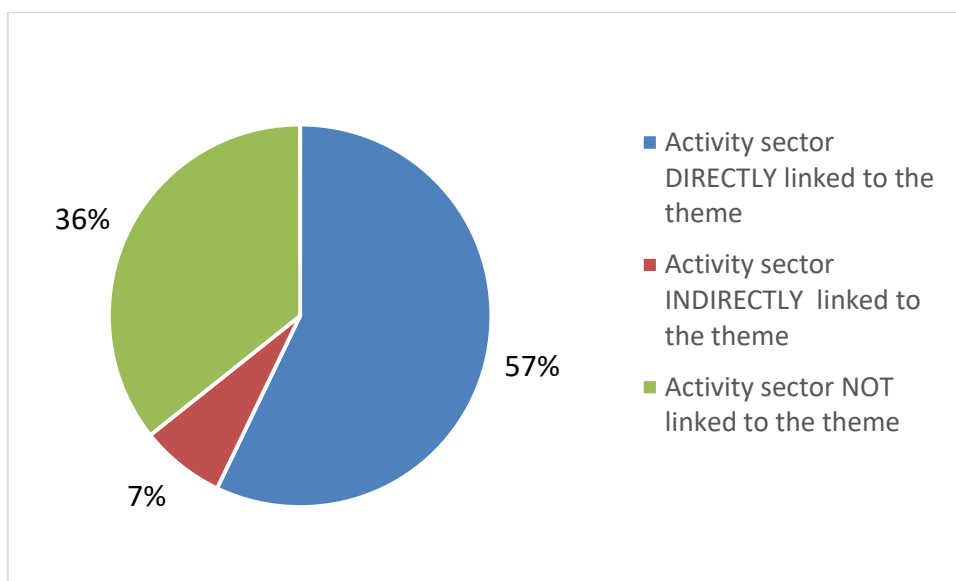
Figure 10 Participant activity sectors in relation to the theme of the workshop

- Age
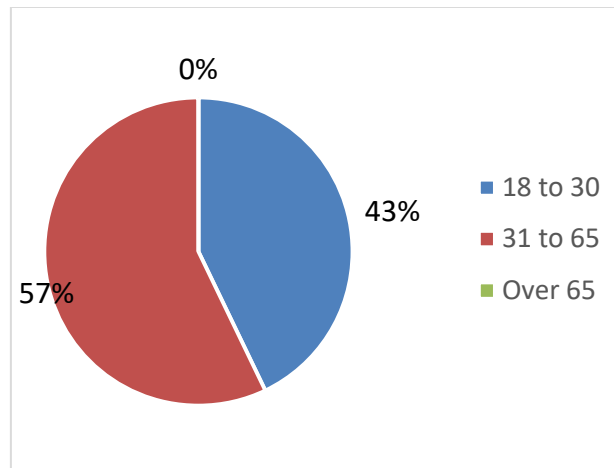
Figure 11 Participant age groups

8.2 Participants' personal aims to attend the workshop

As demonstrated on the below given figure, the vast majority of the participants (11 in total) joined the workshop with a view to engage with a wide range of different people from the society while a significant proportion of them (64%) answered that they participated in order (a) to work on the concept of sustainable development / marine issue / Responsible Research and Innovation, (b) to learn about a new marine scientific topic and (c) to produce results that follow ethical principles. On the contrary, only one participat indicated the answer "to propose a solution to a topic related to a marine challenge" and "to suggest priority topics for research and innovation" as their driving force to attend the workshop.
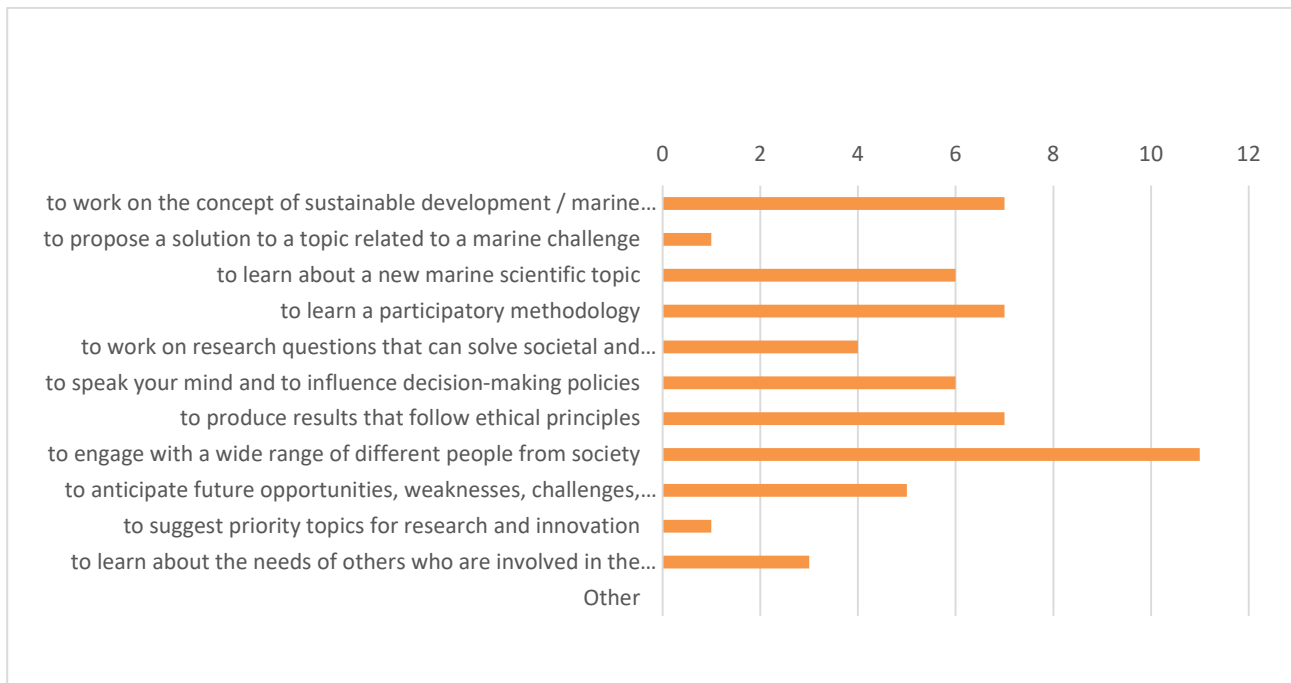
Figure 12 Participants' personal aims to attend the MARINA workshop in Larnaca, Cyprus

