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COMMUNICATION AND REGULATORY CHALLENGES IN BALTIC SEA REGION PORTS

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1 INTRODUCTION

The Baltic Sea is one of the most heavily trafficked seas in the world. The countries of the Baltic Sea Region (BSR) are heavily dependent on shipping for imports and exports as well as for internal trade. Passenger transport and cruise tourism is also considerable. The current high level and expected growth in vessel traffic increase the risk that there will be more accidents in the future, unless improved safety and security procedures are set in place. Therefore, the EU's vision is that the Baltic Sea should become a leading region in maritime safety and security. (CEC 2015)

Emergencies can be caused e.g. by fire, explosions, leakage of hazardous substances, or by natural causes such as flooding. Also, security issues can pose a serious problem to supply chains through criminal activities related to cargo and/or vehicles and to the mobility of people as evidenced by the rapidly changing situation with immigrants and asylum seekers. Subsequently, mitigating the adverse effects of such safety and security incidents is very much in the interest of seaports (see e.g. on safety DfT - Department for Transport 2015, Haveman and Shatz 2006, Bichou 2008, Helmick 2008 on security). It is also the responsibility of competent authorities – notably rescue services or their equivalent – to deal with such incidents both before, during, and after they might occur.

The joint research project HAZARD aims at mitigating major accidents in major multimodal seaports in the BSR and deals with a range of relevant safety and security concerns in relation to port activities. HAZARD brings together rescue services, port authorities, logistics operators, and universities from Estonia, Finland, Germany, Lithuania, Poland, and Sweden. One process to support the project's aims was to carry out a BSR-wide Delphi study. The objective of the Delphi study was to create an overall picture of the communicational and regulatory challenges related to safety and security issues for major seaports in the Baltic Sea Region. The Delphi process recognized major safety and security challenges and had two major purposes:

- To identify major challenges and problems related to regulatory aspects on safety and security issues as well as challenges related to communication and joint exercises in seaports by exploiting experts' knowledge and
- To identify improvements and solutions that experts in the field would suggest to be made in the near future (five years' time span) to mitigate emergencies and accidents in seaports.

The first challenge topic on problems related to regulatory aspects on safety and security issues is related to Work Package 3 (WP3) of the project, and the second challenge related to communication and joint exercises is related to the Work Package 2 (WP2) of the project. In order to get experts' views and development ideas on these topics, the method chosen was Delphi, because it is widely applied for structuring a group communication process, so that it is effective in allowing a group of individuals as a whole to deal with a complex problem (Gordon 2011, Linstone and Turoff 1975). The aim was to study emergency situations by using Delphi and to identify circumstances, where different actors have recognized potential problems or risk

situations related to emergencies in seaports, allowing us to create an overall picture of these challenges. The relevance of this study is in engaging major actors of Baltic Sea Region seaports in a mutual learning process of how to overcome challenges and innovate solutions to the problems of seaport safety and security. The results help improve safety and security preparedness of ports and reduce damages in an emergency.

2 DELPHI STUDY

2.1 Overview

The aim was to study problem situations using Delphi to identify the circumstances, where different actors have recognized potential problems or challenges in regulatory aspects of safety and security issues as well as challenges related to communication and joint exercises in seaports in the Baltic Sea Region, allowing us to create an overall picture of these challenges. The aim was also to get experts' views on improvement and development ideas on the challenges recognized in the study.

The Delphi study was carried out between August 2016 and August 2017. In the Delphi study, participants were selected from the experts of a field of study, and the aim was to cover all the relevant aspects of the study objects. Therefore, the successful realization of Delphi requires the design of an expert group structure, allowing for many knowledgeable individuals from different disciplines or specialties who have different working backgrounds and experience, and who contribute information or assessments that are broader in scope than is possible for any single individual. (Gordon 2011, Kuusi 1999, Laakso et al. 2012, Laakso 2014, Linstone and Turoff 1975.)

In this Delphi application, the panel of experts was selected from the organizations of the fifteen project partners and ten associated organizations, i.e. rescue authorities, seaports and logistics companies, and universities. Three competence areas for experts were identified during the planning phase of HAZARD: experts were expected to have knowledge on 1) the regulatory framework on seaport safety and security, 2) communication in emergency preparedness, and 3) preparedness through joint emergency exercises. In addition to project partners and associated organizations, the panel was supplemented with other experts, so that in the panel, there were experts from three interest groups from all Baltic Sea Region countries.

2.2 Phases of the Delphi process

The Delphi study was a two-round process (Figure 1). The execution of the Delphi rounds was done by online questionnaires. Questions and claims for the rounds were formulated based on the desk study and workshop results for the first round and the analysis of the material from the first round for the second round. The experts were asked to answer not only as representatives of their own organization, but also as representatives of their branch. The invitations for joining the panel was sent to 61 respondents, of which 27 accepted the invitation. The respondents were from five different Baltic Sea Region Countries: Estonia, Finland, Germany, Lithuania, and Sweden.

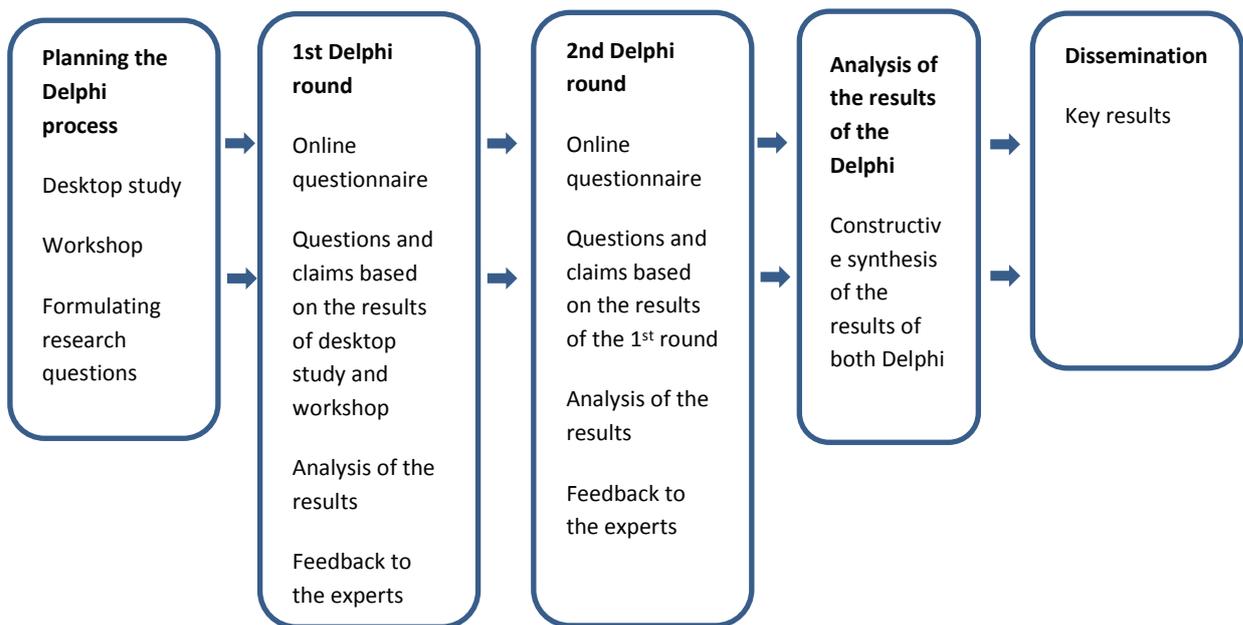


Figure 1. Structure of the HAZARD Delphi process.

In this Delphi application, the complete anonymity of the experts was considered necessary. The anonymity of the experts helps avoid the limitations in expressing problem situations and possible solutions to the challenges, which can be present e.g. in face-to-face workshops. Also, anonymity ensures that the status of an expert does not affect forming opinions (Rescher 1998). Furthermore, in the interest of value conflicts, issues do not become personalized in the same ways, if you can reply anonymously. Anonymity ensures that Delphi is suitable for research questions when searching for solutions to complex problems and is also suitable for very sensitive topics (Gordon 2011; Laakso and Ahokas 2013).

3 FINDINGS OBSERVED IN THE FIRST DELPHI ROUND

3.1 Challenges in the regulatory safety and security framework within the seaport context

3.1.1 Inadequate regulation related to major accidents

In the first question concerning regulation, the experts were asked to assess the current regulation related to major accidents within the seaport context. The experts were asked to assess the following claim:

Regulation related to major accidents is inadequate in seaports.

The claim concerns the trend that society is more vulnerable than before, as natural disasters such as storms and floods, for example, seem to be increasing. Also, society nowadays is more dependent on technology and thus, more vulnerable. Therefore, the legislation should obligate all players to take major accidents more into account.

The experts were asked to assess how they agree with the claim related to challenges in the regulatory safety and security framework. Most of the experts agree with the claim (Figure 2). They saw that regulation related to major accidents should be improved and focus should be more on preventive measures and local circumstances. Some experts had noticed that nowadays there is, for instance, a lack of clarity on regulatory responsibility areas and this should be improved as society becomes more vulnerable and interconnected. Only 15 percent of the experts disagree with the claim. They stated that focus should be more on preventive technologies than on regulation. Some considered that the regulatory work would be too excessive and require a great deal of administrative work, since the Seveso III Directive already handles most of the risks.

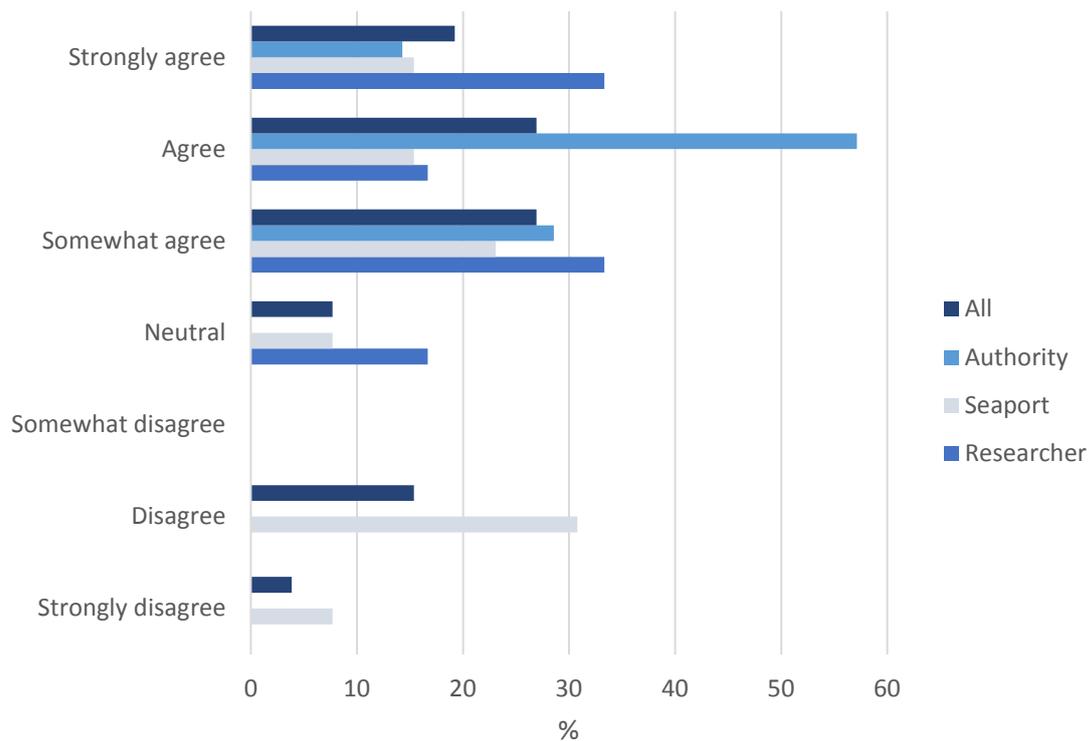


Figure 2. Regulation related to major accidents is inadequate in seaports. Percentage of all respondents, N = 27.

3.1.2 Lack of common terminology

For the second issue concerning regulation, the experts were asked to assess challenges related to terminology that administrative branches use. The experts were asked to assess the following claim.

It is a problem that different administrative branches have their own terminology.

The claim relates to the observation that terms used in safety and security documents vary, as competent authorities do not have common terminology, causing too heavy burden for seaports in the form of parallel documentation.

The experts considered that, on average, it is a problem that different administrative branches have their own terminology (Figure 3). It is worth noticing that 50 percent of research representatives strongly agreed with the claim. They saw that it would help seaports, if all authorities had common terminology. Common terminology would also make communications faster and clearer. On the other hand, some seaport experts and authorities assessed the claim as neutral or disagreed with the claim, because they saw that authorities already use terminology that is understood by all those who are involved, or they have not faced any big challenges caused by terminology.

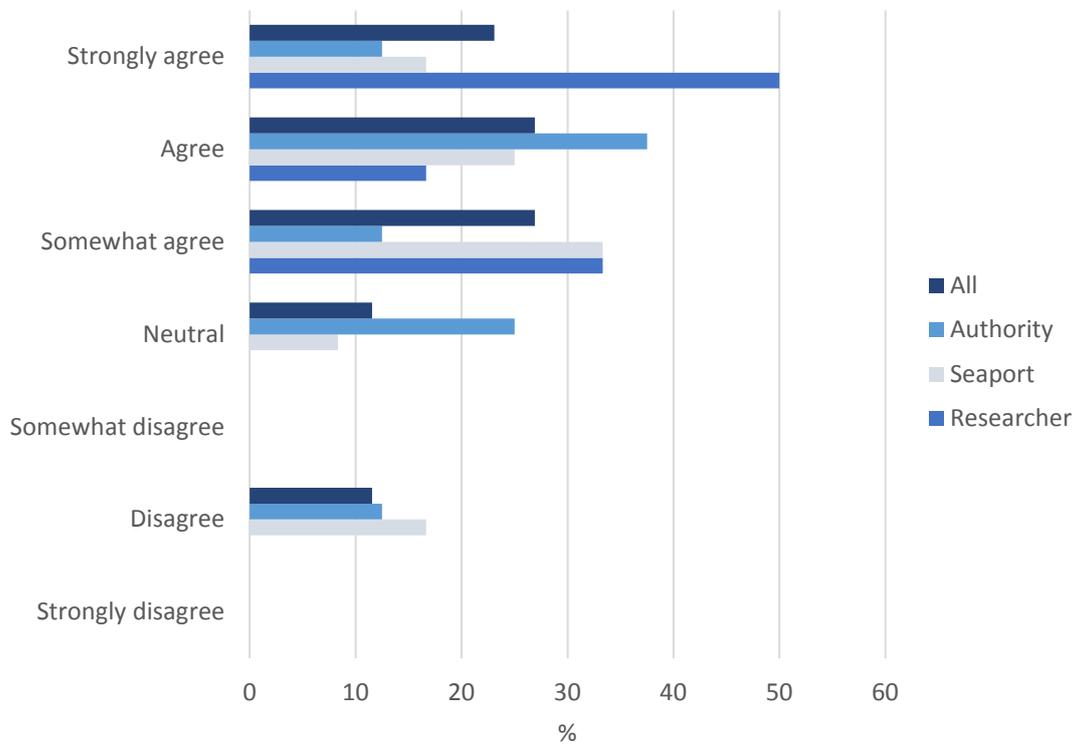


Figure 3. It is a problem that different administrative branches have their own terminology. Percentage of all respondents, N = 27.

3.1.3 Regulation related to cyber threats

For the third issue concerning regulation, the experts were asked to assess challenges related to cyber threats within seaport context. The experts were asked to assess the following claim:

Regulation related to preparedness for cyber threats is inadequate in seaports.

The claim concerns the trend that external threats to IT systems (or cyber threats) have increased, and the effects of threats to the cyber operational environment have become wider. Therefore, cyber security should be improved from its current state in seaports by means of regulation. The experts clearly agreed with the claim, because regulation related to cyber threat preparedness is inadequate overall and not only in the case of seaport (Figure 4). Nowadays, society relies heavily on IT services, and there has not been enough security measures in the IoT (Internet of Things) issues. IT systems are widely used in port activities and, therefore, it is necessary to ensure data protection. Researchers and authorities agreed with the claim especially strongly. A few seaport experts disagreed with the claim, because even though

legislative challenges may exist, according to them, the biggest challenge is the incapability of recognizing cyber threats and defining the related needs for seaports.

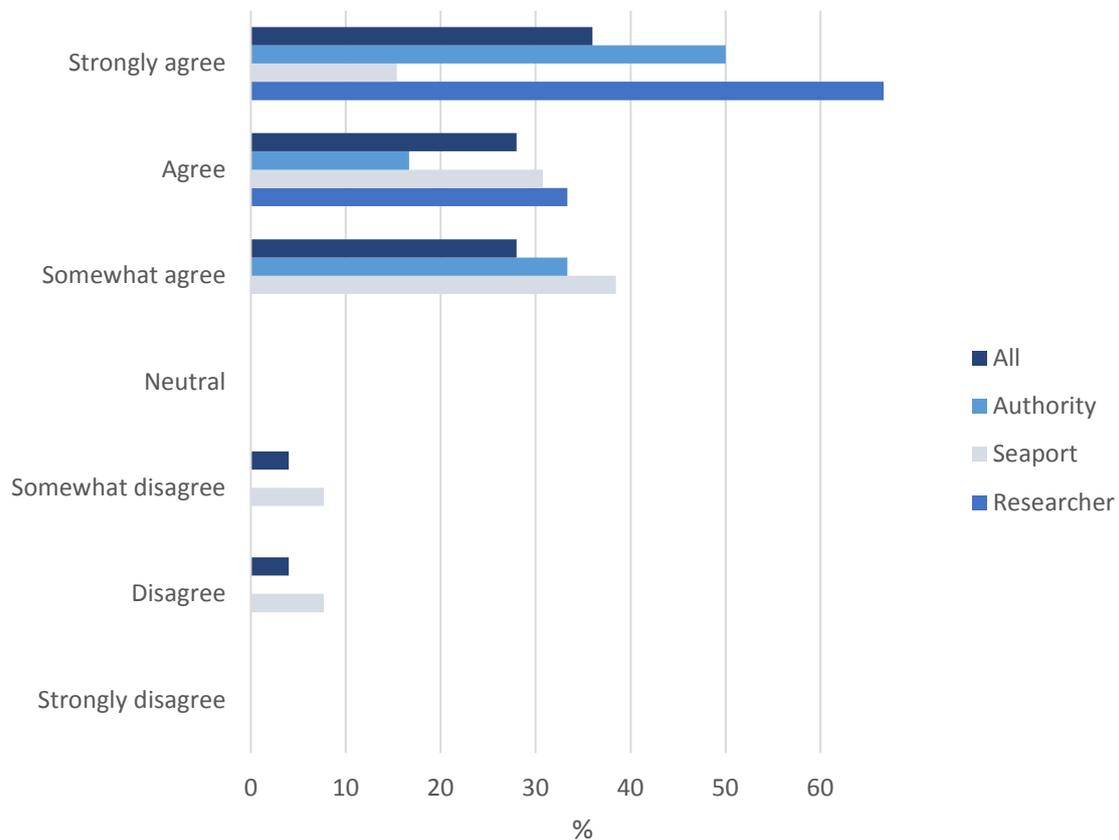


Figure 4. Regulation related to preparedness for cyber threats is inadequate in seaports. Percentage of all respondents, N = 27.

3.1.4 National variation between the EU countries in safety and security regulation

In the fourth question concerning regulation, the experts were asked to assess problems and challenges related to national variation between the EU countries in safety and security regulation. The experts were asked to assess the following claim:

It is challenging that in the Baltic Sea Region, there is national variation between the EU countries in safety and security regulation and administrative demands.

The claim is connected to the challenge that authorities in different EU countries can, e.g., interpret the same regulation in different ways. Assessment of the claim diverged only slightly (Figure 5). Most of the experts considered it to be challenging that regulations vary between countries. This challenge leads to locational advantages. It is also very difficult for seaports to

find a common way to interpret regulations due to the different ways that safety and security are organized within the Baltic Sea Region countries. Only a few experts considered the claim neutral or disagreed with the claim. According to them, EU regulation requirements must be understood in the same way across all the EU countries, but all countries should take local circumstances into account.