8.3 Participant knowledge of the RRI

The graph below shows the knowledge of participants about RRI and its dimensions before and after the workshop. As demonstrated, there is an evident increase in the number of participants who understood the

principles of the RRI after the event and know now how to implement RRI aspects in their daily work/life from two to six and from one to four respectively.
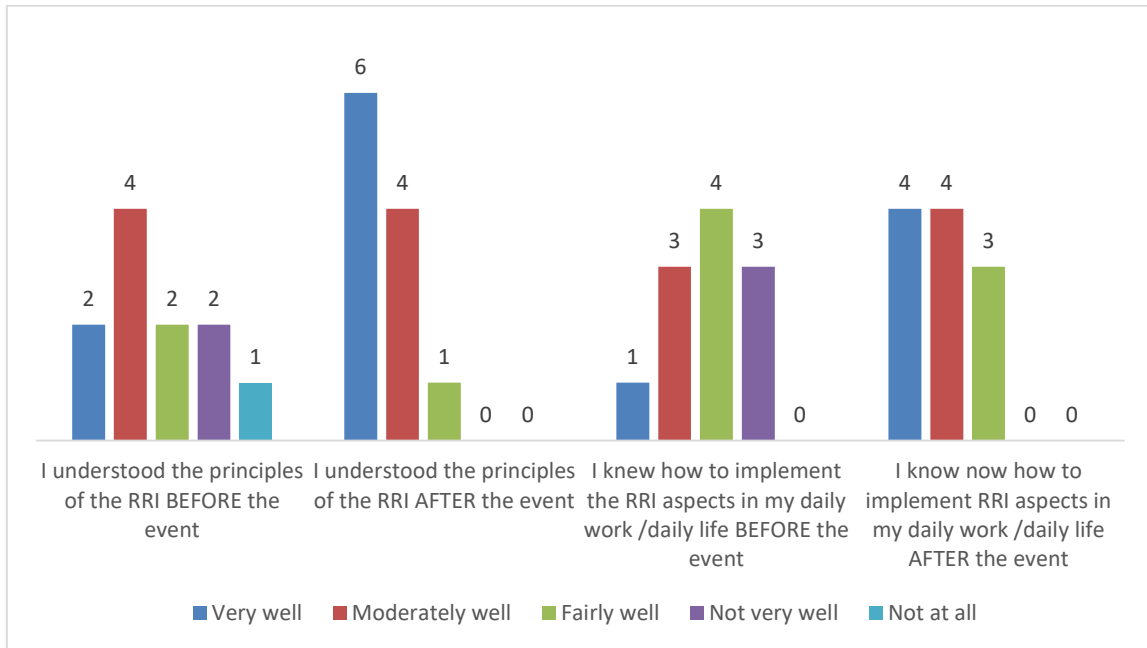
Figure 13 Participant's knowledge of RRI before and after the workshop

The below graph presents the answers to the question "How important it is to you research and innovation aspects and to learn about RRI" according to which nine participants indicated as highly important the answers "that research and innovation respect ethical principles", "that gender equality is supported throughout research and innovation processes" and "that scientific publications and data are made publicly available".
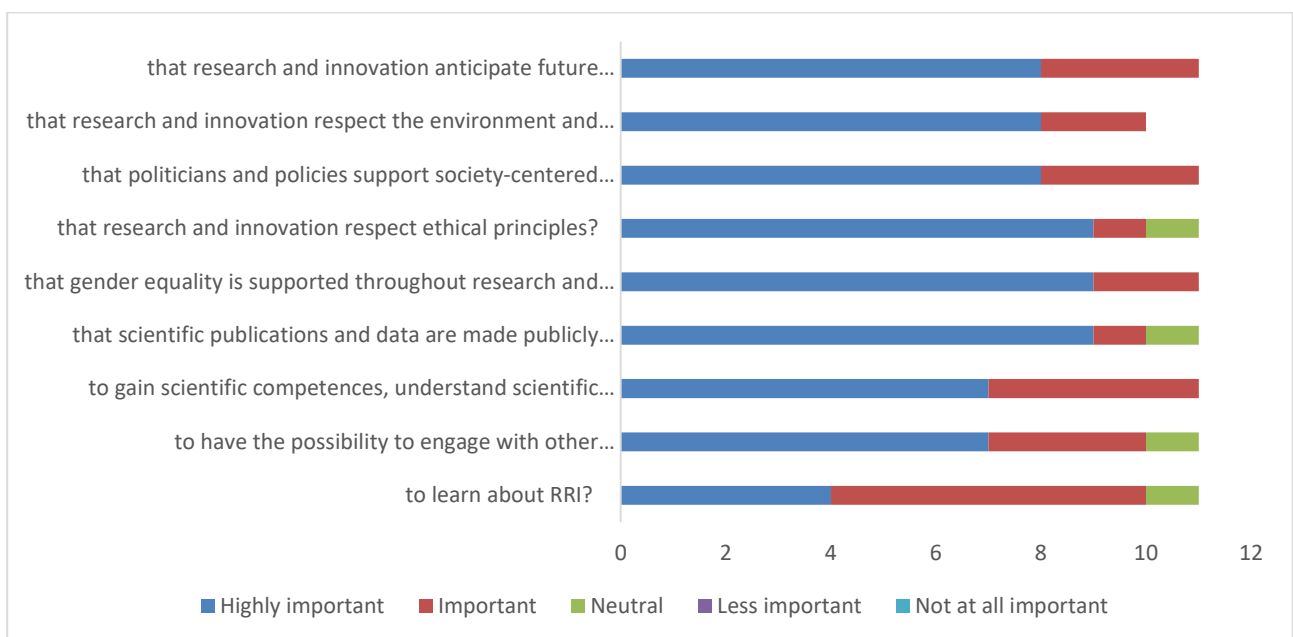
Figure 14 "How important is it to you research and innovation aspects and to learn about RRI"