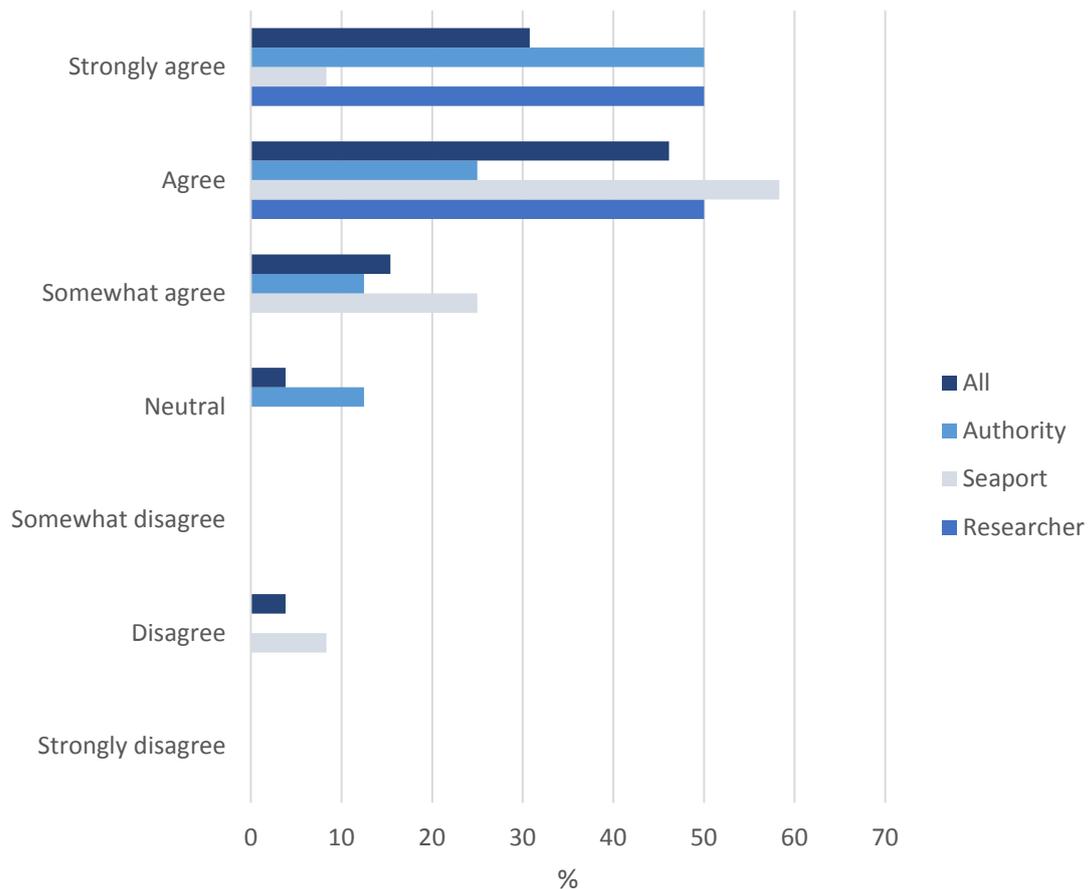


Figure 5. It is challenging that in the Baltic Sea Region, there is national variation between the EU countries in safety and security regulation and administrative demands. Percentage of all respondents, N = 27.

3.1.5 Regional variation in the interpretation of regulations

In the fifth question concerning regulation, the experts were asked to assess the challenges related to regional variation in the interpretation of regulations. They were asked to assess the following claim:

It is challenging that there is regional variation in the interpretation of regulations and administrative demands within a country.

The claim is connected to the problem that it is challenging that seaports are not in equal situation, since obligations can differ within a country. The experts considered this as a problem, because civil servants' level of knowledge and their interpretation of legislation is not uniform within a country nowadays (Figure 6). This is problematic, especially if your organization has to work in different regions of a country, because it is hard to make decisions due to the variation in interpretations. This also leads to locational advantages for different actors. In this study, only Estonian experts disagreed with the claim, because they considered this to be centrally regulated, so there cannot be regional variation.

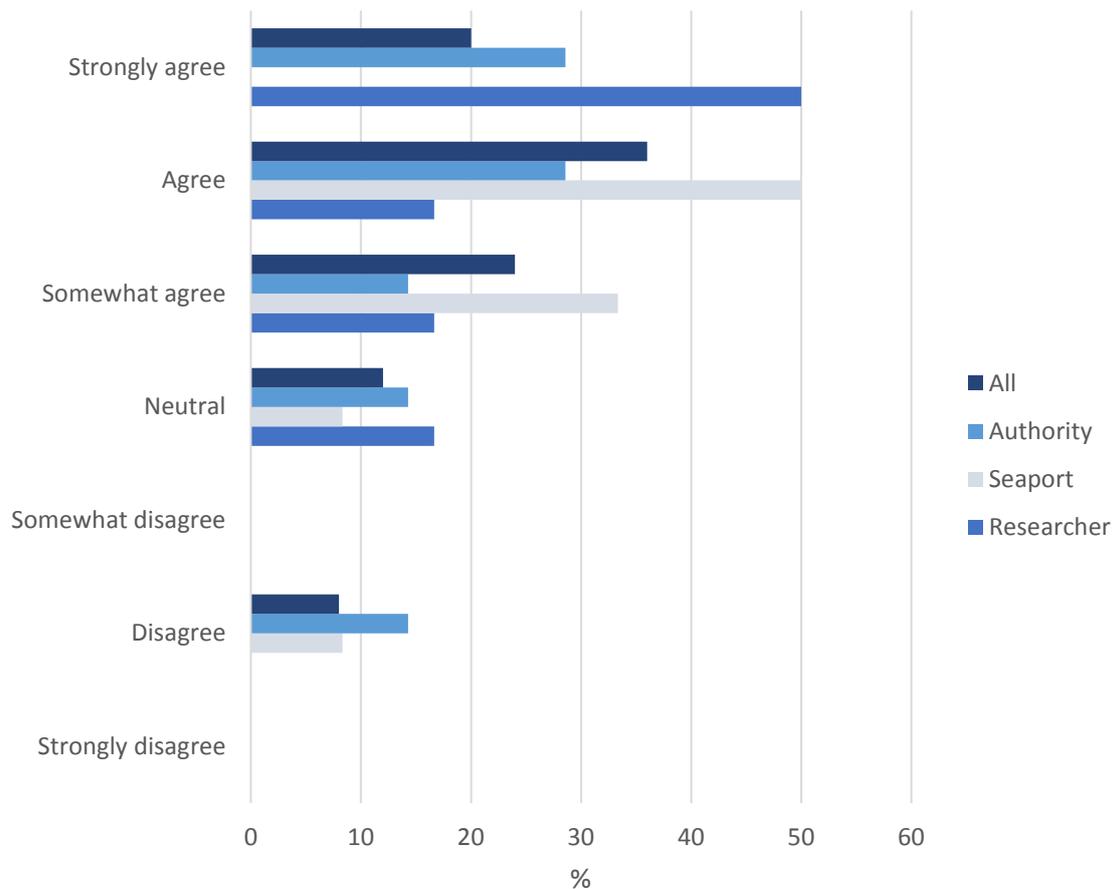


Figure 6. It is challenging that there is regional variation in the interpretation of regulations and administrative demands within a country. Percentage of all respondents, N = 27.

3.1.6 Inconsistency of safety and security regulation

In the sixth question concerning regulation, the experts were asked to assess problems related to fragmentation and inconsistency of safety and security regulation. The experts were asked to assess the following claim.

Safety and security regulation is not consistent, which causes fragmentation and is a problem for seaports.

The claim is connected to the challenge that there are several safety and security planning obligations based on laws from different administrative branches. Regulation related to safety and security plans should be simplified and overlapping should be reduced.

The experts were almost unanimous that inconsistency of safety and security regulation causes fragmentation and is a problem for seaports (Figure 7). The representatives of researchers seemed to agree with the claim especially strongly. The experts felt that the current situation is problematic and a burden for both seaports and authorities. Coordinated management seems to be missing, causing overlapping. Only a few experts disagreed with the claim.

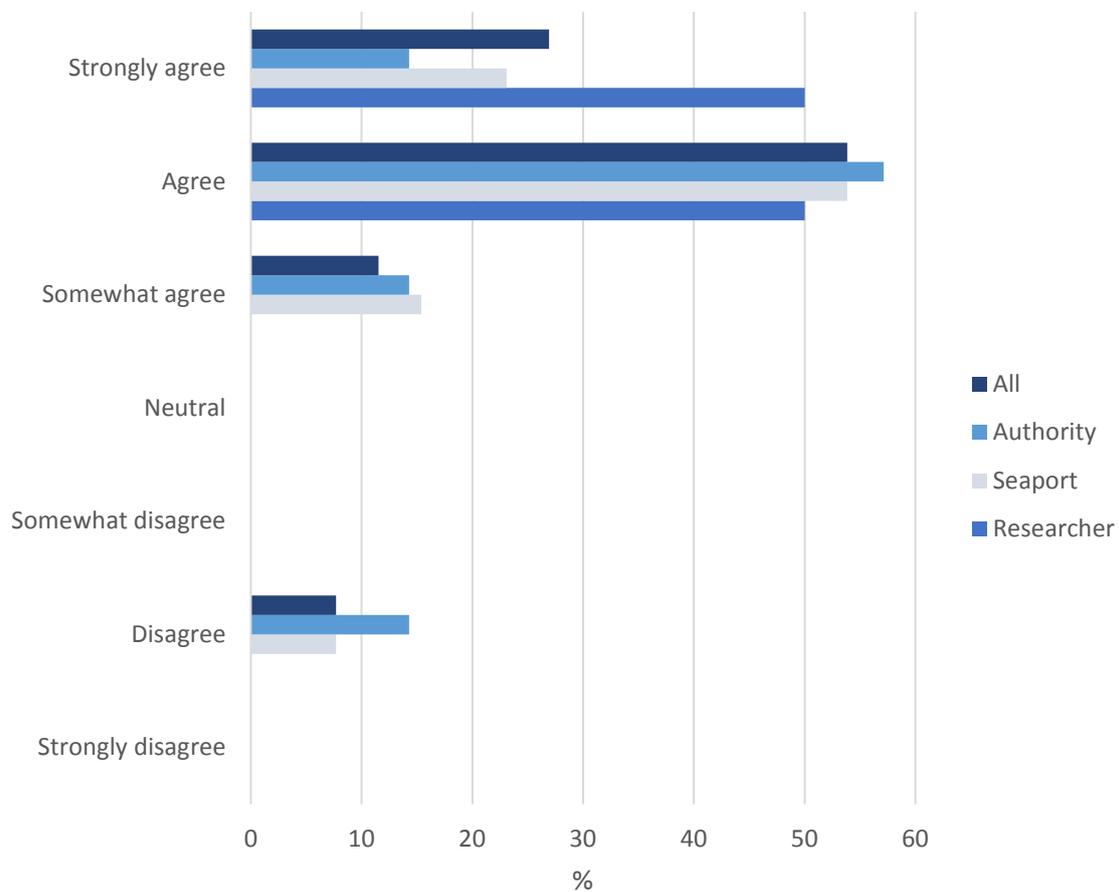


Figure 7. Safety and security regulation is not consistent, which causes fragmentation and is a problem for seaports. Percentage of all respondents, N = 27.

3.1.7 Interpretation of regulations

In the seventh question concerning regulation, the experts were asked to assess challenges related to interpretation of regulations for seaports. They were asked to assess the following claim:

Interpretation of regulations is challenging for seaports.

The claim is connected to the challenge that it is difficult for seaports to follow all regulations, because different authorities can interpret the same regulation in different ways. The current regulations are considered to leave a lot of room for interpretation on how, e.g., the aspects of safety should be taken into account in seaport operations. It has been challenging for seaports to interpret acceptable methods of achieving required standards. The experts mostly agreed with the claim, because it would be easier, if for seaports, it was clearer how to have acceptable methods of achieving the required standards (Figure 8). Authorities agreed with the claim especially strongly. However, authorities' answers diverged significantly, since some authorities disagreed with the claim. Those who disagreed argued that each port possesses a different operational environment, so the appropriate standards should always depend on that.

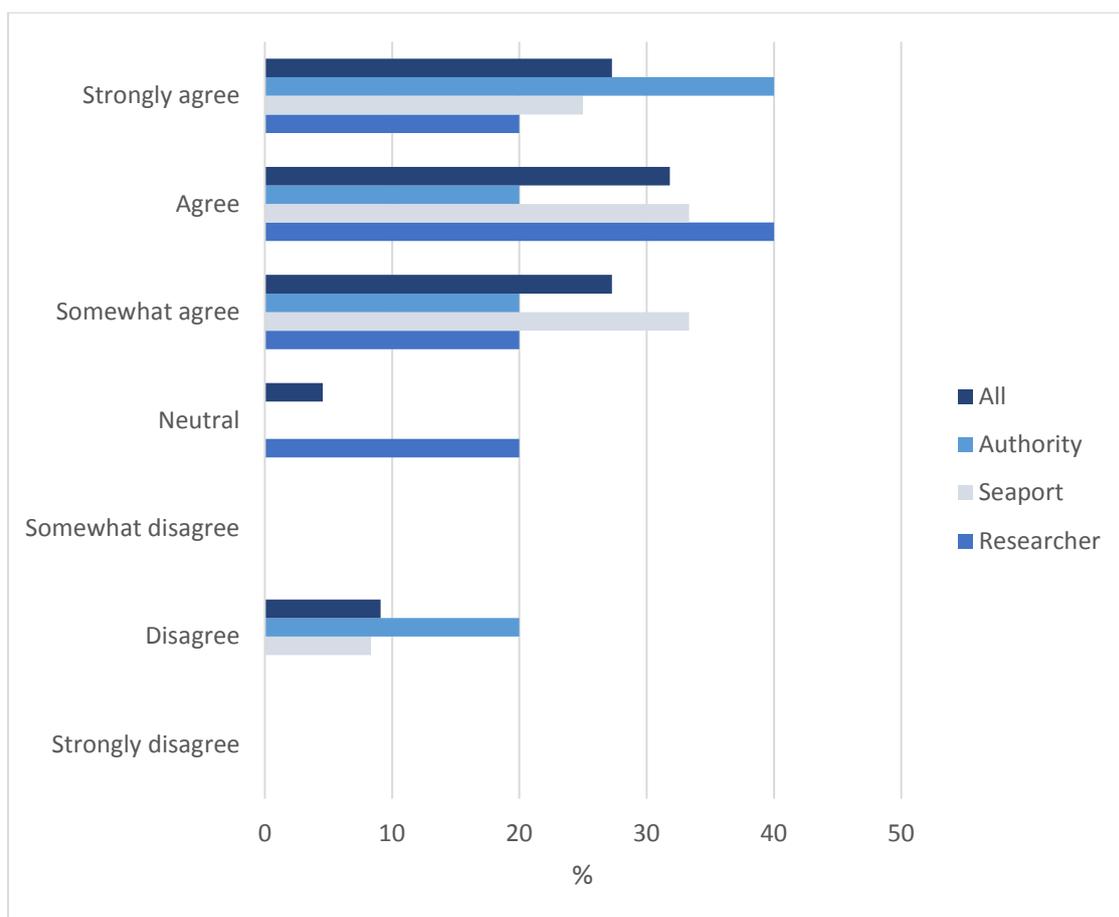


Figure 8. It is challenging that there is regional variation in the interpretation of regulations and administrative demands within a country. Percentage of all respondents, N = 26.

3.1.8 Inadequate seaport safety and security regulation

In the eighth question concerning regulation, the experts were asked to assess challenges related to the lack of clarity about the areas of responsibility of different authorities. They were asked to assess the following claim:

Seaport safety and security regulation is inadequate, because it does not clearly define the responsible authorities.

The claim relates to an observation that in regulations, in some cases, there has been lack of clarity about the areas of responsibility of different authorities. The assessment on the claim diverged somewhat (Figure 9). Many experts considered that authorities cannot always determine who is responsible in different emergency situations. This is especially a problem in large rescue situations and in dangerous goods transportation, as issues are spread out over different sectors. As regulations do not clearly define the responsible authorities, they cause difficulties like overlapping and disjointed administrative responsibilities. When analyzed by respondent group, researchers were by far the group that strongly agreed with the claim. On the other hand, some seaport and authority experts considered that they have not experienced any lack of clarity in the responsibilities of different authorities.

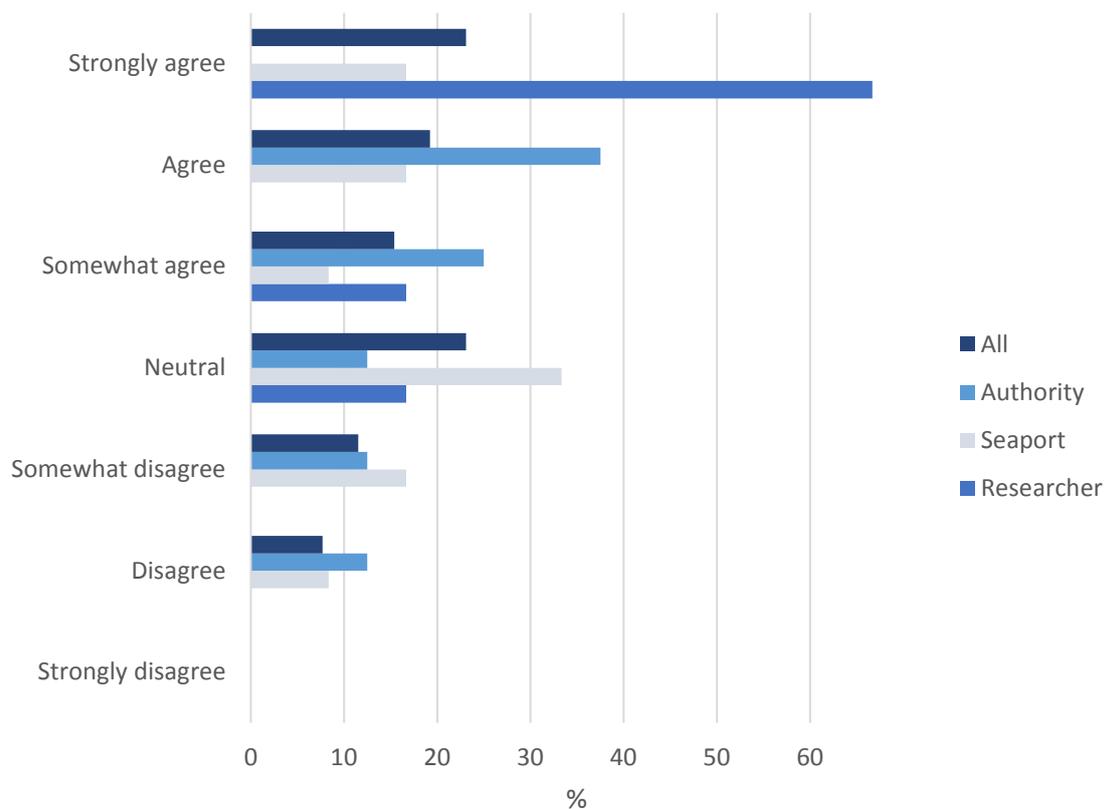


Figure 9. Seaport safety and security regulation is inadequate, because it does not clearly define the responsible authorities. Percentage of all respondents, N = 27.

3.1.9 Outdated regulations

In the ninth question concerning regulation, the experts were asked to assess challenges related to outdated regulations. They were asked to assess the following claim:

Regulations are not always up-to-date, because national legislative processes are too slow.

The claim relates to an observation that decrees and guidelines regarding the regulations may in some cases be outdated. This hinders the activities of the authorities. Most of the experts did believe that keeping regulations up-to-date is a clear developmental need (Figure 10). In their experience, sometimes decrees and guidelines do not mirror reality. That is why regulations should be updated more regularly. Authorities and researchers agreed with the claim especially strongly.

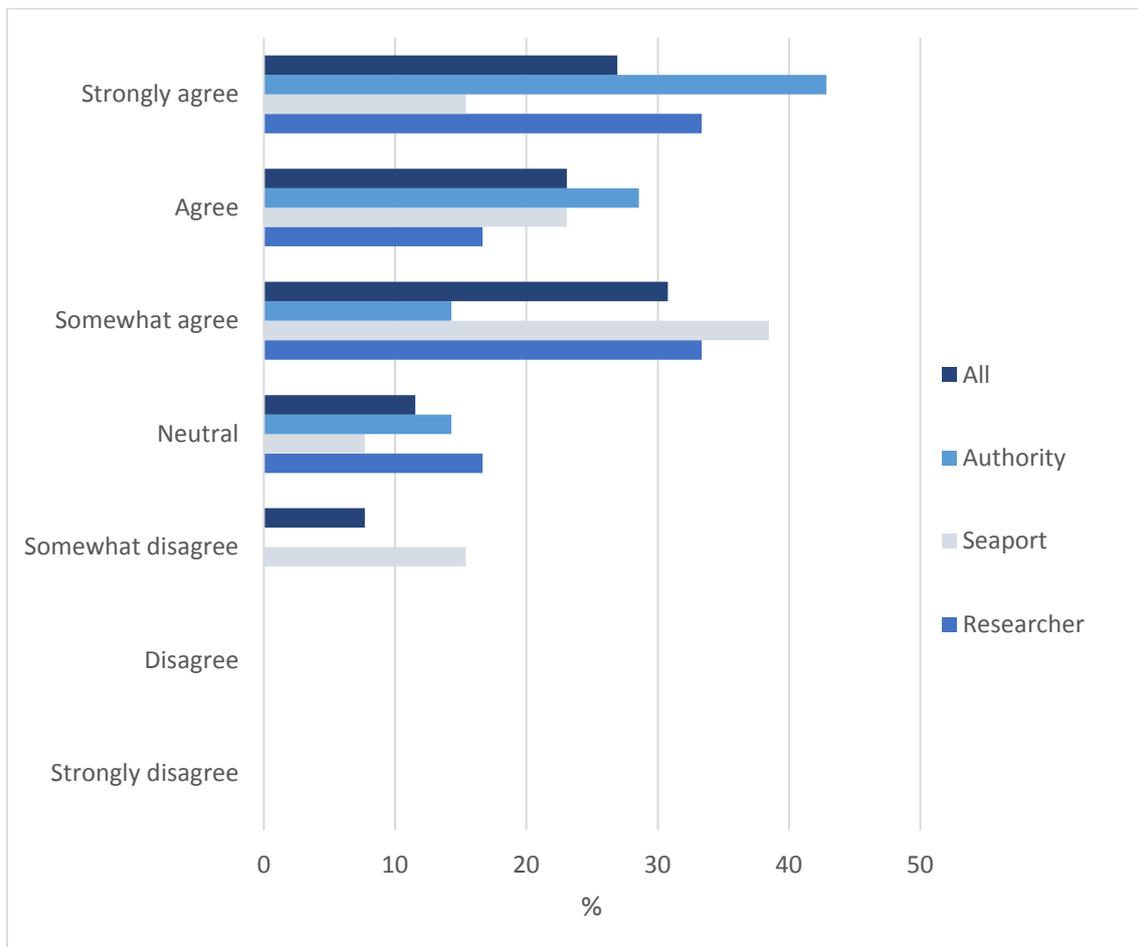


Figure 10. Regulations are not always up-to-date, because national legislative processes are too slow. Percentage of all respondents, N = 27.

3.2 Challenges in communication and the flow of information within the seaport

3.2.1 Obstacles preventing flow of information between authorities

In the first question concerning communication and the flow of information, the experts were asked to assess challenges related to obstacles that can prevent or slow down the flow of information between different authorities. They were asked to assess the following claim:

There are obstacles that prevent or slow down the flow of information between different authorities.

The claim is based on the observation that in some cases, management relationships are not always clear in multi-authority operations. Also, overly tight data security and poorly interoperating IT-systems can in some cases be seen to hinder or slow down the flow of information between different authorities.

Most of the experts agreed with the claim (Figure 11). They considered that the exchange of information between different authorities requires procedures, and the real challenge is the lack of such procedures between authorities who have not had shared responsibilities before. Experts regarded there being too many IT systems as a challenge, and interoperating IT systems for data transfer would be needed. When analyzed by respondent group, researchers and authorities were groups that agreed with the claim the most. However, some experts did not fully agree with the claim, because they believed that in most cases, the current communication methods guarantee information flow between authorities.

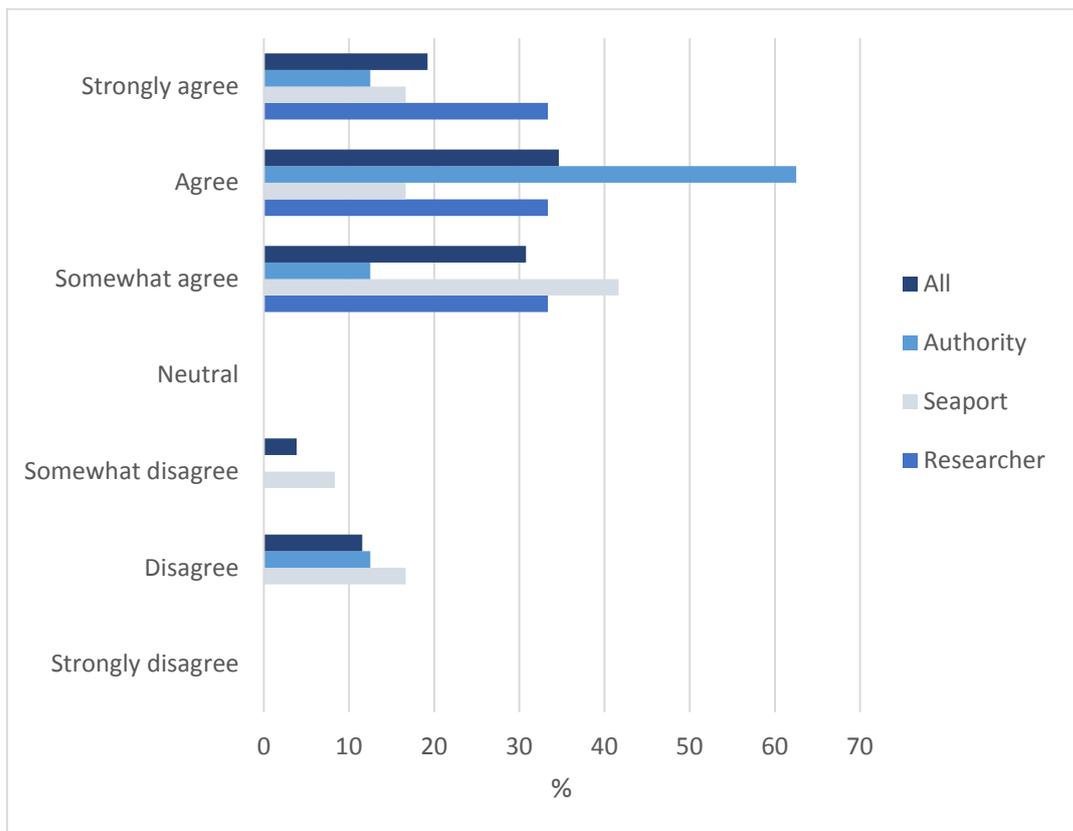


Figure 11. There are obstacles that prevent or slow down the flow of information between different authorities. Percentage of all respondents, N = 27.

3.2.2 Obstacles preventing the flow of information between different stakeholders

In the second question concerning communication and the flow of information, the experts were asked to assess challenges related to obstacles that can prevent or slow down the flow of information between different authorities and seaports. They were asked to assess the following claim:

There are obstacles that prevent or slow down the flow of information between authorities and seaports.

The claim is based on the observation that in some cases, there are regulatory obstacles that hinder the flow of information between authorities and seaports. In addition, overly tight data security can in some cases to be seen to hinder or slow down the flow of information between different players.

Over 70 percent of the experts agreed with the claim (Figure 12). They considered that the exchange of information requires procedures between authorities and seaports, and a lack of these procedures is a challenge. Some experts regarded that there are no direct obstacles, but

we just lack continuous communication. Some experts disagreed with the claim, because they considered that there are only a few obstacles that might hinder the flow of information.

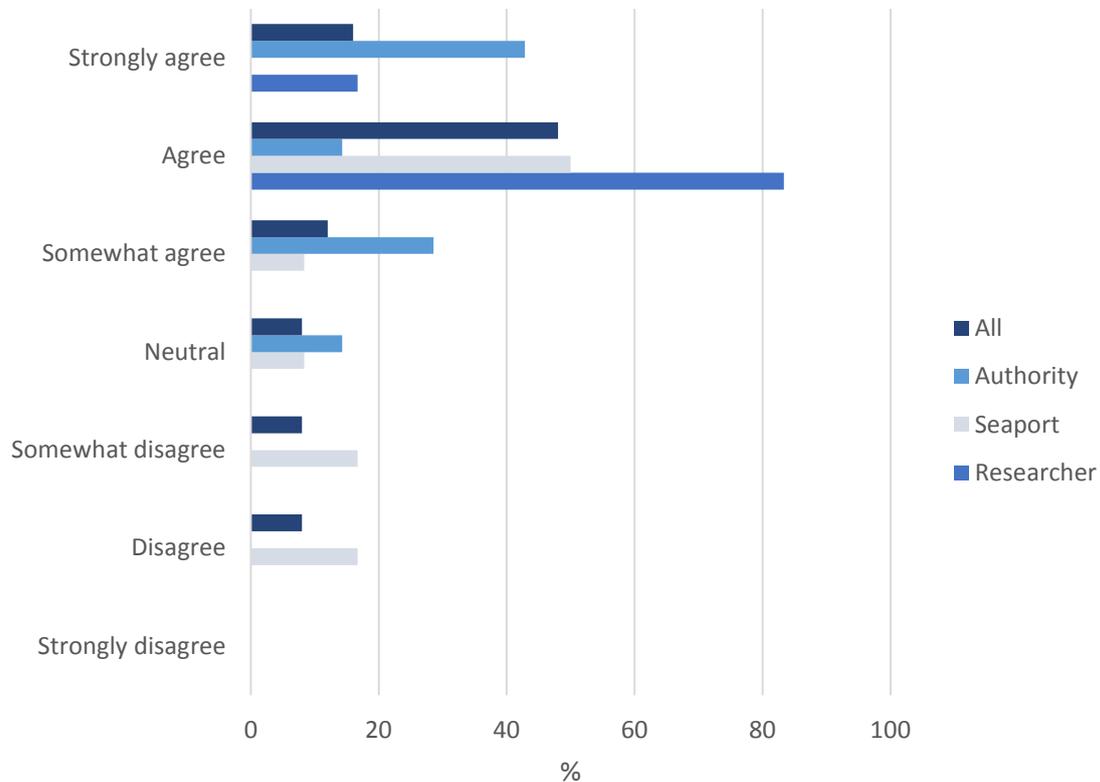


Figure 12. There are obstacles that prevent or slow down the flow of information between authorities and seaports. Percentage of all respondents, N = 26.

3.2.3 Lack of skills in managing major accidents

In the third question concerning communication and the flow of information, the experts were asked to assess challenges related to managing major accidents in multi-authority operations. They were asked to assess the following claim:

There is a lack of skills in managing major accidents in multi-authority operations.

The claim is connected to the problem that in the future, multi-authority situations are expected to become more common. For instance, major accidents are multi-authority situations and in such cases, management relationships may be unclear; furthermore, there is a lack of major accident management expertise. These can hinder communication and the flow of information. Most of the experts did see that responsibility for overall management is unclear (Figure 13). There is a lack of experience in managing major accidents because these things do not happen

that often. However, 30 percent of the respondents disagreed with the claim, because they considered that rescue operations are well-managed and exercises are held regularly.

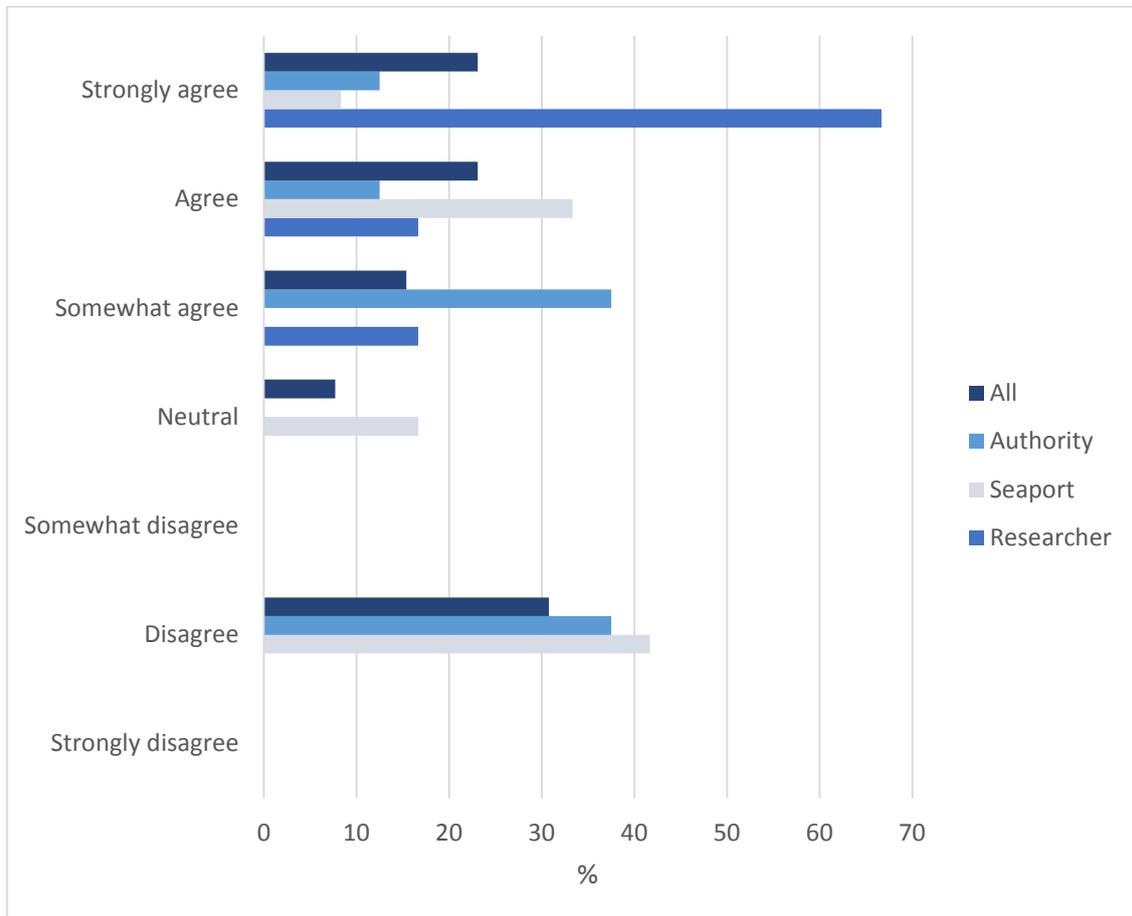


Figure 13. There is a lack of skills in managing major accidents in multi-authority operations. Percentage of all respondents, N = 27.

3.2.4 Electronically available information

In the fourth question concerning communication and the flow of information, the experts were asked to assess challenges related to information that is not easily available digitally for the rescue operations. They were asked to assess the following claim:

Seaports' site maps, other relevant information and/or rescue plans should be available in electronic form for rescue operations.

The claim is connected to the challenge that in the event of an accident, the required information is not easily available for the authorities. Over 90 percent of the experts agreed with the claim, and none of them disagreed (Figure 14). They strongly recommended this type of

development, because this type of quickly available information would be useful in rescue operations. However, access to this digital information should be private and limited to just the competent authorities. Authorities agreed with the claim especially strongly.

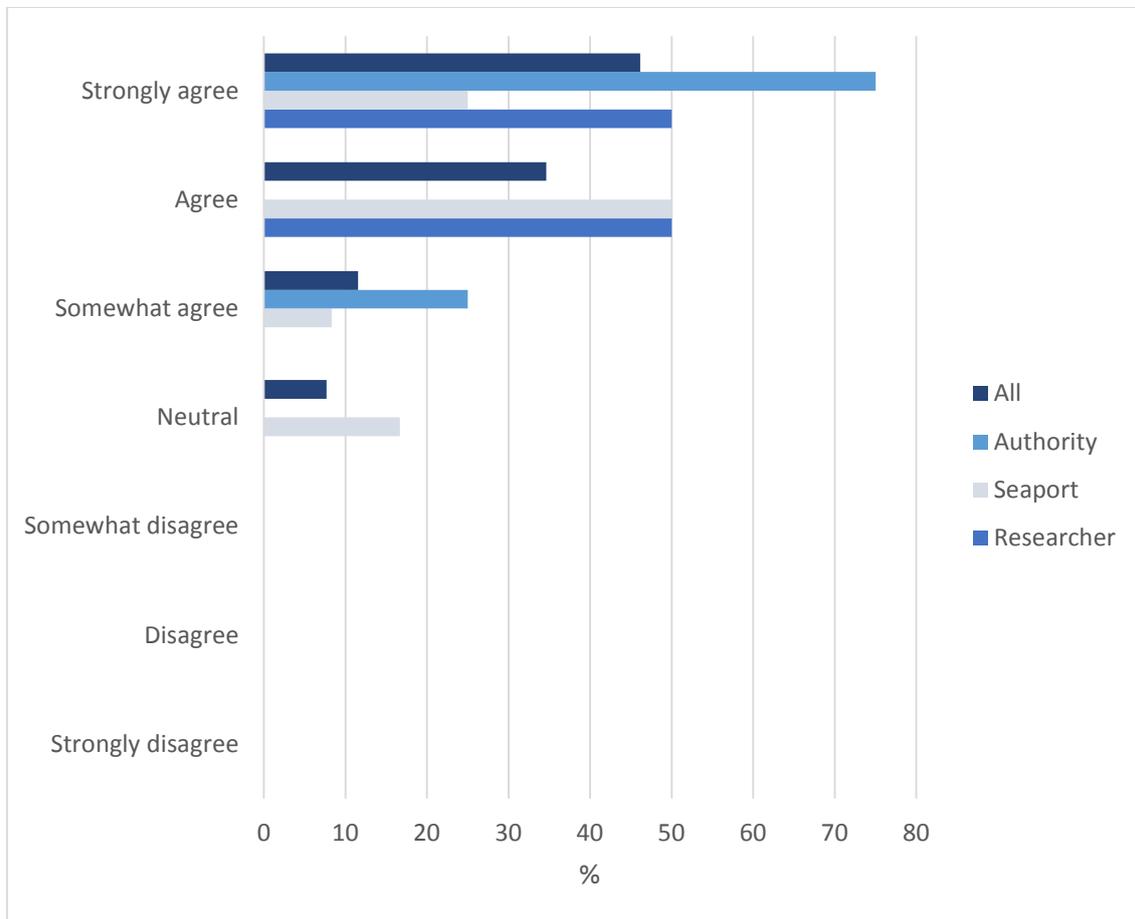


Figure 14. Seaports' site maps, other relevant information and/or rescue plans should be available in electronic form for rescue operations. Percentage of all respondents, N = 27.

3.2.5 Interoperability of IT systems

In the fifth question concerning communication and the flow of information, the experts were asked to assess challenges related to the interoperability of IT systems between stakeholders. They were asked to assess the following claim:

Interoperability of IT systems between different stakeholders should be developed.

The claim is connected to the challenge that situational picture systems should be developed, so that it is possible to share information between stakeholders. This information can be, for example, pictures and other information from databases or pictures, for instance, from seaport security cameras. This claim was almost unanimously agreed upon, as almost 90 percent of all the respondents either agreed or strongly agreed with the claim (Figure 15). When analyzed by

respondent group, authorities were by far the group that strongly agreed with the claim. Even though experts considered a lack of interoperability being a challenge, they also noted that these IT systems should only be developed if all stakeholders are involved in the development process. All the stakeholders should have an opportunity to define their specific needs. Some experts also thought that privacy issues should be considered in the IT development process.

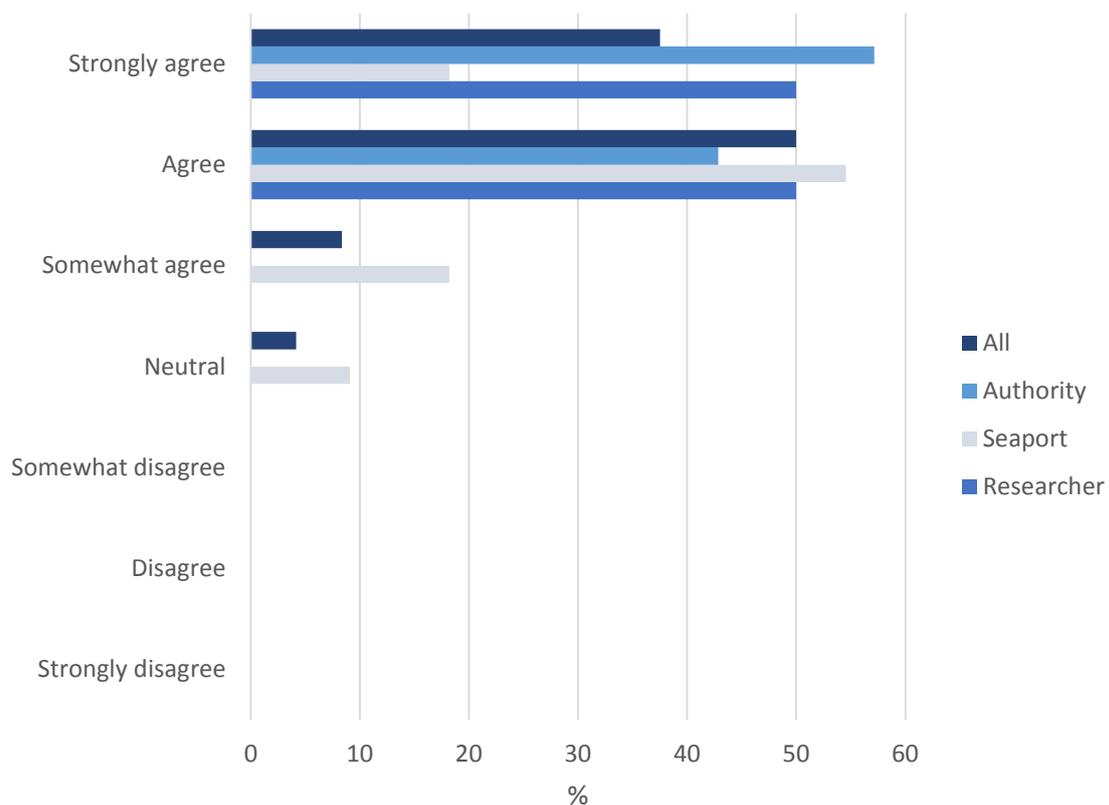


Figure 15. Interoperability of IT systems between different stakeholders should be developed. Percentage of all respondents, N = 26.