8.4   Participant assessment of the workshop

Participants anwered as follows to the question "Which of the following is useful for you: Responsible Research and Innovation tools: Research related to the marine challenge discussed; Participatory processes; Responsible Research and Innovation concept and dimensions; Policy agenda; Networks and communities of practice/interest". As evident, eight out of the eleven participants marked "Responsible Research and Innovation concept and dimensions" as useful closely followed by "Research related to the marine challenge discussed" and "Responsible Research and Innovation tools" both of which were chosen by seven respondents.
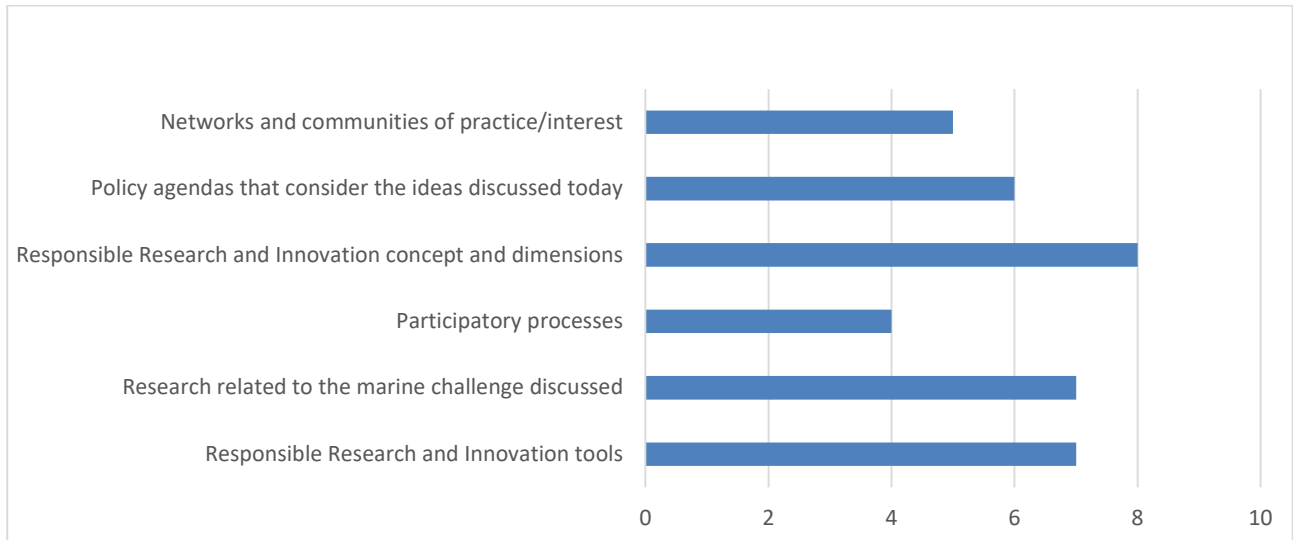
Figure 15 Workshop participants' preference to the RRI Tools

- Participants answered as follows to the statements:
  - "I will continue to exchange with the participants on this hot topic"
  - "I will continue to participate in the community on the MARINA Knowledge Platform on line"
  - "Do you plan to use the knowledge/skills gained in this workshop for your private or professional projects."
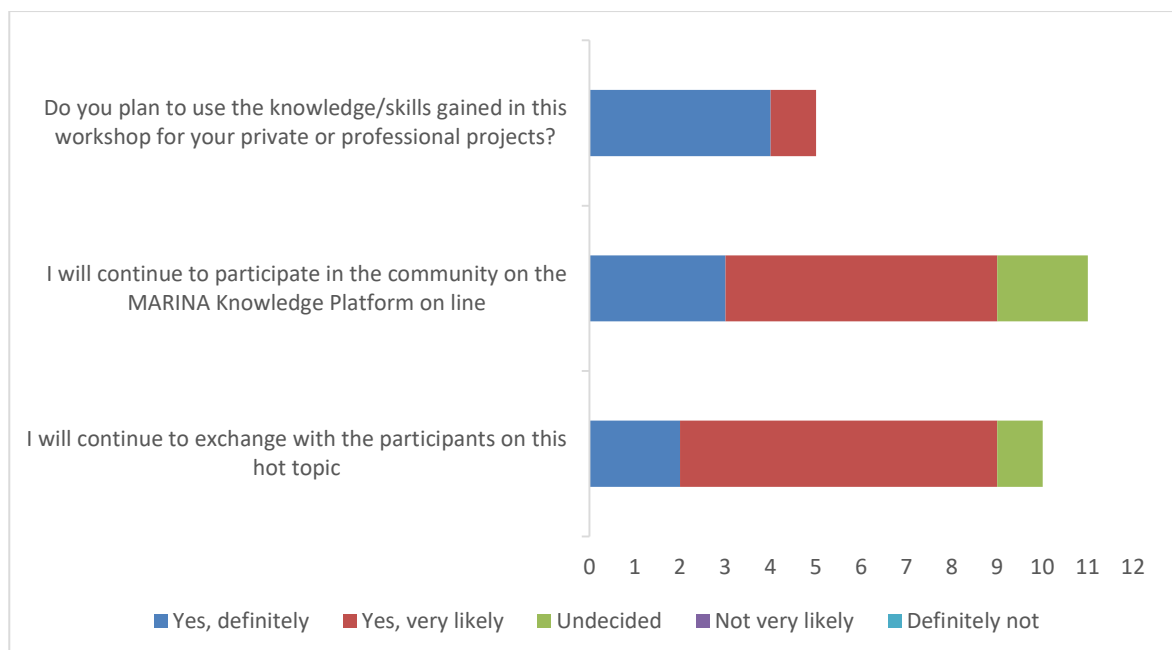
Conclusions

The 14 participants of the Cyprus International MML workshop discussed the development of a sustainable Maritime Research, Technological Development and Innovation (RTDI) in the perspective of Responsible Research and Innovation. The triggering question to address this issue was "What Responsible Research and Innovation (RRI) actions are needed for a resilient, responsible and sustainable maritime sector by 2030?"? In response to it, they put forth forty-five proposals of participatory RRI–driven actions.