3.2.6 Making better use of seaport experts

In the sixth question concerning communication and the flow of information, the experts were asked to assess challenges related to communication in command center operations. They were asked to assess the following claim:

The use of seaports' experts in authorities' command center during an accident needs to be developed.

The claim is connected to the challenge that seaport experts have the best knowledge of seaport operations, so they should be used better in command centers during an accident. In this way, it is immediately possible to obtain information from seaport experts. Up-to-date and quickly

available information can prevent a minor accident from escalating into a major accident. On average, the experts agreed with the claim (Figure 16). The experts considered this to be an important development issue, as having a seaport expert in a command center operation shortens communication routes and facilitates the process of enacting the relevant measures to mitigate the effects of an ongoing disaster. In fact, there is a need for several experts with the latest information in case one of the experts is unavailable. One expert mentioned that this should already be possible within the present situation and legal framework. Maybe a better use of seaport experts just requires more concrete practices. When analyzed by respondent group, seaports and authorities were groups that agreed with the claim the most.

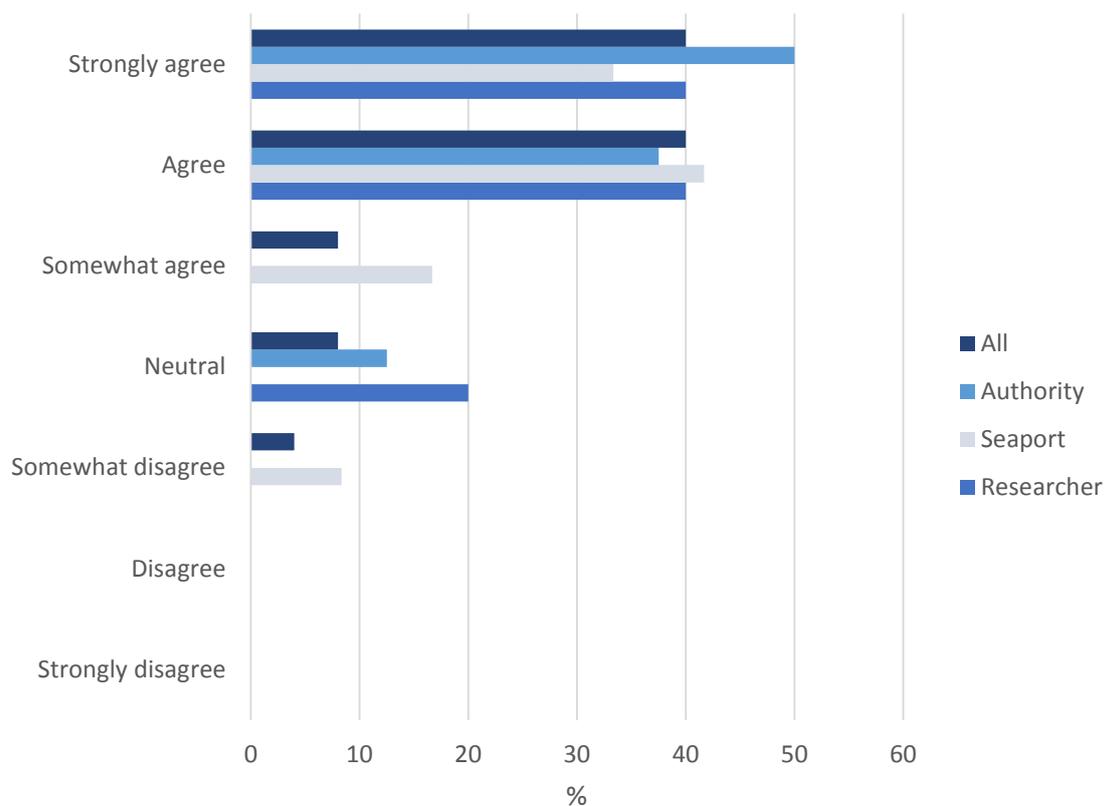


Figure 16. The use of seaports' experts in authorities' command center during an accident need to be developed. Percentage of all respondents, N = 27.

3.2.7 External crisis communication

In the seventh question concerning communication and the flow of information, the experts were asked to assess challenges related to external crisis communication. They were asked to assess the following claim:

External crisis communication by using social media and mobile/smart phones to e.g. neighboring citizens and/or companies should be trained more.

The claim is connected to the observation that authorities in particular are not always familiar with using social media and other technical devices in external crisis communication. Most of the experts agreed with the claim, because many experts are not familiar with social media, for instance. This could help with communicating information to the people who are near the accident, for example. However, the experts were not unanimous, as 7,5 percent of the experts disagreed with the claim (Figure 17).

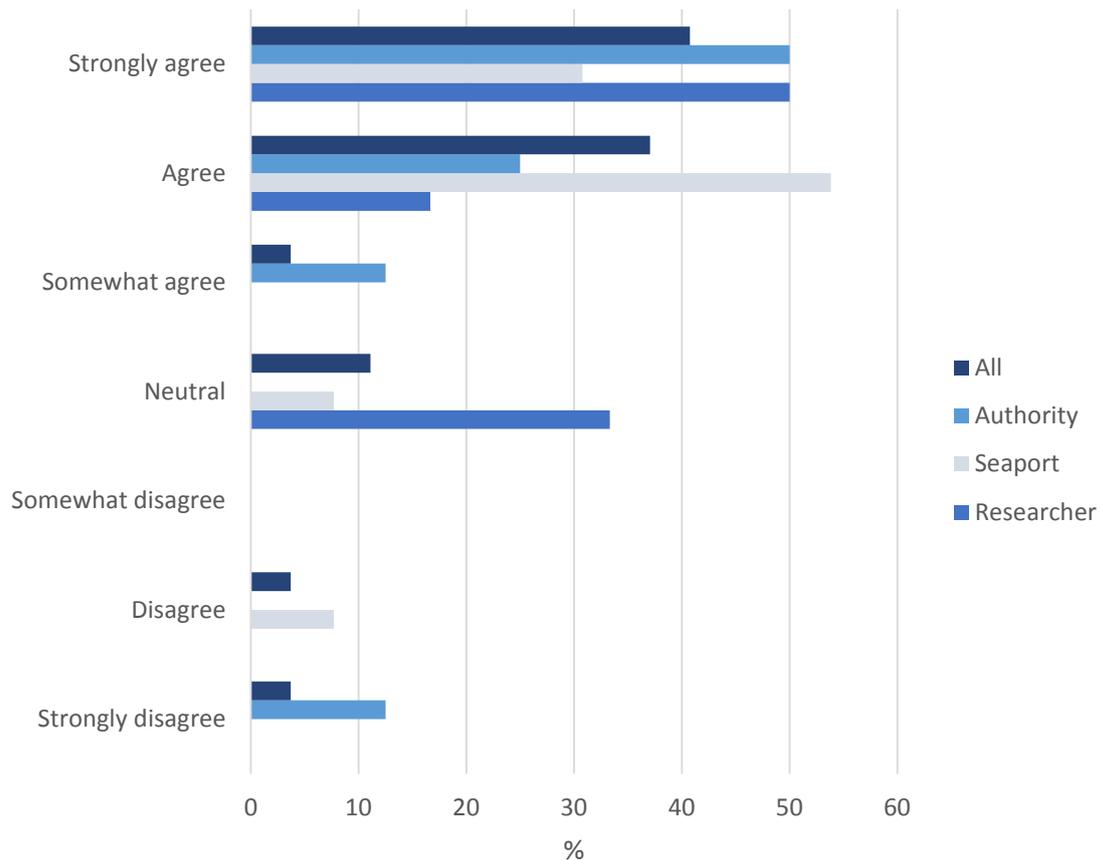


Figure 17. External crisis communication by using social media and mobile/smart phones to e.g. neighboring citizens and/or companies should be trained more. Percentage of all respondents, N = 27.

3.2.8 Seaport cooperation

In the eighth question concerning communication and the flow of information, the experts were asked to assess challenges related to co-operation between seaports. They were asked to assess the following claim:

In order to increase safety and security, seaports should do more co-operation with other seaports.

The claim is connected to the observation that awareness of the risks faced by another seaport assists a seaport in its own risk management, and these risks can be taken into account in contingency planning. Seaports could also learn from each other's joint exercises, which would improve the level of joint exercises so that they would be able to simulate real situations better. The experts were quite unanimous, as almost all experts agreed with the claim (Figure 18). Only one expert gave a neutral response. When analyzed by respondent group, authorities were by far the group that strongly agreed with the claim.

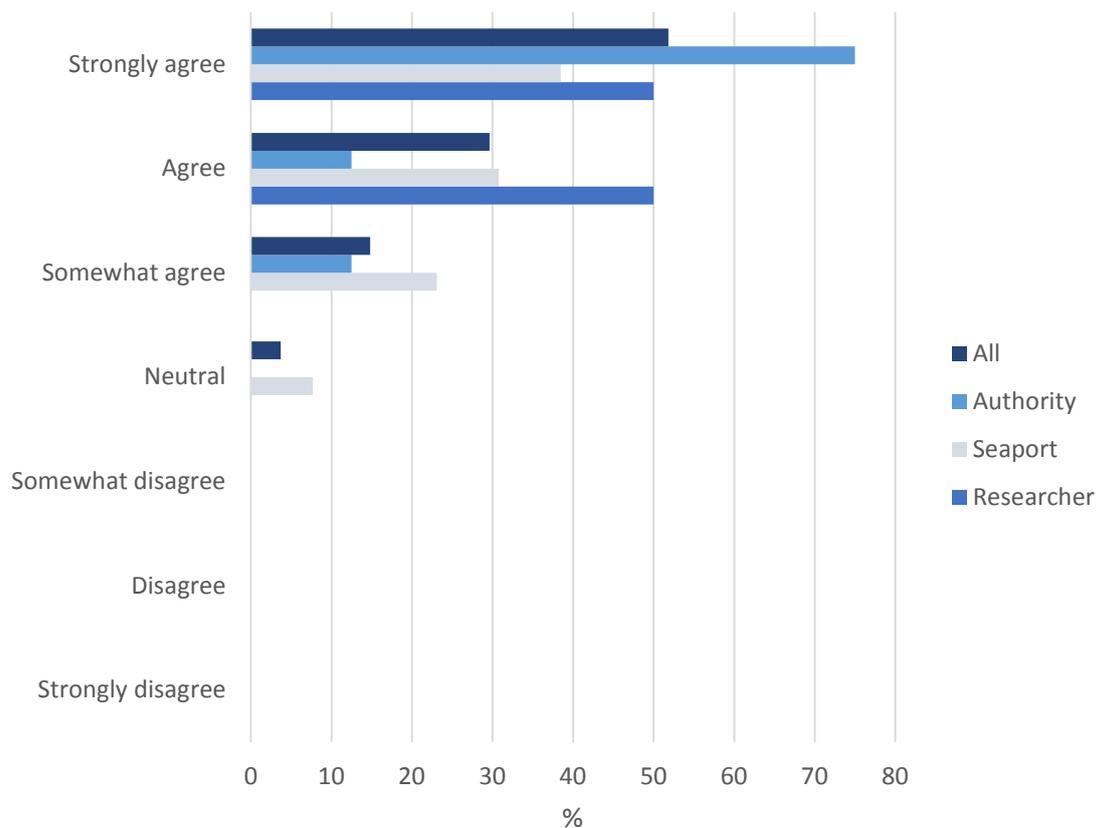


Figure 18. In order to increase safety and security, seaports should do more co-operation with other seaports. Percentage of all respondents, N = 27.

3.2.9 Preparedness for cyber threats

In the ninth question concerning communication and the flow of information, the experts were asked to assess challenges related to cyber threats. They were asked to assess the following claim:

Seaports are not well prepared for cyber threats.

The claim concerns the trend that external threats to IT systems have increased, and the effects of threats to the cyber operational environment have become wider. Therefore, preparedness for cyber threats should be improved from its current state. Most of the experts agreed with the claim, since cyber threats seem to present a future challenge, and seaports have to be better prepared for that specific threat (Figure 19). Cyber security issues are a quickly developing area. When analyzed by respondent group, seaports were the only group that disagreed with the claim. They argued that cyber threat preparedness is already of a high standard.

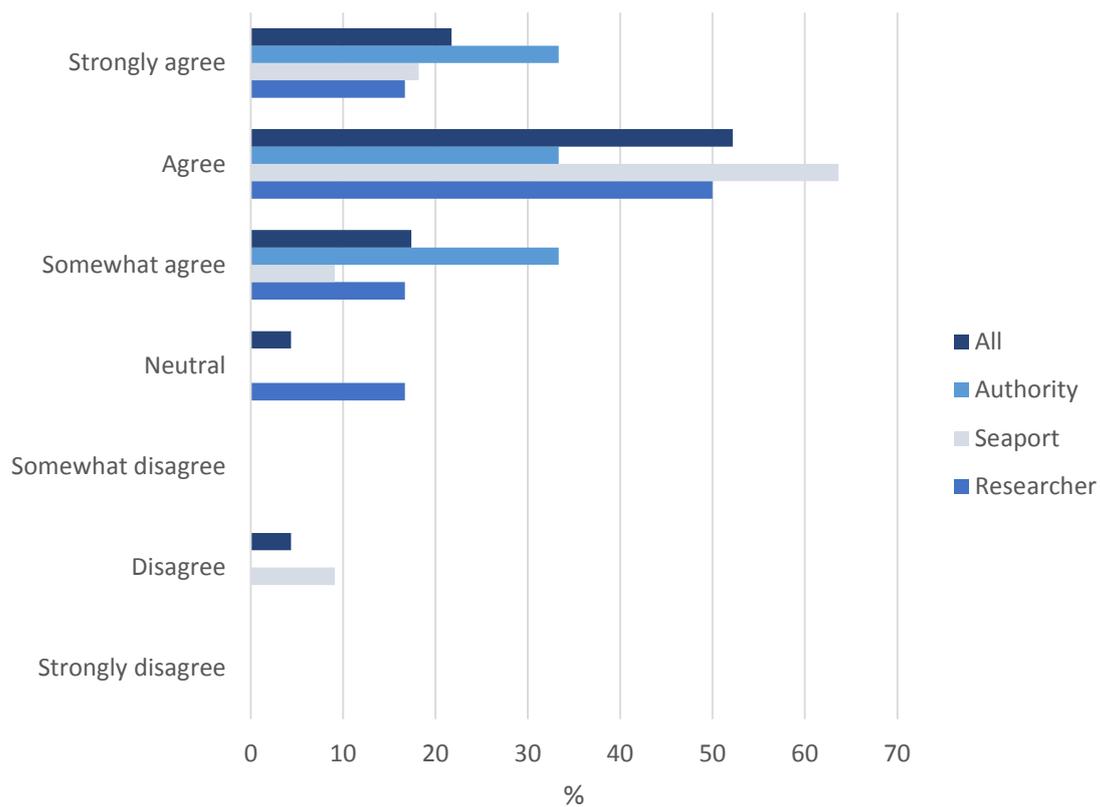


Figure 19. Seaports are not well prepared for cyber threats. Percentage of all respondents, N = 27.

3.2.10 Crisis communication training

In the tenth question concerning communication and the flow of information, the experts were asked to assess challenges related to crisis communication. They were asked to assess the following claim:

Crisis communication training should be increased in the context of seaports.

The claim is connected to the challenge that both authorities and seaports should pay more attention to communication planning. The whole communication process should be planned

ahead: action processes, most important stakeholders and people responsible for communication and the flow of information in different situations. The experts fully agreed with the claim, since communication is an increasingly important part of accidents today, as everyone has a mobile phone that is equipped with a camera. Communication skills have to be trained more regularly. When analyzed by respondent group (Figure 20), researchers and authorities were groups that by far agreed with the claim the strongest.

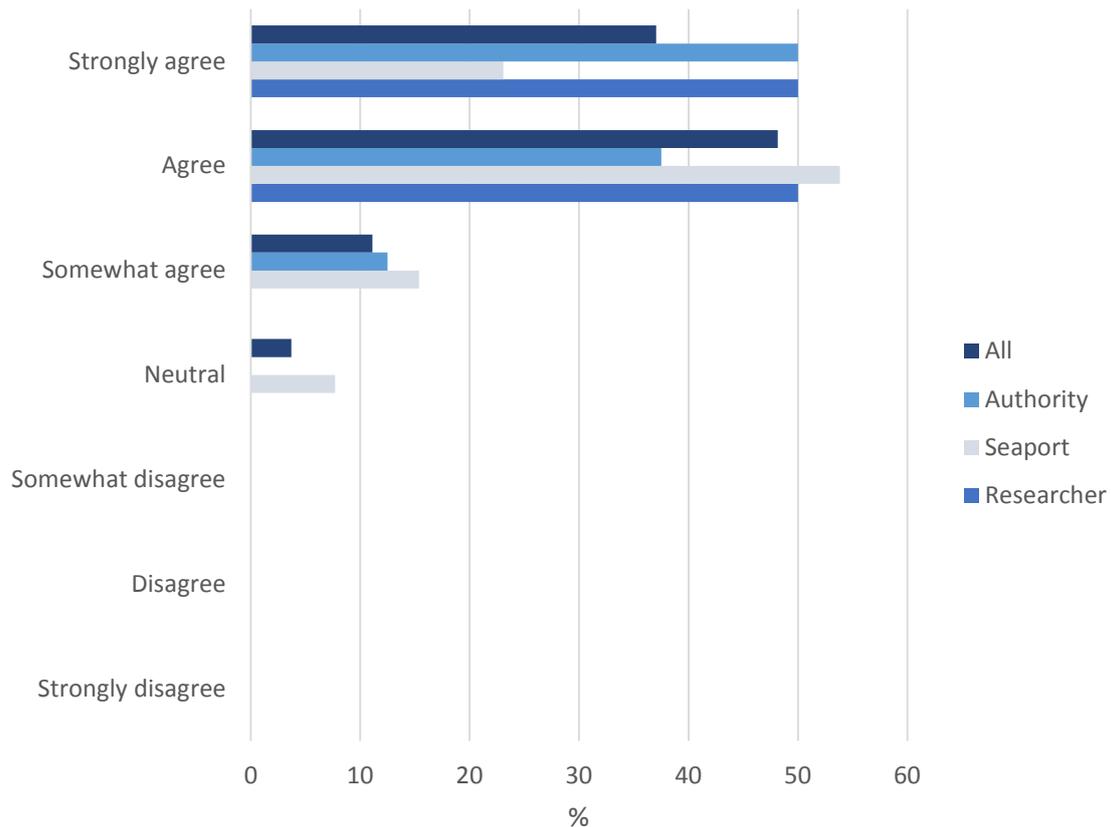


Figure 20. Results on the claim: Crisis communication training should be increased in the context of seaports. Percentage of all respondents, N = 27.

3.3 Challenges related to multi-authority exercises within the seaport context

3.3.1 Ranking the topics related to developing multi-authority exercises

Several development suggestions were identified in the literature review and in the workshop on how to develop multi-authority exercises. The aim of the first question concerning exercises was to assess the importance of these development suggestions. The experts were asked to

assess the importance of the following 10 development challenges on improving multi-authority exercises listed below:

- More command center operations training.
- Better use of seaports' experts in the planning and post analyses of multi-authority exercises.
- Long-term and more systematic formulation of exercise plans (e.g. five years ahead).
- A wider group of stakeholders should be involved in planning multi-authority exercises.
- Developing a data bank of best practices in multi-authority exercises.
- Practicing the communications operating model between stakeholders more.
- More effort in post-analysis of multi-authority exercises.
- The media should always be asked to join in multi-authority exercises.
- More table-top exercises and smaller parts of some wider accident scenarios should be practiced.
- The starting point of a multi-authority exercise should be that it offers benefits like development ideas for all participants.

According to the views of the experts, the most important development ideas for improving multi-authority exercises were:

1. Better use of seaport experts in the planning and post-analysis of multi-authority exercises.
2. Developing a data bank of best practices for multi-authority exercises.
3. More effort in the post-analysis of multi-authority exercises.
4. More tabletop exercises should be held and smaller parts of some wider accident scenarios should be practiced.
5. The starting point of a multi-authority exercise should be that it offers benefits like development ideas for all participants.

When analyzing the respondent group, it is noticeable that seaports were especially concerned about making better use of seaport experts in exercise planning as the most important development suggestion (Figure 21). Researchers, on the contrary, highlighted that the most important development suggestion is that they should put more effort in the post-analysis of multi-authority exercises. Authorities, on the other hand, wanted to stress that a data bank of best practices for multi-authority exercises should be developed.

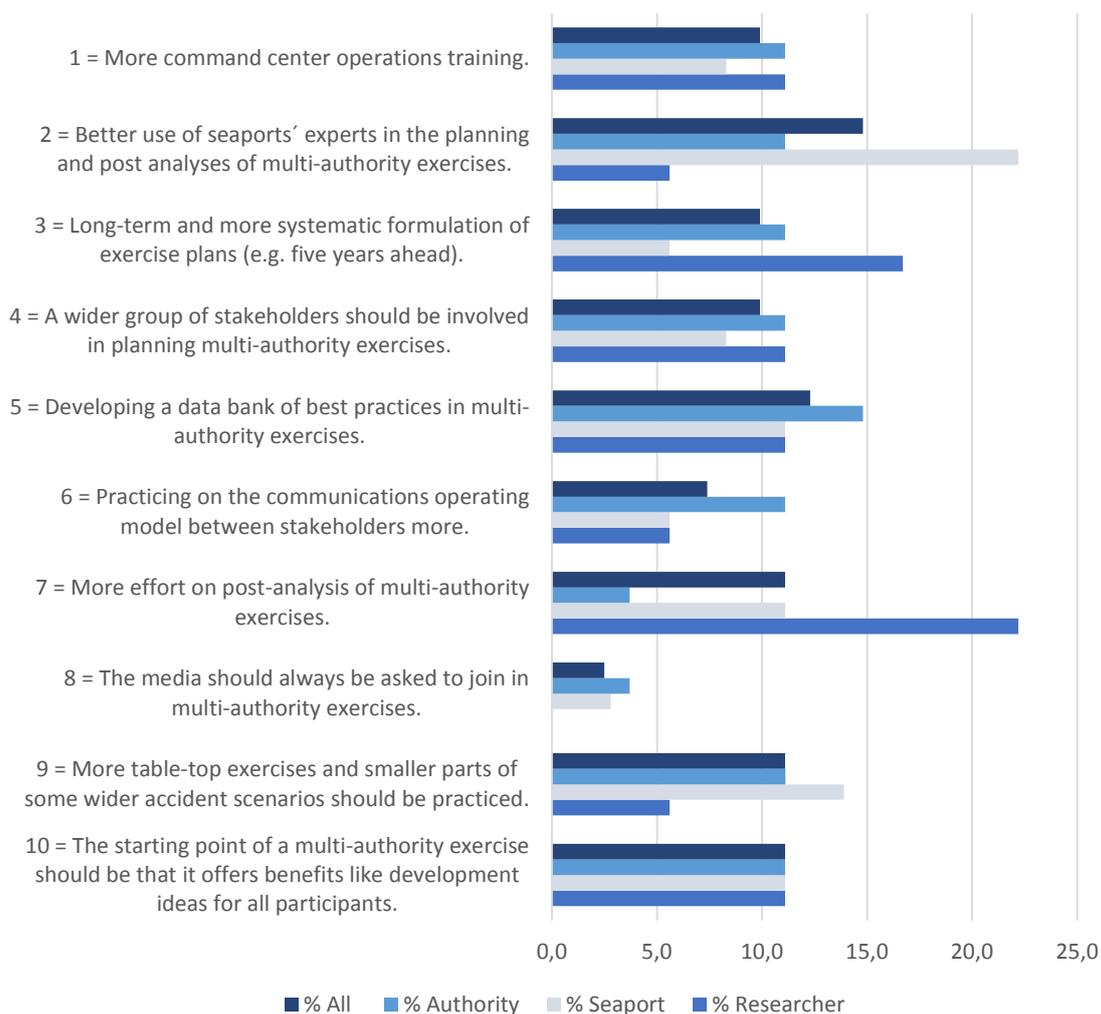


Figure 21. Improving multi-authority exercises. Percentage of all respondents, N = 27.

3.3.2 Better accident scenarios

In the second question concerning multi-authority exercises, the experts were asked to assess challenges related to accident scenarios. They were asked to assess the following claim:

Better accident scenarios based on risk analysis are needed.

The claim is connected to the challenge that the selection of scenarios used in joint exercises is often too narrow. Only very typical or small accident, or only a few accident scenarios are used, and they are often created several years ago. On the other hand, incidents, shocks, and surprises (e.g. electricity or IT failure) should be tested, which may reveal weaknesses, for instance, in seaport management and resilience. The experts agreed on the claim almost unanimously, as almost 90 percent of all the respondents either agreed or strongly agreed with the claim (Figure 22). The experts regarded that a large range of exercises is too foreseeable nowadays. Trained

staff should also be confronted with unexpected scenarios. When analyzed by respondent group, authorities and researchers were groups that by far agreed with the claim the strongest.

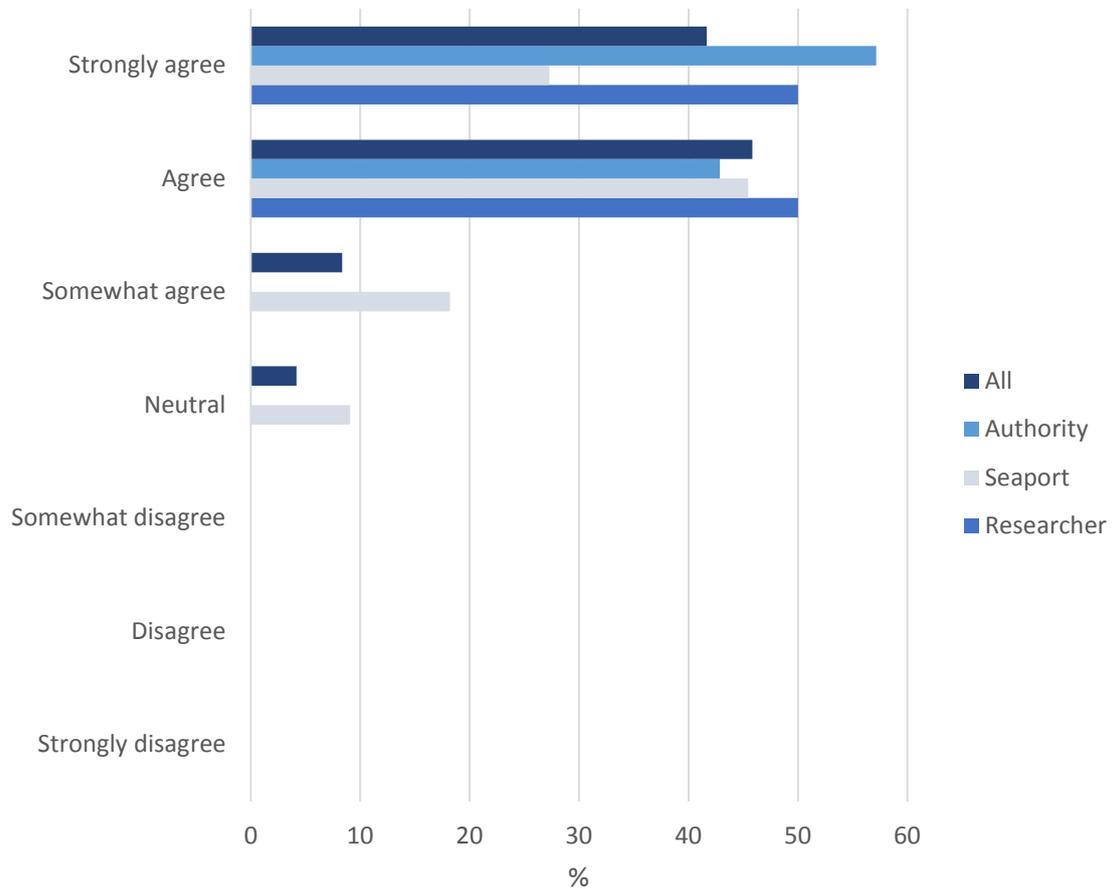


Figure 22. Better accident scenarios based on risk analysis are needed. Percentage of all respondents, N = 27.

4 SOLUTIONS AND DEVELOPMENT IDEAS IDENTIFIED IN THE SECOND DELPHI ROUND

4.1 Development ideas related to regulatory aspects on safety and security

4.1.1 Fragmented regulation and outdated regulations

The first key challenge related to regulation that was identified in the first round of the Delphi study was related to regulation fragmentation, inconsistency, and outdated regulations. It is challenging that in today's fast-changing operating environment, safety and security regulations are not always up-to-date, and regulation is sometimes fragmented and not always consistent, which is a burden on both seaports and authorities. The experts were asked to assess three propositions on possible solutions for this challenge. The propositions were:

1. National-level seaport SAFETY regulation should be standardized and done in a coordinated fashion with more broad-based cooperation than at the moment.
2. National-level seaport SECURITY regulation should be standardized and done in a coordinated fashion with more broad-based cooperation than at the moment.
3. As higher-level regulations (acts, laws, EU Directives) are updated relatively seldom, by updating lower-level regulations more frequently (e.g. decisions, decrees, and guidelines issued by Competent Authorities), changes in the operational environment can be taken into account properly.

The experts quite strongly agreed with the proposition that national-level seaport safety regulation should be standardized (Figure 23). They regarded that a fleet visiting the port should always meet the same regulation in the Baltic Sea Region ports. Therefore, regulation should be done in a more coordinated fashion between different administrative sectors. Regulation should also be done in co-operation with the industry.

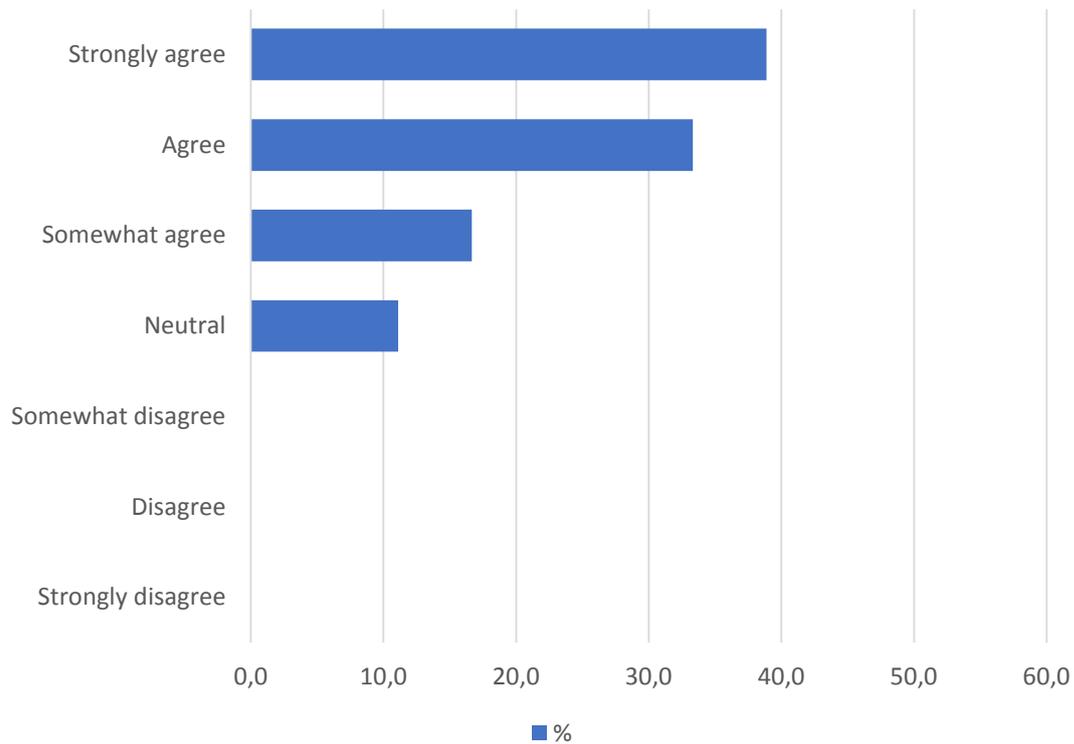


Figure 23. National-level seaport SAFETY regulation should be standardized and done in a coordinated fashion with more broad-based cooperation than at the moment. Percentage of all respondents, N = 18.

The experts equally agreed with the proposition that national-level seaport security regulation should be standardized (Figure 24). Also, in this case, regulation should be done in co-operation with different administrative sectors and seaports. The experts stressed that co-operation with the industry is needed, because for security issues, it is important that legislation is based on a good level of knowledge of port sector characteristics.

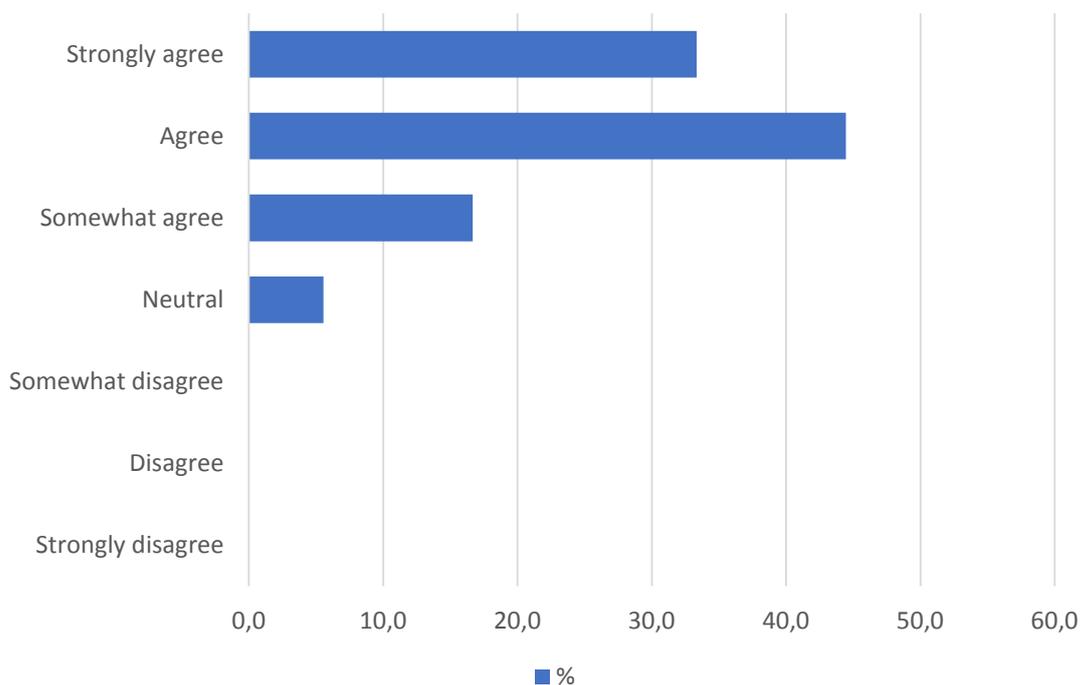


Figure 24. National-level seaport SECURITY regulation should be standardized and done in a coordinated fashion with more broad-based cooperation than at the moment. Percentage of all respondents, N = 18.

The experts' answers divided somewhat, as they assessed the proposition concerning updating lower-level regulations more frequently to take changes in the operational environment more properly into account (Figure 25). Some experts also suggested that IMO (The International Maritime Organization) regulations should include seaport regulation. Some argued that they might also need extended safety and security ISPS code for the Baltic Sea. In each respondent group, there were experts that disagreed with this proposition. Altogether, 25 percent of the respondents disagreed with updating regulations more frequently, because too frequent changes in lower-level regulations can cause instability and confusion and may lead to discrepancies between countries. One expert also mentioned that not everything needs to be solved by legislation. For instance, cooperation, technical help, and different kinds of development programs can be effective measures to take account of changes in the operational environment.

On the whole, the experts considered that it is challenging how legal preparatory processes suffer from a lack of resources and a lack of well-developed cross-sectoral links. Developing mechanisms for regular interaction between different sectors, agencies, and ministries could be one way of attending the problem. As regulatory work in co-operation with different stakeholders would become a more familiar and a more permanent way of doing regulatory processes, fragmentation, inconsistency, and outdated regulations could decrease.

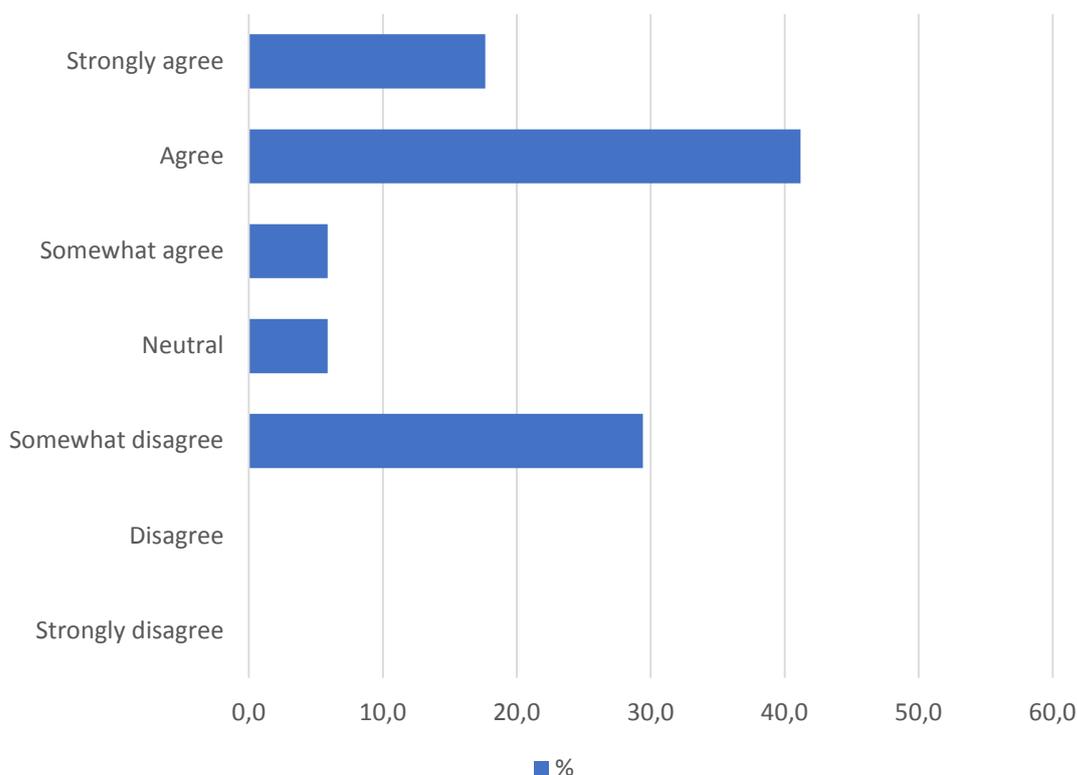


Figure 25. As higher-level regulations (acts, laws, EU Directives) are updated relatively seldom, by updating lower-level regulations more frequently (e.g. decisions, decrees, and guidelines issued by Competent Authorities), changes in the operational environment can be taken into account properly. Percentage of all respondents, N = 18.

4.1.2 National variation in interpreting safety and security regulation

The second key challenge related to regulation that was identified in the first round of the Delphi study was national variation in interpreting safety and security regulation. It is challenging that there is national variation between EU countries in the Baltic Sea Region in interpreting safety and security regulation and administrative demands, because it is challenging for ports and can lead to locational advantage. The experts were asked to give development ideas and solutions on how to reduce national variation.

Based on the answers, the experts recognized that co-operation should be increased. There should be, for instance, more co-operation between legislative authorities from various countries in the field of port management. Regulation should also be harmonized. It could be possible to unify safety and security regulations on IMO level. Another idea is that BREF – documents (The European Commission’s best available technique reference documents) could be established as the standard in the national regulations.

Also, one concrete solution to this challenge could be to make interpretation of regulations more uniform. EU directives should be more precise, as port safety and security are important topics and should be regulated in a similar fashion in all EU countries. EU could also provide better interpreting directions for safety and security regulations. We could also develop processes concerning cross-border issues that should have a similar interpretation. This could be done in co-operation, for instance, it could be possible to organize joint training or workshops for competent authorities of the Baltic Sea Region.

However, some views raised were that it seems to be difficult to reduce national variation due to the fact that the Baltic Sea Region countries are differently organized and vary a lot. One way to solve this could be to carry out risk analysis in Baltic Sea Region countries to identify and define threats and make guidelines based on these results.

4.1.3 Preparedness for cyber threats

The third key challenge related to regulation, was connected to the challenge that regulation related to preparedness for cyber threats is inadequate in seaports. The experts were asked to assess four propositions on possible solutions to better preparedness for cyber threats in seaports. The propositions were:

- Regulation should set more detailed requirements on planning for cyber risks in seaports.
- Regulation should set more detailed requirements for back-up systems (e.g. IT systems, electricity supply, and various IoT solutions) in seaports.
- Regulation should set more detailed requirements on exercises related to seaport resilience to cyber-attacks.
- Regulation should set more detailed requirements for authorities, so that they are able to assess port capabilities and resilience to cyber threats (e.g. requirements for having "cyber personnel").