The main conclusions of the workshop were the following:

1. Collaboration between policy makers, the academia and the industry is essential in order to (a) develop lesiglations to govern marine activities, (b) indicate the societal and industrial needs (c) produce results, products and technologies which are aligned with the needs of the industry
2. Exploitation of the new technologies and the internet in order to develop tools which foster open access to data and raise awareness among the stakeholders about the marine environment
3. Creation of physical infrastructure to host scientists is pivotal for the development of marine RTDI in Cyprus
4. Introduction of marine related courses in all levels of the educational system, from primary school to Universities is urgent to cultivate marine culture among the citizens
5. Establishment of funding schemes deriving from national and European funds to assist new research and start-up initiatives

Responsible Research and Innovation (RRI) implies a transparent and interactive process where societal actors and innovators actively collaborate to co-create solutions, services and products that are socially acceptable, sustainable and resolve important societal issues. RRI focuses on how to make research and innovation more useful to the society and how to protect the environment at the same time. Regarding how Responsible Reseearch and Innovation (RRI) and its dimensions may enable marine biotechnology research and innovation actions, the actions focused on the following dimensions:

Governance was the most important dimension, which appeared in 30 actions, that is a percentage of 67% in the total number of actions, followed closely by Science Education (29 actions), Public Engagement (23 actions) and Ethics (20 actions). As evident, Open access was connected to 18 actions while Gender equality seems to be the least important RRI dimension in the workshop considering that only six actions, a percentage of only 13% of all the actions generated, were associated with this particular dimension.

9 Appendices

9.1 Appendix 1: A list of actions and their clarifications

N	ACTION	CLARIFICATION	VOTES
1	Develop a marine environmental monitoring program and technology in support of the industry	We know the pressures coming from the industry so industry people with scientist have to decide specific technology and data that can be collected in order for the industry to be environmentally friendly and sustainable.	3
2	Develop and implement water treatment equipment	This is something that has been used in the oil and gas industry for the past 20 years, so it is something that can also be used also for the maritime sector. You will be able to take out of the water the smallest part of the oil. So it will be a good practice in order to send out clean water and not polluted water. It can be funded by the government or the industry, to the universities or individual organization in order to create a better water treatment practice.	0
3	Encourage students about the maritime sector and intelligent devices	Expert people from organization and government can go to universities and organize seminars and other events to educate students, explain what actually is maritime and help to improve the lifestyle to improve the environment. These seminars can take place every 6 months.	2
4	Create a global maritime sustainability fund		1
5	Use the media to inform people about maritime		4
6	Take measures to create culture	In terms of infrastructure. This means to create museums or innovate ancient ports. Take advantage of our histories to show to youngster and other people how to build up culture in this sector. It is a long term plan that will need funding from government and private investors to build culture. Use ships, ports, museums to youngsters can actually see history.	3
7	Establishment of cooperation schemes between companies and academia	One of the main problems of the maritime industry is the lack of skilled work force. By promoting schemes like trainings and apprenticeships, young students will be able to take skills that are necessary and will be more capable once they graduate and look for a job in the maritime transport sector. You can measure this through programs. This should be done through some companies in the maritime sector and universities. I know for example; the University of Cyprus is now establishing a new school of marine science and technology. So schools like that are related to this industry could cooperate with companies with the support of the government. This is not something that can be done immediately because this is a policy issue, but it could be feasible in 3 years' time. This should be more at the national level, but can be regional. Start locally and meet the problems of our own industry and then move regionally to the European level. The maritime industry is global.	1
8	Address climate change by placing suitable targets for the reduction of green house gases	This is a hot issue in the shipping industry in the past and future years. The shipping vessels burn the worst fuels, what ever is left in the refinery is sent to the ships. This means that the quality of the emission is very bad. Shipping and navigation are international and have been left out of the climate agreement so this year they will address this issue. We want to reduce our emissions, and we can measure this against the regulation where companies have to report their emissions to the authorities. The industry in general should implement this with the enforcement of the government. This specifically includes refineries producing appropriate fuels, appropriate engines, and run the ships in the most efficient way. This is relevant because to achieve this we need a lot of new technologies, monitoring systems, sensors and a lot of governance including the effect of regulations globally. Part of the discussion should include emission trade system where you pay for your emissions. The target set by the EU is 2050, or possibly less.	1
9	Introduce free access to data	This helps in considering in a greater extent and respect more the people and the environment and can keep the business image under	3