Most of the experts agreed that regulation should set more detailed requirements on planning for cyber threats (Figure 26), as seaports have only shallow knowledge about the planning for cyber risks in seaports. For instance, common ISPS (International Ship and Port Facility Security) standards would be required. However, the experts' assessment diverged slightly. Some seaport experts disagreed, because they regarded that the operator has bigger interest in security than the state. Cyber issues are also a fast-developing area, so legislation is likely to be lagging behind all the time. There are more possibilities than just regulation. Seaports could build up its capabilities within the industry together with competent authorities. Also, IT audits could be made regularly in ports.

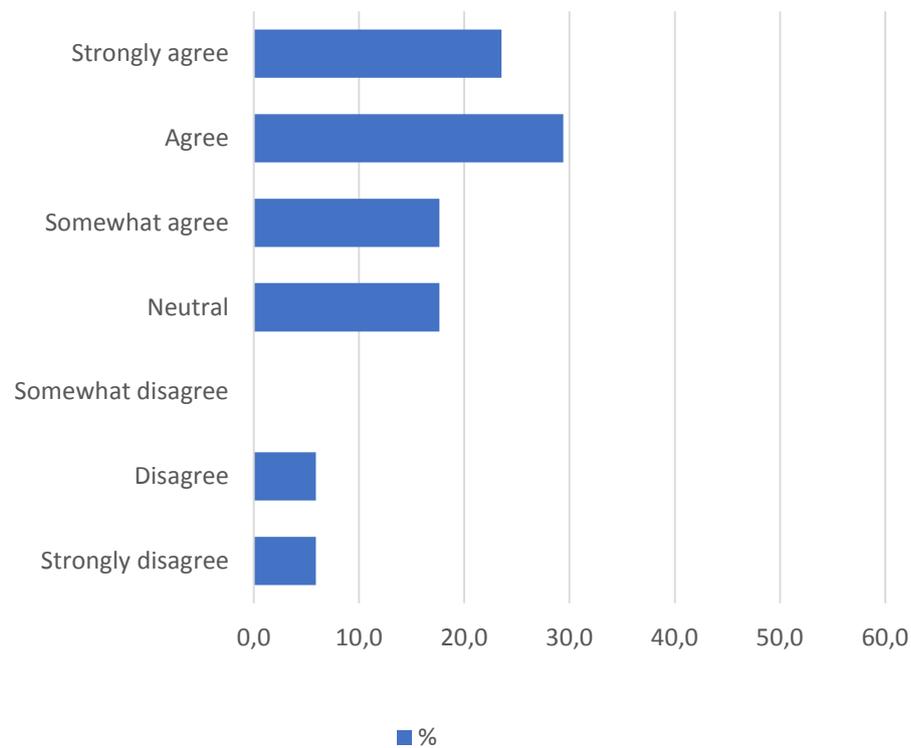


Figure 26. Regulation should set more detailed requirements on planning for cyber risks in seaports. Percentage of all respondents, N = 17.

Most of the experts also agreed that regulation should set more detailed requirements for back-up systems in seaports, as this would increase preparedness for cyber threats (Figure 27). On the other hand, some seaport representatives thought that there are more possibilities than just regulation to improve the situation. More detailed regulations might not be the solution, as the operational environment and technologies evolve so quickly in the field that legislation is likely to be lagging behind all the time.

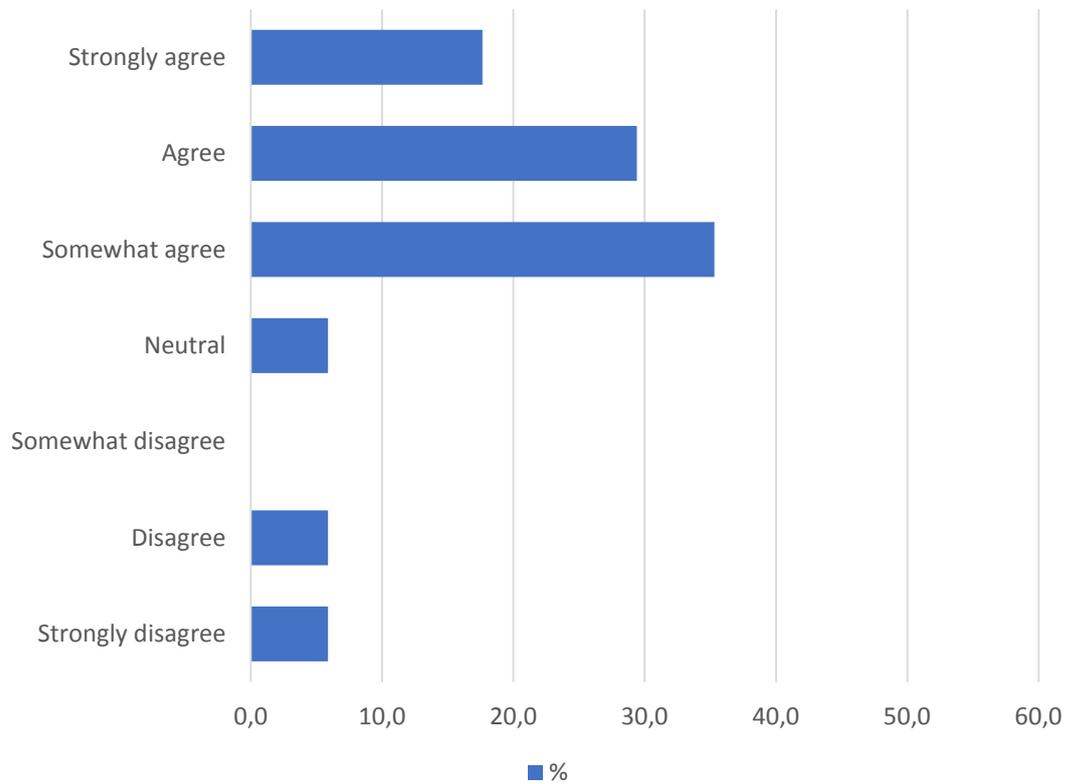


Figure 27. Regulation should set more detailed requirements for back-up systems (e.g. IT systems, electricity supply, and various IoT solutions) in seaports. N = 17

Around 80 percent of the experts agreed with the claim that regulation should set more detailed requirements on exercises related to seaport resilience to cyber-attacks (Figure 28). All kinds of threats should be trained for, and more detailed requirements on exercises could increase resilience to cyber-attacks. Some considered that regulation could set at least minimum-level standards. Those who did not fully agree with the claim regarded that requirements for exercises should not come through regulation, even though cyber security is a challenge.

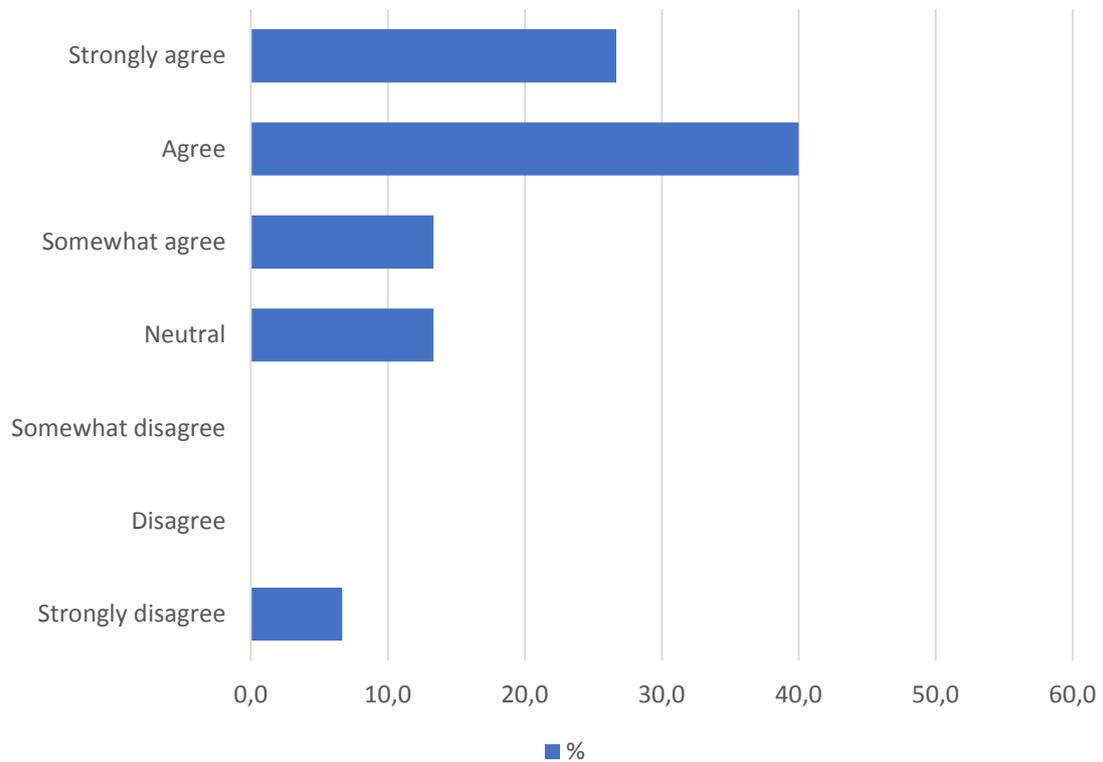


Figure 28. Regulation should set more detailed requirements on exercises related to seaport resilience to cyber-attacks. Percentage of all respondents, N = 17.

The expert assessment of the fourth proposition concerning preparedness for cyber security diverged (Figure 29). Most of the experts answered that regulation should set more detailed requirements for authorities, so that they are able to assess port capabilities and resilience to cyber threats. Those who disagreed with the claim argued that it is a good idea for authorities to have their own set of criteria to help their work with preparedness for cyber security, but this should not be anything mandatory. Regulation is not an answer to every problem.

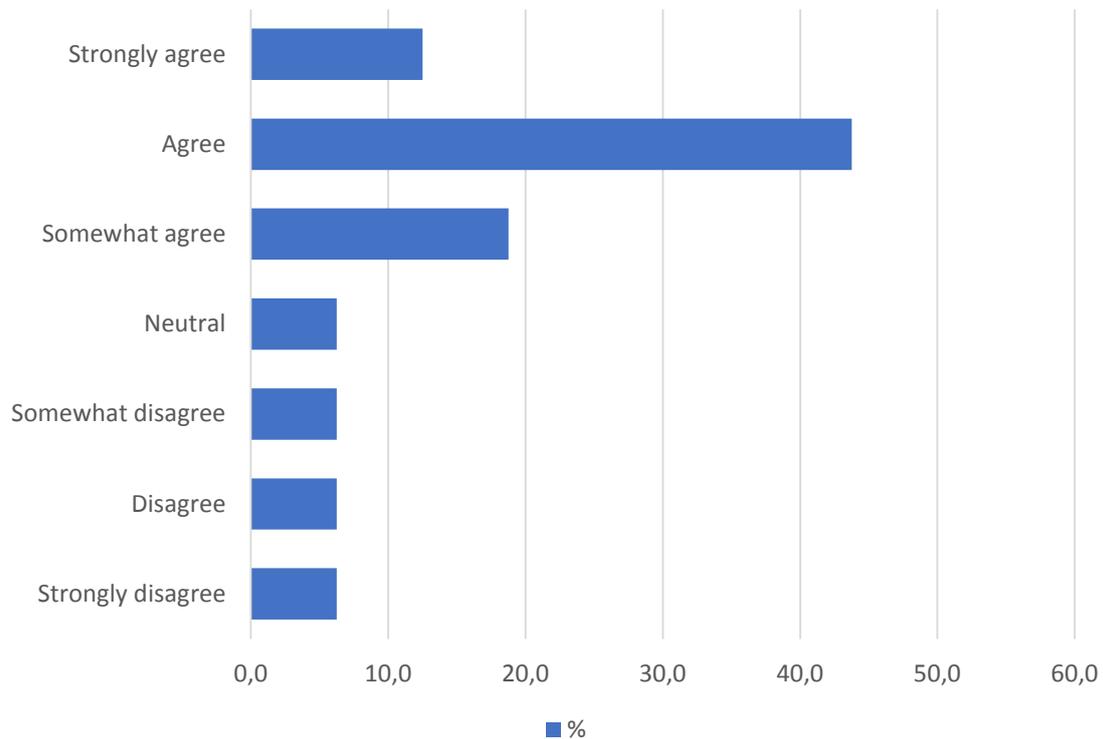


Figure 29. Regulation should set more detailed requirements for authorities, so that they are able to assess port capabilities and resilience to cyber threats (e.g. requirements for having "cyber personnel"). Percentage of all respondents, N = 17.

4.2 Development ideas related to communication

4.2.1 Increased use of seaport experts

The first key challenge related to communication that was identified in the first round of the Delphi study was related to increased use of seaport experts. In the first Delphi round, the experts argued that in order to improve communication between seaports and authorities, the knowledge of seaport experts should be used more. With increased use of seaport experts, authorities could obtain information from them to take relevant measures to mitigate incidents. In the second round, the experts were asked to assess two propositions on possible solutions for this challenge. The propositions were:

- In case of an accident, seaport experts should be used more in command center operations as "interpreters" between seaport and authority.
- Seaport experts should be used more, for example, in planning work and post-analyses of emergency exercises.

The experts clearly agreed with the proposition that seaport experts should be used more in command center operations (Figure 30). Around 50 percent of the experts strongly agreed with the proposition. The respondents argued that seaport experts' expertise should be used more, because they know the risks of the port best. Some experts already have had experience with experts involved as liaison persons, and this has proved to be successful. Communication between authorities and seaport experts should be continuous. In this way, communication would be more fluent in crisis situations.

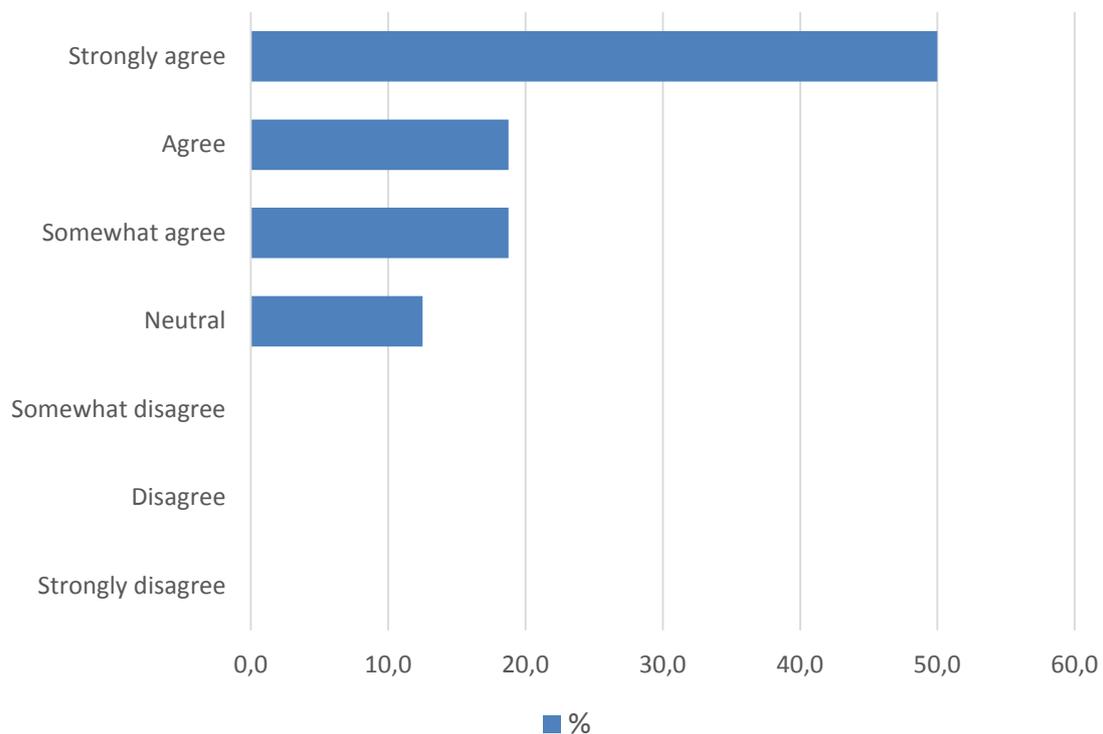


Figure 30. In case of an accident, seaport experts should be used more in command center operations "interpreters" between seaport and authority. Percentage of all respondents, N = 17.

Based on the results, the experts strongly agreed with the second proposition that seaport experts should be used more, for example, in planning work and post analyses of emergency exercises (Figure 31). They argued that seaport experts' knowledge should be used much more in the planning and analysis of exercises, because they know the risks best. One expert also offered an idea that it would be very useful, if seaport experts would publish the results and useful recommendations from post-analyses of emergency exercises or accidents.

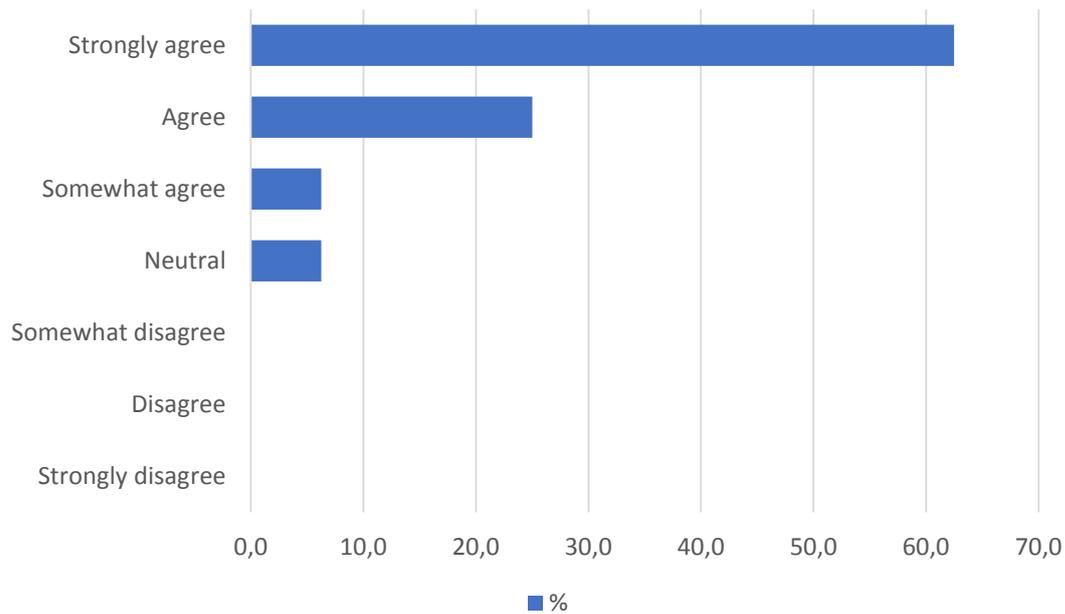


Figure 31. Seaport experts should be used more, for example, in planning work and post-analyses of emergency exercises. Percentage of all respondents, N = 16.

4.2.2 Interoperability of IT systems

The second key challenge related to communication and flow of information that was identified in the first round of the Delphi study was related to badly interoperating IT systems of different stakeholders. Interoperability of IT systems between different stakeholders should be developed, and seaport site maps, rescue plans, and other relevant information should be available in electronic form. Interoperability of IT systems of different stakeholders and promoting digitally available information increases the flow of information. In the second Delphi round, the experts were asked to assess four propositions on possible solutions for this challenge. The propositions were:

- Interoperability of authorities' IT systems should be improved.
- In order to ensure uninterrupted communication in seaports, technical and organisational ability to mitigate cyber threats should be improved.
- Seaports should make their situational picture available to the authorities (e.g. information from cameras and access control, amounts and places of dangerous goods/chemicals).
- Seaport rescue plans and other relevant information should be prepared in electronic form and authorities should improve their systems, so that seaports are able to submit and update their own materials in authorities' databases. This way, plans and other relevant information would be easy to access e.g. in case of an accident.

Almost 90 percent of all the experts agreed with the first proposition on improving interoperability of authorities' IT systems (Figure 32). They argued that to ensure successful cooperation between stakeholders, all involved agencies and authorities should use the same or at least compatible IT systems. All information that can help authorities' work should be easily available at all times.