	concerning maritime sector	criticism. It is specific because we have data to show and exchange. We can measure how many countries are involved. All countries have to respect this agreement. It will help sustain the maritime sector and the environment. We can start this now, and keep going.	
10	Invest on technology, research and innovation to reduce pollution to the marine environment	The idea is to focus on research and development for improving the technology involved in maritime activities such as fuel efficiency and size of shop vessels. This can be done by replacing older ships with new, smaller and more efficient ships. This will reduce pollution in the sea. This is to be done by both government and companies within the maritime sector. The time scale for this can be considered long-term, raging from 5 to 10 years.	4
11	Connect lifestyle to maritime pollution	This is useful to the citizens to know how their habits in life, how they live and what products they use creates pollution to the marine life in general. You can start by going to the beach and what you leave there or what you leave in the open. Especially on an island because what ever you leave like plastics will end up in the ocean. This will change the citizen and the pollution will be diminished. This should start by the government bodies that are interested in pollution. The CSOs could take actions and multiply the knowledge to the department.	1
12	Create an all inclusive coordination platform on maritime RTD	The idea is to bring together all the relative stakeholders around one table where they could exchange ideas on measures to be taken and where the actions should go to. This is specific because it enhances dialogue and interaction between the different stakeholders. It also allows the exchange of valuable ideas as well as getting informed about the challenges and what the limitations are from each relative party. Maybe the most relevant stakeholder to do this is an international organization like the UN or an international conference on oceans or marine life. It should not have a time limit, it should be a body that starts existing and works on the same issues forever. Maybe this is what the IMO, but the idea is to bring together all the stakeholders of the industry and environmental agencies, etc.	0
13	Increase environmental and science education to promote societal understanding and participation	For sustainable change there should be greater focus on primary and secondary education. This will create a society of environmentally conscious citizens and hopefully influence more women into the field of science. This can be done directly through changing the curriculum or projects and workshops where NGOs go to schools to talk specifically about a topic such as ocean pollution or women in maritime science.	3
14	National funding for maritime research and innovative start ups	Funding is important to give incentives to the public for developing research institutes for projects in non-profit organization, start-ups, etc. That's going to take time to be decide in terms of what the amount will be, to who, how relevant the activities of the funded body will be regarding maritime. However, it's important to move national funding and not to depend only on funding from the EU.	1
15	Ballast water treatment and management		1
16	Development of information exchange system between government, industry and universities	The basic idea is to have up to date all three parties. As we know all members state of the EU have to comply with the EU regulations and regulations. Based on this information systems the government can upload new regulations and the industry can identify new issues that need to be solved. They can also ask for help from the universities in order to develop new technologies to treat these problems. Based on this triangle they will be able to communicate faster, easier and have solutions in less time. It is specific we have to update all three parties. The three parties will invest in this kind of system. It is not time bounded, because once it is started it will continue.	7
17	Connect the impact on seafood	As we know, millions of plastic waste ends up in the sea each year. Our sea food might come with a side of plastic, so people have to worry about the quality of food they eat almost every day. If people are aware of this matter, they may stop throwing rubbish into the sea and pollute and damage the marine life. So to conclude the awareness of people using different methods, social media or other seminars and events. It is should be continued, not time bound.	0
18	Use the web to inform and educate all stakeholders	By all stake holder it means all those that uses the web. It is quite general but can be specific to maritime sustainability RD because you can use the marketing networks from the web to promote ideas or to advertise education, definition and other stuff that has to do with maritime sustainability and educate everyone. It can be on the side of Facebook, or google search. It is not time bounded because you can do it forever, for a week, or just in certain countries. National fund can pay for this, or on a global scale you can engage with google to give you free space so the EU can start promoting these ideas.	3

		This is be universal, US based, regional, local. Just needs someone who is relevant to the subject to come up with ideas. For example, what is maritime, what is involved and what is suitability? Then the minister can come up with a circular or publication and send it all over the web. Start by using the adverting network to reach people.	
19	Create academic programs in all educational levels	This means each ministry of the counties need to develop lessons and courses to educate from primary to PHD thesis about his sector. So the sector can always be improved from RD scope. This will be done from the ministry's that will create the courses and it can start anytime.	1
20	Creation of blue entrepreneurship programs	This is another policy recommendation. The idea is to give people like graduate students or even employed professionals to develop an idea and put it in to action, and idea that is relevant to maritime sector. This is an idea that came from a workshop in Ireland in the marine field. So we should transfer the knowledge and best case senarios we have from other countries and try to transfer them to Cyprus and adapted them to the Cypriot reality. It is specific policy recommendation. You can start with a number like 20 people, employed or student and measure. This is mostly from funding from the government and possibly from the maritime transport sector, or professional organization. This is relevant because we need to encourage people to become more business oriented than research orientated. It is good to have research, but also good to have a business mind set because research will not take you too far but applied research and transform to product and marketable ideas is good. It is not something that can be done in a short time, it should be in a long term national strategy. It could be feasible in maybe 3 years if the government has a holistic approach to promoting research technology and innovation in the blue economy. This can also be done with the industry involved, but in a national context because it is hard to get business to invest unless they see it work. So it will be easier to get the government to fund as a leverage to commence business to invest as well. This can also be at a regional level with EU.	0
21	Engage researchers with the industry for the development of appropriate technologies	One of the issues we are facing in Europe is that a lot of the time researchers that are paid by universities and work with universities where the budget is very limited, often they spend a lot of money and effort on research and that does not produce anything useful for the industry or society. They just produce papers for the libraries and their CVs. There have been statements from people in Europe saying that the researchers are not having an appropriate impact on the economy. So we need researchers to understand with the industry really needs so that they can produce products, solutions and innovations that can really be applied.	4
22	Establish a platform for exchange of experience in maritime management	Experience is vital and exchanging experiences helps choose best practice. This helps to save time and money. By choosing best practices we can help the specific issue of sustainability and we can improve any practice. We can measure how it develops. This is help sustain the eco and maritime system. This can continue step by step.	1
23	Increase awareness of the recent maritime challenges	This can be done by both the education system and all relevant stakeholders such as maritime companies. We should strengthen the Cypriot awareness of challenge involved with the resent rise of maritime activities in Cyprus and its effect on the economy. This needs to be support by the EU and should be done in the next couple of years.	0
24	Educate people on preserving marine life through tourist activities	Cyprus is a place for tourism and we have a lot of opportunities to educate people in general and tourist from all over the world in how they should treat the ocean and the beach. The government bodies which are tourist organization, they should find different places at the beach and ocean to show the bottom of the sea and show them the good and bad in the area so they are educated. The tourist industries can get theses areas and use pleasure activities so they have fun but are also educated. We know that the tourist industry is seeking places that have activities, so it could be beneficial for collecting data and other ideas.	1
25	Enforce environmental protection framework in all maritime activities	Not only maritime activities but all activities that effect the ocean and marine life. The idea is to find ways to enforce measures that protect. There probably are already some, but the idea is to make them broader and stricter and give incentives for all stakeholders to respect the environment and take action for environmental protection. This is something that should affect society and industry in all levels, not just vessels that transport in the seas but also coastal activities or even simple citizen life style. This could start from local communities like villages, schools or local library for education oriented. It could also be the state government or international organizations such as the IMO.	5
26	Promote ongoing dialogue between stakeholders and government regards policies	As policies are crafted and implemented all stakeholders should be included such as locals, like divers and fishers, businesses and scientists. This can be done through the creation of a new consulting body, online platform for legislative feedback, or in a town hall setting using SDD or similar methodology.	1