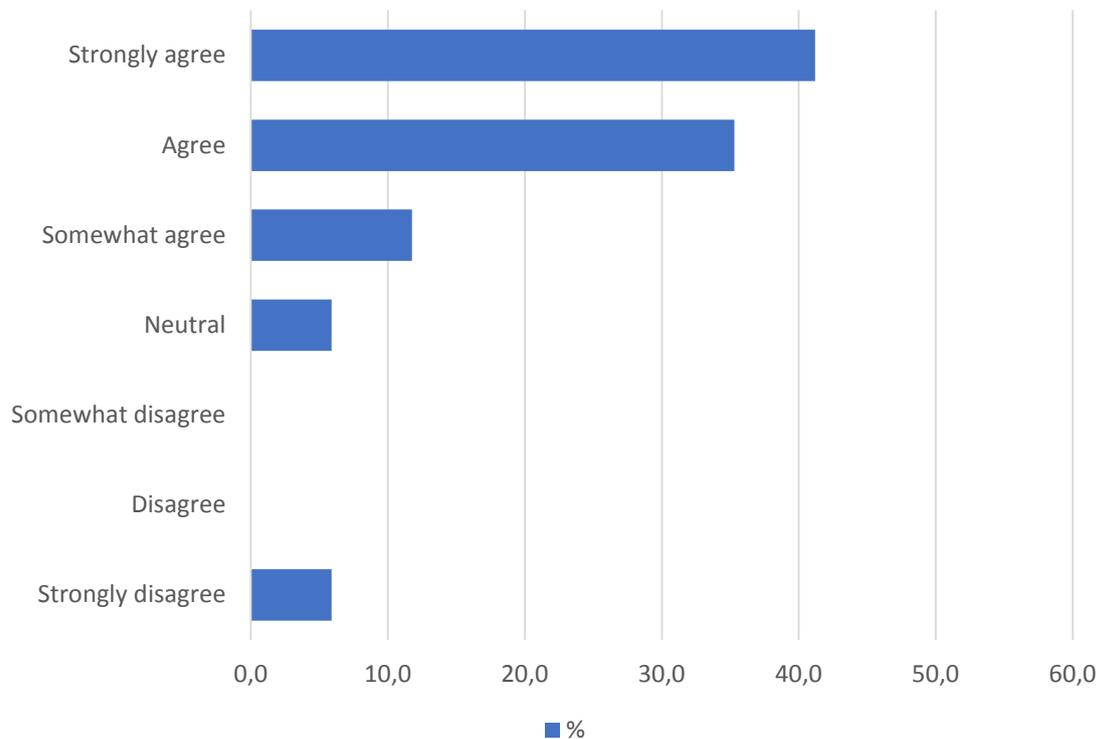


Figure 32. Interoperability of authorities' IT systems should be improved. Percentage of all respondents, N = 18.

The experts also agreed on the second proposition that in order to ensure uninterrupted communication in seaports, technical and organizational ability to mitigate cyber threats should be improved (Figure 33). When analyzed by respondent group, it was observed that the representatives of researchers and authorities agreed with the proposition the most.

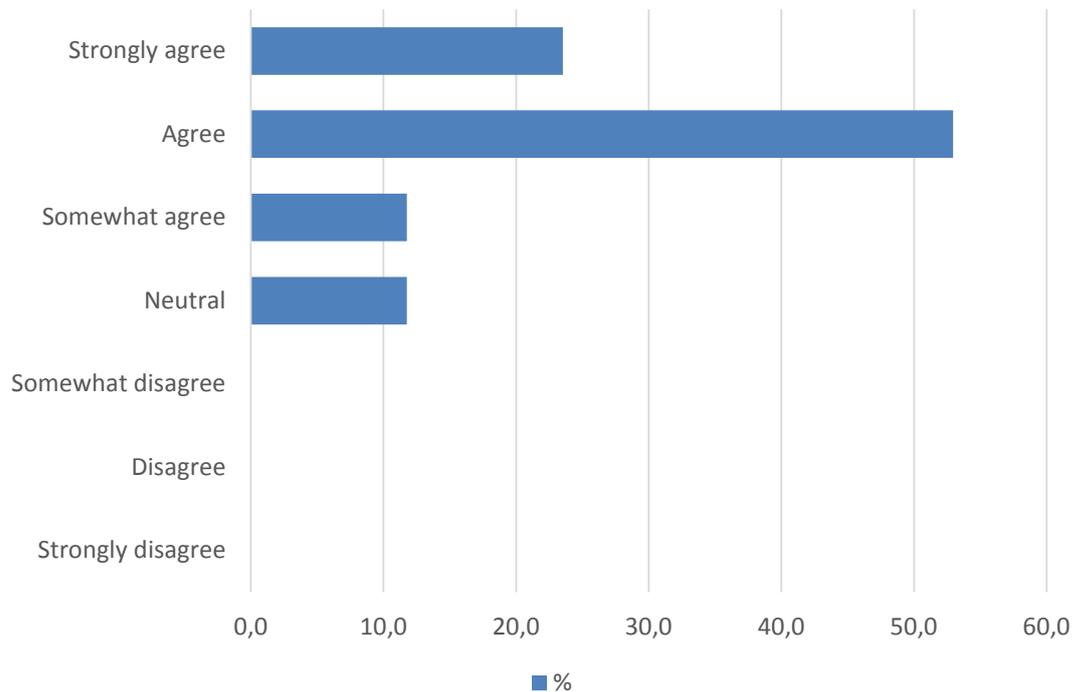


Figure 33. In order to ensure uninterrupted communication in seaports, technical and organizational ability to mitigate cyber threats should be improved. Percentage of all respondents, N = 18.

The expert assessment of the third proposition was diverse (Figure 34). The proposition was related to the idea that seaports should make their situational picture available to the authorities. Seaports should share, e.g., information from cameras and access control, amounts and places of dangerous goods and/or chemicals to improve the flow of information. Most of the experts agreed with the proposition, as all information that can help authorities' work, should be easily available. Having all available information, and especially everybody having the same information, guarantees successful cooperation. On the other hand, some seaport representatives disagreed with the proposition. They argued that this should not be done automatically, but only when needed.

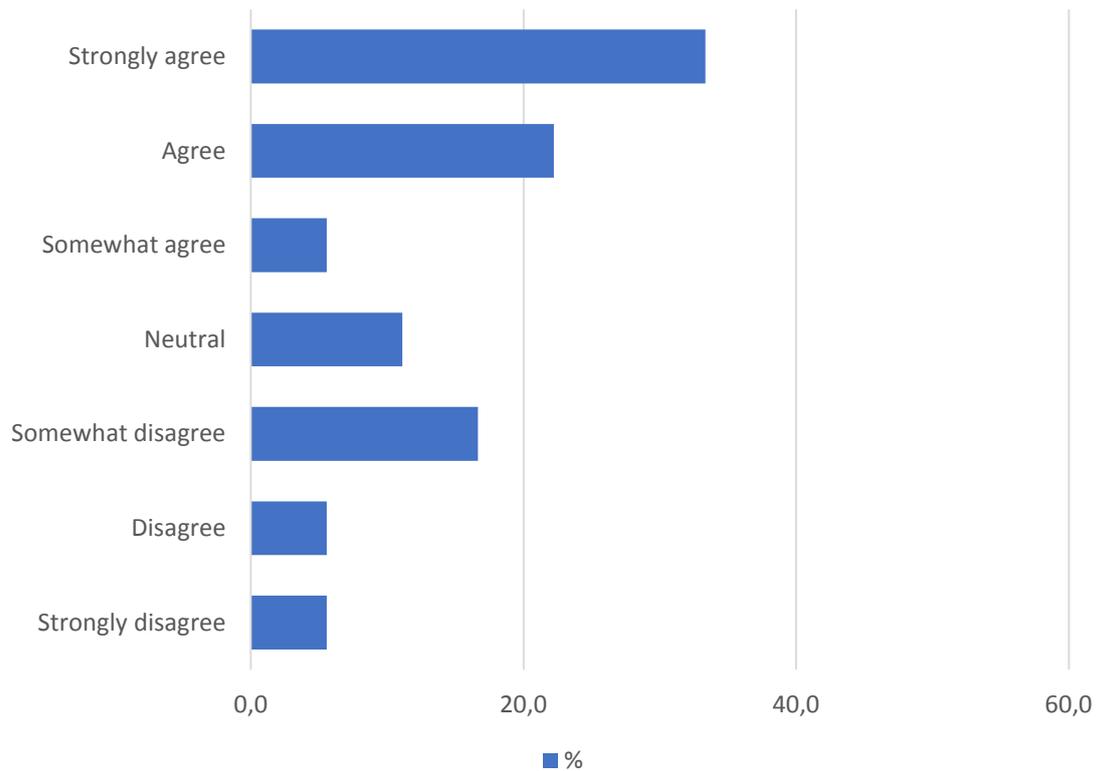


Figure 34. Seaports should make their situational picture available to the authorities (e.g. information from cameras and access control access, amounts and places of dangerous goods/chemicals). Percentage of all respondents, N = 18.

The experts agreed with the fourth proposition concerning interoperability of IT systems the most. They agreed that authorities' systems should be developed, so that seaports are able to submit and update their material digitally to authorities' databases. 95 percent of all the experts agreed with the proposition (Figure 35). They considered it to be a good development idea that authorities would improve their systems, so that seaports are able to submit and update their own digital materials in authorities' databases. This way, plans and other relevant information would be easy to access. Updates of seaport rescue plans and other relevant information helps out with mitigating the effects of accidents. However, to make interoperating IT systems work, an international standard to support this IT development must be agreed upon.

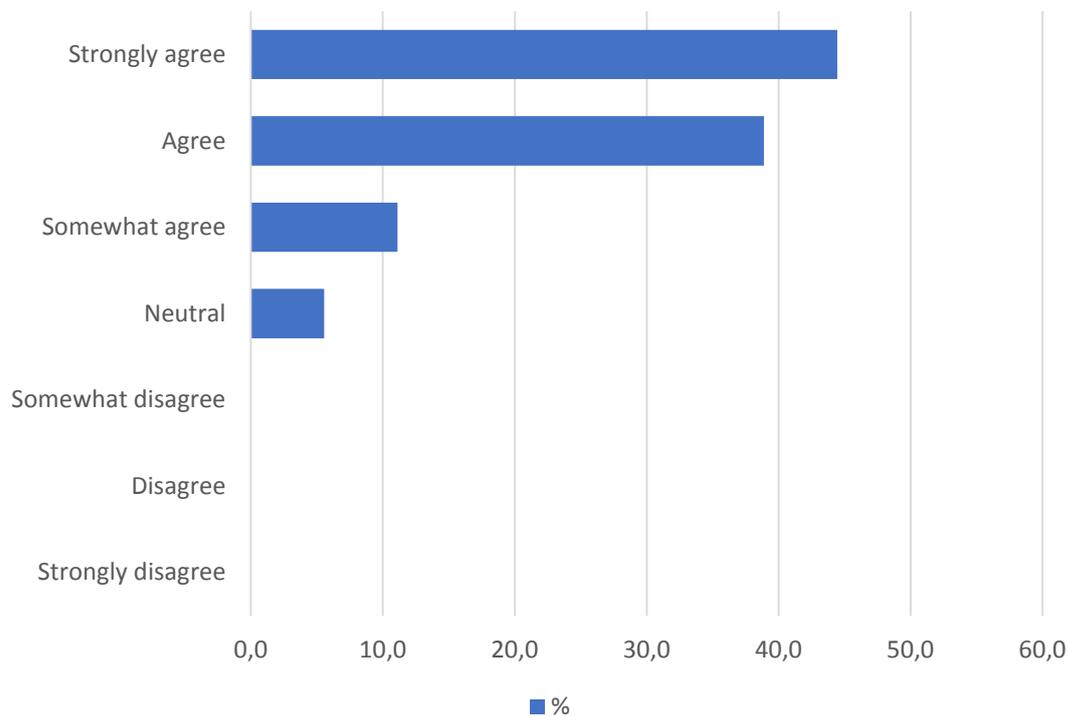


Figure 35. Seaport rescue plans and other relevant information should be prepared in electronic form and authorities should improve their systems, so that seaports are able to submit and update their own materials in authorities' databases. This way, plans and other relevant information would be easy to access e.g. in case of an accident. Percentage of all respondents, N = 18.

4.2.3 Co-operation with seaports

The third key challenge related to communication and flow of information that was identified in the first round of the Delphi study was inadequate co-operation with seaports. In order to increase safety and security, seaports should more actively co-operate with other seaports, e.g. by benchmarking other seaports' emergency exercises or by sharing information on best practices of how to prepare safety and security plans. The experts were asked to give concrete examples of how the co-operation between ports could be improved concerning preparedness.

Experts especially noted the importance of organizing multi-port exercises. Seaports could, e.g., practice joint exercises together with authorities. When organizing multi-port exercises, everyone could get more out of the annual big exercise. Also, the responsibility of arranging exercises could then loop, so that each port's turn comes less often. Experts also mentioned that inviting experts from other ports as observers to exercises is another possibility to increase collaboration. This only needs an agreement between member ports that colleagues can come

and follow exercises. Port professionals could also have a role in the exercises of other ports, if needed.

There were also other individual remarks on how to improve preparedness by increasing co-operation between seaports. These remarks were, for instance, staff exchange, regular mandatory meetings, e.g., in the form of a review board, seminars, and workshops with speakers on specific topics. Seaports could also share information on the best practices of preparedness like data exchange via software interfaces, or ports could share some form of performance management system with appropriate indicators.

The experts were also asked to identify the kind of obstacles that can hinder co-operation between seaports. The experts raised the view that rivalry between ports is one concrete obstacle that can hinder co-operation. Ports compete with each other, and sometimes they do not want to share their work with others. Ports may want to cover business advantages and other secrets. The experts also recognized that seaports may have an attitude problem. Some may think that they know the things best, so they do not need any help or advice from other ports.

One individual remark was also an observation that lower national regulatory standards can hinder co-operation. For example, some seaports are not interested in spending more money on developing and testing expensive but safer equipment in co-operation with other seaports, if it is not necessary by national regulation.

4.2.4 Crisis communication training

The fourth key challenge related to communication and the flow of information that was identified in the first round of the Delphi study was related to insufficient crisis communication training. In the second round, the experts were asked to assess two propositions on possible solutions for this challenge. The propositions were:

- Accident scenarios for exercises should always include aspects that will test situations, where lines of communication fail down.
- Post-analysis of accidents and emergency exercises should include more detailed information on communication difficulties.

The experts agreed on the proposition concerning the idea that accident scenarios for exercises should always include situations where communication fails. Almost 85 percent of the experts agreed with this development idea, of which almost half strongly agreed with it (Figure 36). The experts argued that communication is a vital component in managing accident response. Therefore, crisis communication is a relevant part of exercises and should be trained regularly. In particular, there should be many more exercises in seaports, which includes external communication.

Some of the experts gave a neutral answer, as they regarded it as dependent on the exercise's objectives, whether accident scenarios should include test scenarios where communication fails or not.

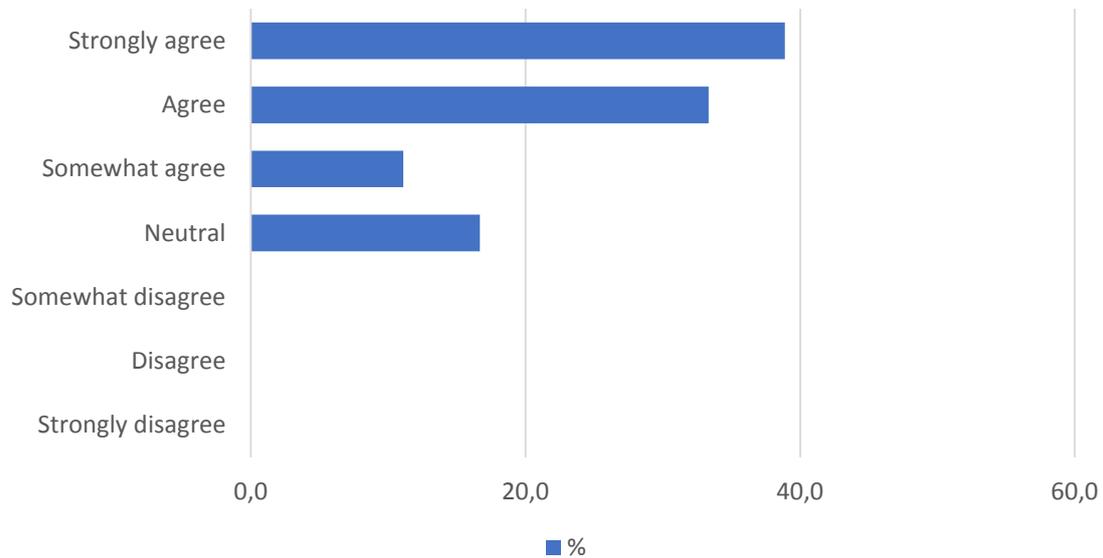


Figure 36. Accident scenarios for exercises should always include aspects that will test situations where lines of communication fail down. Percentage of all respondents, N = 18.

The experts were very unanimous with their answers on the proposition concerning post-analysis of accidents and emergency exercises. Almost 95 percent of the experts strongly agreed or agreed with the idea that post-analyses should include more detailed information on communication difficulties (Figure 37). The main argument was that as communication is a core issue of exercises, this part should also be extended in the analysis.

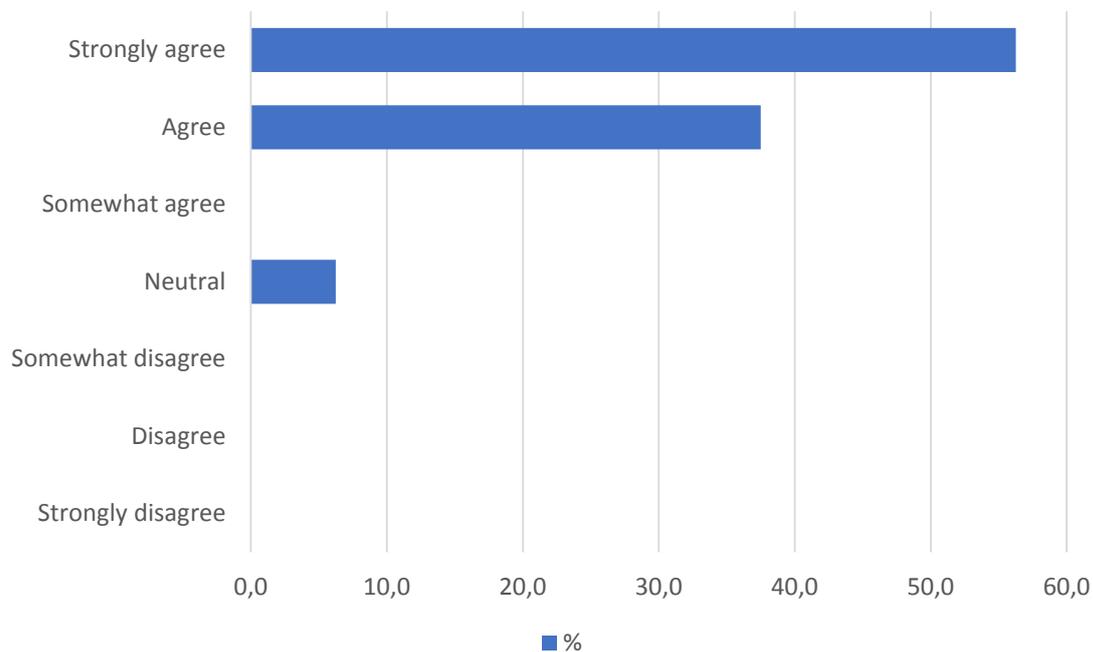


Figure 37. Post-analysis of accidents and emergency exercises should include more detailed information on communication difficulties. Percentage of all respondents, N = 18.

4.3 Challenges related to joint emergency exercises within the seaport context

The key challenge related to joint emergency exercises that was identified in the first round of the Delphi study was that a variety of scenarios used in the joint exercises is often too narrow. Only very typical or small, or only a few accident scenarios are used and are often created several years ago. On the other hand, incidents, shocks and surprises should be tested, which may reveal weaknesses, for instance, in seaport management and resilience.

In the second round, the experts were asked to assess three propositions on possible solutions for this challenge. The propositions were:

- Accident scenarios for emergency exercises should also include unlikely scenarios that may have high impact on the seaport area, because unexpected situations are the best way to reveal possible problems and development areas.
- Accident scenarios should be improved by more systematic planning, i.e., by planning emergency exercises and scenarios, e.g., with a five years' time perspective.
- Very large-scale accident scenarios could be prepared for by training in smaller parts or by table-top exercises.

Almost 85 percent of the experts agreed with the first proposition that emergency exercises should also include unlikely scenarios that may have a high impact on the seaport area (Figure 38). They argued that all imaginable scenarios should be trained to be prepared for all possible

problems. Authorities in particular agreed with the proposition that we should test unexpected situations to reveal possible problems. It was also suggested that to plan for scenarios based on the accidents that have already happened somewhere in the world.