27	Trade Transparency Protection body	I suggest a governmental body responsible for the Trade Transparency regarding the conservation of human rights, environmental protection and for avoiding smuggling. It will take time to set up such a body bit it's too depending on on how important government find it. And if that is established and as far as it works properly, it should stay forever.	0
28	Create an inventory of antipollution practices	We know the treats for the marine environment and we have a lot of experience with past pollution incidents. We have to be ready at any time to face such incidents. So we should identify all the anti pollution technology and practices currently used world wide. With this collected experience, we will be ready to face any threat coming form the shipping industry. This is very easy because it is just a review so it can be done now.	1
29	Implement RES technology in harbours and shipping vessels	The meaning of RES is renewable energy source, solar energy, wind energy etc. According to the EU regulations, Cyprus will not meet its goals for the 2020 regarding green house gases and carbon dioxide emission. This is important because these emissions effect the marine life, so it is an opportunity to implement this technology to shipping vessel in harbours to reduce green house gas emissions. We can replace conventional energy sources such as oil and gas, in order to create energy from renewable sources. This is specific because we are talking about reducing emission, and we can measure the deduction of emission. This has to be done between the government, EU funding and the industry.	2
30	Smart totem	This is a new technology that is a material pattern, a smart pylon that offers many facilities. You can add many devices like HR cameras and other things to address the problem. You can control the safety of the sea using the camera. Governments can install the totems in order to control monitor the pollution. You can add measurement sensors in order to calculate the emission and other problems can be solved using these pylons.\nThe government can monitor the people who throw rubbish in the sea for example. And they can also be used to collect data and can use RES (not electricity).	1
31	Create a real time observation system for monitoring environmental impact on maritime ecosystem	New technology creates opportunities for real time observation. We can use multi sensor systems to create and help understanding of human activities. We can create real time standards towards these activities. We can bring this to observe the distribution of drilling wastes and effect on the marine ecosystem. The government should fund this.	3
32	Create RTDI driven ecosystem where all stakeholders will be involved	We should create our own silicone valley here in Cyprus for the maritime sector. We have the industry that is huge, they usually recruit people from abroad to develop technologies and conducting applied research. Business do not look locally because we lack the infrastructure. In Cyprus the government approved an organization that will provide leverage to fund research technology and innovation programs. This is being set up in a few years' time. So we have the funds and the industry but we lack something that will develop technologies and research in order to meet the needs of the industry locally and international. We are building a center of excellent here in Cyprus, but we need more involvement of the government and the industry. This is hard to measure because this is a policy recommendation, but it will involve the government, EU institutions, the industry and universities. This is a long term plan, maybe one or two decades to put together.	3
33	Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges	One of the issues that we face in Europe is that we are spending Billions and billions in Europe on small programs that do not have the ability to produce anything meaningful. it would be better that we spend money on bigger projects that can build infrastructure and produce solutions. In more advanced nations, they have centers of excellence and institutes that are able to employ a lot of people, bring in the best minds, create labs and develop technologies. But people are getting into small projects and getting money to produce just papers. So we should create centers of excellent that have the capacity to hired competent people, and have the equipment and asset to produce something really useful.	7
34	Development of a smart system like data analytics to predict changes in maritime environment	Data is the basis for all researchers. It is the bases to develop and innovate. So keeping data helps to find a better solution. Data analytics is a tool to process this data quickly and have a solution. It gives the influence, how the data effects each other and keeps a history of data. So you can take measure to save or improve something.	0
35	Develop more maritime courses in Cypriot academia in order to improve engagement in maritime	This is due to the ongoing advancement in the Cypriot maritime industry, so it is important to invest in maritime courses in schools and university to maintain and enhance the competitive advantage within the maritime sector which has an increasing demand. This should be done by the educational system by including maritime experience in the study. This can start now and continue based on the	4

		industry	demands of the competitive market.	
36	Focus on SDGs		This is a general idea, but we should try to include as many SDGs in every single measure and research we are developing. If we are talking about climate action or marine life as an SDG, we should include as many as we can, because in every one there are mean dimension to them. For example, gender equality is a major issue we should try to include in all research and activities that we do concerning Sustainable development goals. This is specific because we have the 17 goals clearly. This is done by each person that works on issues related to the SDG and activities that effect the globe.	0
37	Fines depending on pollution		Fines from the government to hotel owners, in coastal areas, and ship owners depending on the marine pollution they cost. It's important to let public know which hotels or ship owners don't respect the limitations and get fined.	0
38	Integrate current control and surveillance systems		We have some surveillance and control systems, but different organization according to their purpose apply their systems. So this idea is to integrate all the systems in support of sustainability and reducing emission, over fishing, etc. So if the police surveys for migration, and another surveys overfishing, this is two different systems using the same technology. So integrating these systems would be beneficial to society.	1
39	Improve skills and education to adapt to changing technologies		This means the creation of professional training courses so that people engage in the maritime sector in general. We will be able to adapt in the changing environment in terms of technology. As soon as they receive a simulation that things are changing they will be educated and able to adapt to the future needs of the industry. We can measure the adaptation of the industry to new things. This should be done by the academics, universities, colleges or the people who regulate the maritime sector. This is an ongoing process that can always be enriched with additional course.	1
40	Apply the integration of women in the maritime sector activities based on the international maritime organization program		Women enrich activities and it is important to open up educational systems and industrial activities to women for gender equality. There are already initiatives from the international maritime organization programs to create educational programs, and this should go into the curriculum and open the system. If it is engineering or business programs, there could be quotas. In Uclan there are only 10% of women in the mechanically engineering program in Cyprus. This is very low, so the problem starts from kindergarten and in the family. This this is a long term issue and has to be a long term goal. The maritime sector is one of the most sexist industry on the planet and education has to be improved. This is not for just women to fix, but it has to start in the industry to educate their employees and management. They need to cut the 'all boys syndrome'.	4
41	Introduce ocean literacy programs in the educational system		The UN through the UNESCO and SDGs have targets to promote ocean literacy. This mean educates people on the influence of the ocean on us and our influence on the ocean. This is something in Cyprus that should be introduced into the educational system so that from an early age people understand our relation with the sea	4
42	Maritime ethics		Ethics is the way we behave. Having a discussion about all these actions, we have suggested a lot of ideas that are related to the stakeholders. These stakeholders do not have the same interests, sometimes they are the opposite. SO there should be an international code of ethics so that everyone plays the same game under the same rule. Through this code of ethics we should establish the procedures and the limits for operations. There should not be one person with the power. The code of ethics should be specific and measurable by seeing how people behave differently. This will take time, because it is something you have to teach and explain how to behave. This will help all the action have a sustainable application.	3
43	Parameters to measure environmental issues in maritime sector		By having parameters, we can measure. Seeing all the quantities, we can decide our actions. This is related to using technologies and sensors to keep all the parameter. We can start by specific parameters, the basic parameters, by talking to the people that are working with this subject. Safety or environmental parameter, etc. for example. This will be done by everyone in the business as well as society.	0
44	Broad public awareness raising campaigns on marine issues		The idea is to inform society in general and keep the society in mind every time we do something. There should be a broad public awareness campaign that includes local communities, cities, governments and international organizations.	5
45	Mentor the young people on the appropriate for the maritime sector behavior competencies		We have been our selves running a mentoring program for a few years now to educate the people of the opportunities in the blue sector. We did a lot of work with school and talked about the opportunities in the maritime profession. But we realized that we may be missing beyond behavioral competencies that are not taught in school and academies. So we should go to a younger age to introduce these things. In the maritime sector there are a lot of opportunities for a career, but they demand a lot of behavior companies that are sometimes missing in Cyprus. Such as personal motivation and strength, and young people no longer have them. This can be done	1

through families, schools, teachers and programs that are structured to attract young people.

9.2   Appendix 2: SMART Action Plans

Create a global maritime sustainability fund (Action 4, Cluster 4, Votes 4)				
S	**M**	**A**	**R**	**T**
Specific (What is the **SPECIFIC** explication of the action?)	Is the implementation of this action **MEASURABLE**? How?	Is the implementation of this action **ASSIGNABLE**? Who is doing this?	Is the implementation of this action **REALISTIC** / **RELEVANT**? Why?	Is the implementation of the action **TIME-BOUND**? When? How long will it take to complete it?
Financial instruments: Funds for sustainability initiatives	The progress of the Fund will depend on how much money it will attract from the different Parties but mainly on how many and of what importance initiatives will be financed by it.	Parties to the IMO.	Many State and non-State actors could apply to the Fund to get initiatives financed. These initiatives will focus on maritime sustainability, thus will fill an important gap between the idea and the action.	With a strong political will, the Fund could achieve a fair amount of money in 2 years and initiatives can start getting funds straight after that.
It's a specific action as the global fund will give the opportunity to many countries including Cyprus to invest money and improve the area of Maritime Research and Technological Development! However, it could be a more specific action in terms of who would be eligible to receive the funding (government bodies, individual research institutes etc).	Identification of the progress could be the reports of the researches done based on that specific global fund.	Could be International Maritime Organisation, Could be part of European Commission's Horizon 2020.	It's realistic action if the aforementioned bodies decide to provide the funds.	Depends on the decision of the aforementioned bodies.
Development of new technologies for environmental protection and monitoring.	Environmental performance and energy efficiency.	United Nations	Funding to projects and initiatives that promote applied research and development of innovative green technologies.	In the long-term after 5-7 years.

Gather funding for maritime projects.	Amount of funding raised and number of projects invested in.	A fund with involvement from governments and private bodies.	Implement maritime projects.	Could be from 3 years up 10-30 years depending on the project.

Create a critical mass of research infrastructure and capability that will allow the development of innovative solutions to industry's challenges (Action 33, Cluster 4, Votes: 7)				
S	**M**	**A**	**R**	**T**
Specific (What is the **SPECIFIC** explication of the action?)	Is the implementation of this action **MEASURABLE**? How?	Is the implementation of this action **ASSIGNABLE**? Who is doing this?	Is the implementation of this action **REALISTIC / RELEVANT**? Why?	Is the implementation of the action **TIME-BOUND**? When? How long will it take to complete it?
Research	Number of independent researchers who are part of this critical mass, and number of associated countries/Universities/research centres.	Network of Universities and research centres already working on maritime issues.	Comprehensive research on maritime issues and innovative solutions on how to tackle them.	It could start in 2 years time and go on for decades.
Spending money for creating centers of excellent and institutes, which will have the research infrastructure and will hire competent people, will lead to meaningful solutions towards the development of maritime.	The creation of the centers of excellence and the institutes is an obvious indicator. Then the solutions given by them to the industry, developed technologies etc will be the indicator of their performance.	European Funds; not for small projects but for greater initiatives as this one.	Yes. It can be done if we could ensure European Funds.	Depends on the time of ensuring the Funds! Also the time needed for the construction of the infrastructure.
Tackling underperformance in terms of RTDI at European and international level through the creation of the necessary infrastructure (labs and equipment).	Creation of centres of excellence	Local actors in cooperation with the industry the academia and the government.	Conduct of applied research, development of new technologies and innovative products, jobs creation.	Given that there is such project currently in progress, this could be achieved in 5-7 years from

				now.

Introduce ocean literacy programs in the educational system (Action 41, Cluster 3, Votes: 4)

S	M	A	R	T
Specific (What is the **SPECIFIC** explication of the action?)	Is the implementation of this action **MEASURABLE**? How?	Is the implementation of this action **ASSIGNABLE**? Who is doing this?	Is the implementation of this action **REALISTIC / RELEVANT**? Why?	Is the implementation of the action **TIME-BOUND**? When? How long will it take to complete it?
Education	Number of schools (or Ministries of Education) that adopt and implement ocean literacy programmes.	Ministries of Education of countries interested in maritime issues (including all States with a coast).	Education from a very early age about maritime and marine issues to raise awareness about these; contribute to a general understanding of these issues; trigger innovative ideas for change.	Long-term measure! It could take 1 generation to have an effect (or 15 years maybe).
Education is important to help youth understand how people influence the ocean and in reverse way how ocean influences people. It's important to be implemented for increasing the interest of young people to continue their studies in the field of Maritime Research and Technological Development.	It could be measure by identifying the increase of interest on Maritime Research and Technological Development from the youth after the introduction of such programs in the educational system.	Ministry of Education and Culture for formal education, Non - Governmental Organizations for informal education.	It's a realistic action given the fact that reform of educational curricula is not a rare phenomenon.	It could be achieved as soon as the Ministry of Education and Culture decides to reform the education curricula and introduce the Ocean Literacy programs in it.
Lack of knowledge of children on the sea, its challenges and opportunities	Number of children that will follow the programs and number of children that will pursue marine and maritime studies after high school.	The Blue Career Centre of Eastern Mediterranean and Black Sea in cooperation with	More young people will choose marine and maritime related studies given the demand of the marine and	Such programs are currently taking place but can be further

		the Ministry of Education.	maritime industry for specialized personnel.	enhanced.

9.3 Appendix 3: Workshop implementation

Recruitment of participants

Extensive research was carried out to identify relevant stakeholders by XPRO and CNTI in close collaboration with the Maritime Institute of Eastern Mediterranean. The network of both organisation has been used to identify participants. Each participant received a personalised invitation and a topic presentation brochure by e-mail by CNTI. The e-mail was additionally sent to all stakeholders who participated at the second local MML workshop organized in Nicosia on February 2018.

Once registered, the participants were contacted by telephone with the instructions to submit their action ideas on the MARINA platform or a dedicated Google form designed for the purposed of the workshop.

Five of the registered participants cancelled their attendance without informing the organizers in advance and providing any explanation.

The workshop was promoted through the websites MARINA, XPRO and through the social media channels (Linkedin and Twitter) of XPRO and CNTI (Facebook).

Workshop facilitation method

Six face-to-face participatory methods were proposed to facilitae the workshops: Focus Group, World Café, Science Café, Delphi, Structured Democratic Dialogue Process and Future Search.

The MARINA workshop What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030? in Larnaca, Cyprus was facilitated according to the Structured Democratic Dialogue method.

The Structured Democratic Dialogue (SDD) participatory method has been developed by the Cyprus Neuroscience and Technology Institute (CNTI). Assisted by software, the method enables a democratic and structured dialogue among a heterogeneous group of stakeholders in a limited amount of time. It is effective in resolving multiple conflicts of purpose and values, in identifying obstacles as well as generating action plans to sufficiently respond to complex questions. The SDD^{SM} was chosen as the facilitation method for the workshops because it allows for integrating contributions from individuals with diverse views, backgrounds and perspectives through a process that was structured, inclusive and collaborative.

Building a roadmap

Please refer to section 5.4. Building a roadmap.

Workshop organisation

The hot topic of the workshop was chosen from the list of marine themes suggested for the MARINA project, resulted from the second round of local MML workshops and was related to the Blue Growth initiative of the European Commission. The original choice of the workshop-topic was marine biotechnology which was the topic of the second local MML workshop organized in Nicosia on February 2018. However, the disappointing lack of interest and participation during that workshop had as a result the immediate shift in the topic choosing marine transportation instead. XPRO took the lead for researching the subject and relating to the Cypriot and European context. This work resulted in the hot topic description of the workshop.

The workshop was held at the House of Arts and Literature in Larnaca. Coffee breaks and lunch were served on side tables in the room. The atmosphere was friendly; the participants were interested in the topic and in the local marine societal issues in general.

The workshop used the Structured Democratic Dialogue (SDD) participatory method that was used also in the first and the second local Cyprus MML workshop. The participants were asked to submit their ideas in advance of the workshop. However, this did not happen despite several reminders. CNTI was in charge of the facilitation of the workshop. The workshop was initiated with an introductory presentation by XPRO about MARINA and its aims, what is RRI and about the marine transportation topic.

The workshop participants were attentive and fully participative and they found the facilitation method very engaging. Greatest amount of time was spent on the clarification of the actions and as a result the clustering phase that followed was done manually according to which participants had to cluster the actions together by

moving them as necessary around. This exercise energised the group who focused on discussing the influences among the most voted actions. The result from the mapping phase was a poor map containing a limited number of actions. The participants were asked again to vote second time on actions that received less than three votes. Each participant received 3 stickers for voting. After the second voting, the discussion of influences among action was restarted. However, again the participants did not agree that the actions had any mutual influence.

Workshop follow-up with participants

At the end of the workshop, participants were asked to further define the actions listed on the action map. Only four participants responded. Following the workshop, the workshop report and photographs are posted on the MARINA Knowledge Sharing Platform, where the workshop participants were invited to download them. A thank you email was also sent to the participants with the workshop report.

The workshop report was also sent to a journalist of the largest English-spoken newspaper of Cyprus "Cyprus Mail" for further communication.
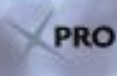
Moreover, the extracts of this report will be published under the event in the Event Section on the MARINA Knowledge Sharing Platform and shared with the workshop participants. This will be an occasion to reach out to the participants and invite them to visit the MARINA platform to retrieve it together with other international MML workshop reports.

Workshop implementation challenges

The greatest challenges of the workshop was to have the participants submit the action ideas online on time and ahead of the workshop and to attract participants from all stakeholders' groups. Even though invitations were sent to relevant ministries and public bodies, the workshop failed to welcome any policy makers.

9.4   Appendix 4: Agenda of the workshop

AGENDA

09:00-09:25 – Welcome, Introduction to the project MARINA, to Responsible
              Research & Innovation and to the goals of the workshop
09:25-09:35 – Triggering Question
09:35-10:35 – Generation and Clarification of Actions

☕ 10:35-10:50 – Coffee Break

10:50-11:35 – Generation and Clarification of Actions

11:35-13:00 – Clustering of Actions
13:00-13:10 – Voting

🍽 13:10-14:00 – Lunch

14:00-15:30 – Mapping of Actions
15:30-15:50 – Discussion of the Map of Influence

☕ 15:50-16:00 – Coffee break

16:00-16:40 – SMART Actions
16:40-17:00 – Wrap-up

LOCATION

House of Arts and Literature
Vasileos Paviou Square, (former Ottoman Bank Building)
Larnaca 6023

🍽 *Light snacks during the coffee breaks and a lunch will be provided

9.5 Appendix 5: A list of communication materials about the workshop

1. Invitation letter
2. Participants' list
3. Hot topic brochure
4. Poster

9.6   Appendix 6: A list of audio-visual material about the workshop

1. Photographs: under "What Responsible Research and Innovation (RRI) actions are needed for sustainable Maritime Research, Technological Development and Innovation (RTDI) by 2030?" event in the event section on the MARINA platform