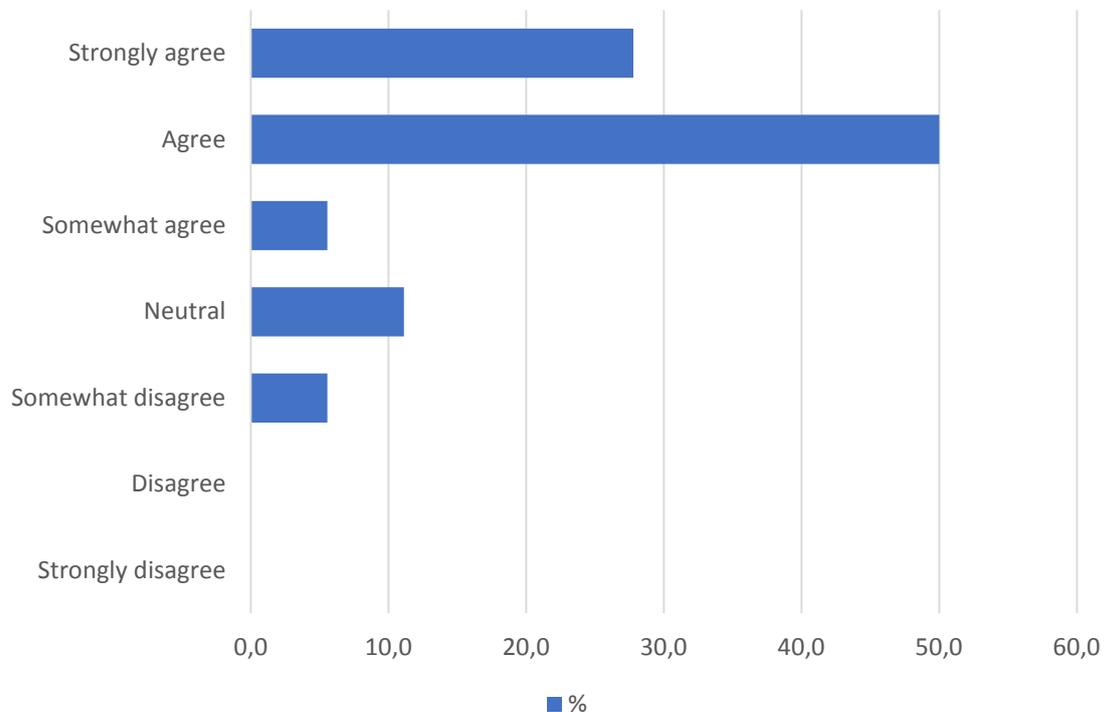


Figure 38. Accident scenarios for emergency exercises should also include unlikely scenarios that may have a high impact on the seaport area, because unexpected situations are the best way to reveal possible problems and development areas. Percentage of all respondents, N = 18.

As the second proposition, the experts were asked to assess, whether accident scenarios should be improved by more systematic planning, i.e., by planning emergency exercises and scenarios, e.g. with a five years' time perspective. Most of the experts thought that a more systematic planning would improve accident scenarios (Figure 39). Although, some experts mentioned that a perspective even shorter than five years could be good. It would be ideal to start with shorter period to get experience, and then, later on, to take a five-year perspective.

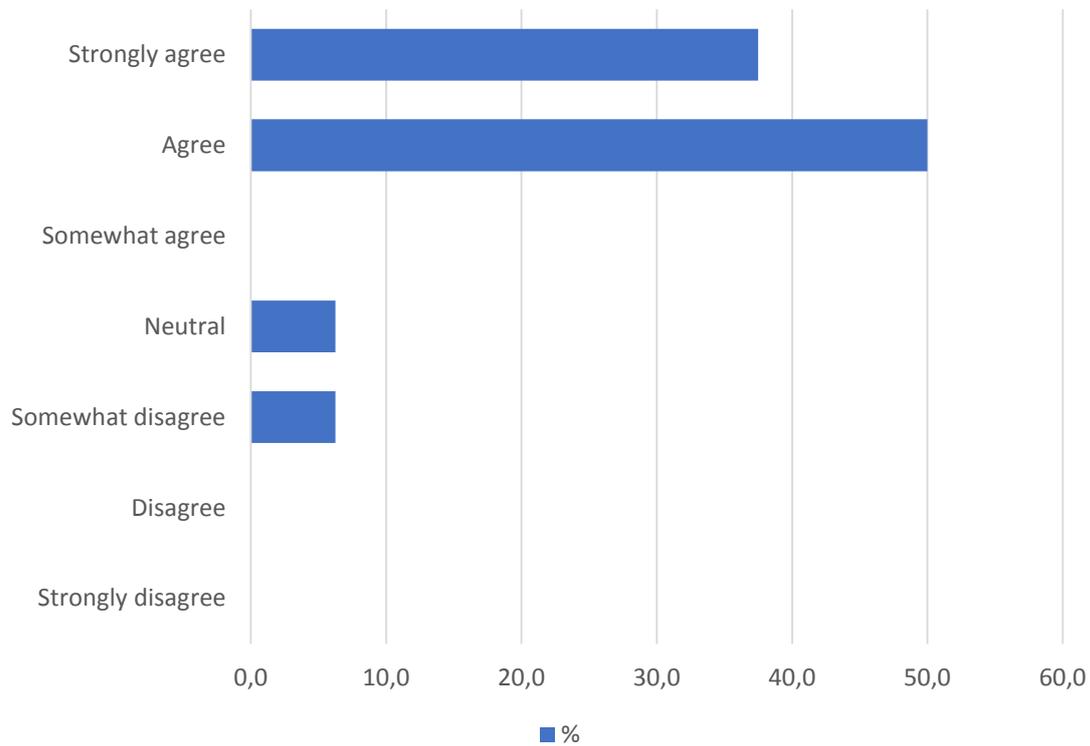


Figure 39. Accident scenarios should be improved by more systematic planning, i.e., by planning emergency exercises and scenarios, e.g. with a five years' time perspective. Percentage of all respondents, N = 18.

As the third proposition, the experts were asked to assess, whether accident scenarios should be improved by preparing very large-scale accident scenarios in smaller parts or by table-top exercises. The experts almost unanimously agreed with this proposition (Figure 40). They argued that large-scale scenarios should be trained for both in smaller parts as well as large-scale exercises. All types were considered necessary. It is easier to learn in smaller pieces and preparing can be very instructive.

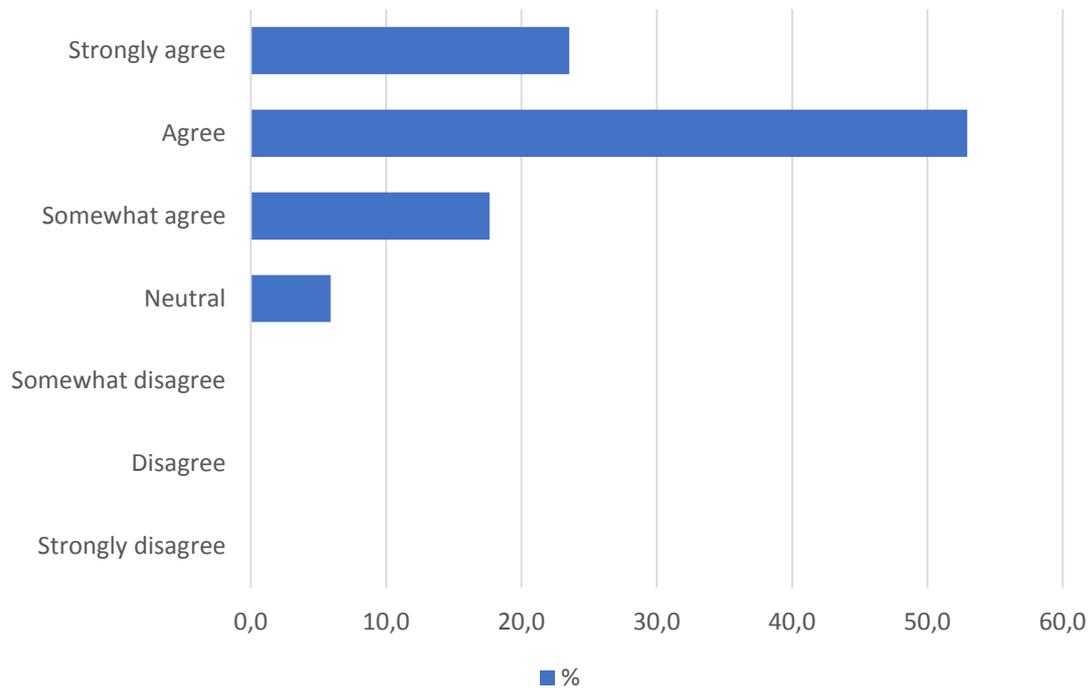


Figure 40. Very large-scale accident scenarios could be prepared for by training in smaller parts or by table-top exercises. Percentage of all respondents, N = 18.

4.4 Importance of the development challenges in mitigating major accidents in seaports

As the final question, the experts were asked to assess the importance of eight different development challenges of the second Delphi round on improving safety and security in seaports to mitigate major accidents in the Baltic Sea Region ports. These eight development challenges raised up for the assessment are listed below:

- Regulations are not always up-to-date, and safety and security regulation is not consistent.
- There is national variation between the EU countries in safety and security regulation.
- Regulation related to preparedness for cyber threats is inadequate in seaports.
- The use of seaports' experts in authorities' command center during an accident needs to be developed.
- The interoperability of IT systems between stakeholders should be developed, and rescue plans and other information should be available in electronic form.
- In order to increase safety and security, seaports should co-operate more with other seaports.
- Crisis communication training should be increased in the context of seaports.
- Better accident scenarios based on risk analysis are needed.

According to the view of the experts, the most important challenges to develop to improve safety and security in seaports were:

1. Crisis communication training should be increased in the context of seaports.
2. In order to increase safety and security, seaports should co-operate with other seaports.
3. There is national variation between the EU countries in safety and security regulation.

The experts raised crisis communication training especially as the most important development challenge, since communication is an increasingly important part of accidents today (Figure 41). Therefore, communication skills should be trained more regularly. According to the experts, another important challenge that should be developed in co-operation with seaports. That way, seaports could learn from each other and could improve their level of preparedness.

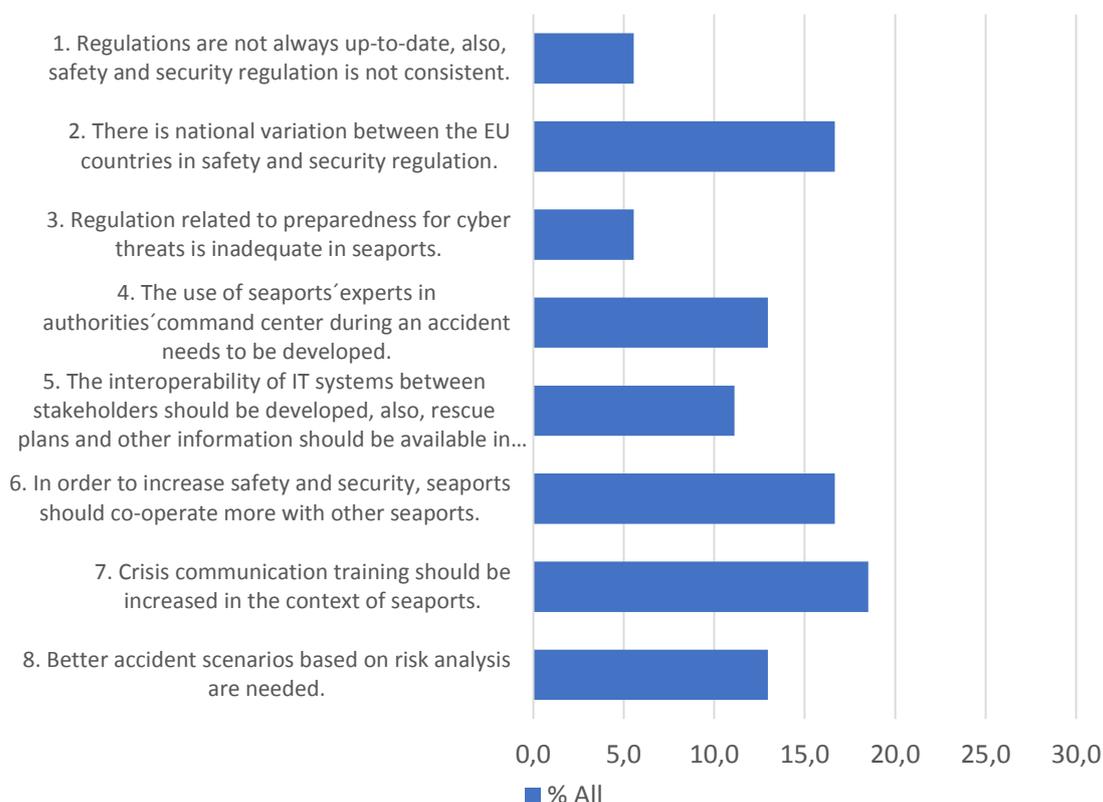


Figure 41. Most important development challenges to improve safety and security in seaports. Percentage of all respondents, N = 18.

National variation between the EU countries in safety and security regulation seemed to be as important development challenge as co-operation with seaports. Due to national variation in regulation, it is very difficult for seaports to find a common way to interpret regulations, as there are different ways safety and security are organized within the Baltic Sea Region countries.

5 DISCUSSION

5.1 The key results of the Delphi study

5.1.1 Problem domains and development areas identified in the first Delphi round

It was recognized that one important development area in regulatory aspects is national variations between EU countries in safety and security regulations and administrative demands. The experts felt that, at the moment, different countries can interpret the same regulations in various ways, which hinders the preparedness operations of ports. This also leads to locational advantage. It was also emphasized that another major challenge in regulation is that regulation related to cyber threat preparedness is inadequate in ports. Cyber threats concern all fields of operation, which is why cyber security should also be improved from its current state by means of regulation. Also, the fragmentation of regulation was recognized as a problem. Safety and security regulations are sometimes inconsistent, which creates fragmentation and causes problems for seaports. The regulation should be standardized and done in a coordinated fashion with more broad-based cooperation than at the moment to avoid fragmentation. The experts also felt that regulations are not always up-to-date, as national legislative processes are too slow. Outdated decrees and advice hinders the activities of the authorities; therefore, keeping regulation up-to-date was seen as a clear development need.

Furthermore, clear development areas in communicational aspects were identified. The interoperability of IT systems between different stakeholders should be developed, and seaport site maps, rescue plans, and other relevant information should be available digitally. The experts recognized this as a clear development need, as well-functioning IT systems are mandatory for rescue personnel in the management of major accidents in order to achieve situation awareness in response. Secondly, collaboration between seaports was also seen to need improvement. In order to increase safety and security, seaports should co-operate more with other seaports. Thirdly, crisis communication training stood out as an important development theme. There is a developmental need for skills in crisis communication, therefore, crisis communication training should be increased within the context of seaports. Also, making better use of seaport experts in all operations was brought up as another development theme. There should be more cooperation with the experts, as it is possible to obtain information from the experts immediately.

The experts felt that many development areas in exercises are factors that increase co-operation between ports and authorities. For instance, more co-operation is needed to use more seaport experts in the planning and post-analysis of multi-authority exercises as well as to put more effort on the post-analysis of multi-authority exercises. Also, more co-operation between ports and authorities is needed to better plan accident scenarios that are based on risk analyses. Authorities also emphasized that one development area in exercises is to establish a common

data bank for the exercises. Furthermore, the experts brought the fact that not all emergency exercises have to be wide-ranging exercises that demand lots of resources. For example, it is possible to separate a smaller part of a major accident scenario and practice only this certain area. Further, the exercises do not always have to be concrete. For example, it is possible to map different kinds of problems and tackle the problems that have been observed with the help of table-top exercises.

5.1.2 Solutions for the identified challenges

The experts emphasized that one of the major challenges in regulation is national variation in interpreting safety and security regulation. In order to decrease national variation, we should increase co-operation. There should be, for instance, more co-operation between legislative authorities from various countries in the field of port management. One concrete solution to this challenge could also be to make interpretation of regulations more uniform. EU directives should be more precise, as port safety and security are important topics and should be regulated in a similar fashion in all EU countries. EU could also provide better directions for interpreting safety and security regulation.

Another regulatory challenge is that preparedness for cyber threats is inadequate in seaports. The experts expressed that the best improvement could be regulations setting more detailed requirements on exercises related to seaport resilience to cyber-attacks. The experts were fairly unanimous on the desirability of tightening regulation in this respect. Also, the fragmentation of regulation and outdated regulations were recognized as a problem. The experts felt that a solution to this could be standardized national-level seaport safety and security regulation and done in a coordinated fashion with more broad-based cooperation than at the moment.

Further, solutions to communication challenges were identified. In order to improve communication between seaports and authorities, the knowledge of seaports' experts should be used more. According to the Delphi experts, seaport experts should be used more in planning work and post-analyses of emergency exercises in co-operation with authorities. In addition, the experts should be more closely involved in the actual joint emergency exercises. This was seen as one significant factor when improving communication between authorities and ports.

Another major challenge is communication training. Crisis communication training should be increased in the context of seaports. The experts agreed that an important development idea could be that post-analysis of accidents and emergency exercises include more detailed information on communication difficulties. Thirdly, another major challenge related to the flow of information is that IT systems between different stakeholders are not interoperable. Also, it is a problem that seaport site maps, rescue plans, and other relevant information are not available digitally for the authorities. Rescue authorities should have sufficient prior knowledge of the risks at the port available. The experts agreed that authorities should improve their systems, so that seaports are able to submit and update their own materials in authorities' databases.

Furthermore, challenges and solutions related to joint emergency exercises were identified. The main challenge is that better accident scenarios based on risk analysis are needed. This can be improved by more systematic planning. Emergency exercises and scenarios could be planned with in a longer perspective. The experts also raised the importance of organizing common joint emergency exercises and doing the post-analysis together in co-operation with ports.

5.2 Policy recommendations

The biggest challenge in regulation seems to be national variation in safety and security regulation. In order to decrease national variation, there should be more co-operation between legislative authorities from all BSR countries. Respectively, port operators from all BSR countries should participate more actively in legislative processes. Generally, regulation should be standardized and done in a coordinated fashion with more broad-based cooperation than at the moment, which also hinders possible fragmentation in regulation in the future.

Another challenge in safety and security regulation is that interpretation of regulations is not uniform, i.e., interpretation of regulations varies among BSR countries. EU directives and lower-level regulations could be more precise, and there could be more detailed interpretation directions included. These improvements would also harmonize the way regulations are interpreted in each country.

Another challenge area in safety and security regulation is related to IT systems and cyber security, because IT systems may inflict concrete challenges to the smooth flow of information. IT systems form an essential part of collecting, computing, and sharing information. However, often the problem is that different IT systems are not interoperable. One solution to this could be that authorities in BSR countries would be obligated to develop their IT systems, so that different stakeholders are able to submit and update their mandatory safety and security documents (e.g. site maps and rescue plans) digitally. This would also support the development of authorities' IT systems' interoperability in the long term. An ideal goal in the long term could be situational picture systems enabling the sharing of one's own situational picture with the other parties involved.

In addition to better, e.g., back-up systems and electricity supply, both authorities and seaport operators, should pay more attention to exercises related to seaport resilience to cyber-attacks. These should include incidents, shocks, and surprises (e.g. electricity or IT failure), which should be tested for to reveal weaknesses, for instance, in authorities and seaport management and resilience.

Communication and the flow of information in real accidents and exercises can be improved, if authorities would make better use of seaport personnel expertise in the command center, because a seaport's own personnel have the best knowledge of seaport operations (e.g. the actual number and location of people in port area or actual amounts and locations of, e.g.,

dangerous substances). Up-to-date and quickly available information can significantly block the expansion of an accident. In addition to co-operation of authorities and seaport personnel in the command center, co-operation in a broader perspective also helps the authorities to understand, for example, the risks in seaport processes, which in part supports decision-making and operations by the authorities in potential accidents.

Communication between different players must be recognized, planned, and practiced. These include communication between the seaport and the rescue authorities, communication between different authorities and also organizing and implementing external communication. Whether it is a matter of the internal communication of the rescue authorities, external communication or communication between seaport operators, all of these can be improved through practice. This means that exercises should always include aspects of communication, e.g. testing situations where lines of communication fail. Also, the results of the Delphi study reveal that internal and external crisis communication should be trained more.

The importance of pre-practicing and jointly defining the agreed operational processes in advance, especially in the case of large-scale accidents, cannot be stressed enough. Therefore, exercises should be planned more systematically, e.g. by planning emergency exercises and scenarios with longer perspective (e.g. a five years' time perspective). This could also help improve the quality of exercises, e.g. to include unlikely scenarios that may have a high impact on the seaport area. The results of the Delphi study also underline that seaports should practice together more, which also improves the quality of exercises. When organizing multi-port exercises, everyone could get more out of the annual big exercise. Also, the responsibility of arranging exercises could then loop, so that each port's turn comes less often, which a longer time perspective of planning exercises supports.

Post-analyses of real accidents and exercises help us prepare better for the future. Therefore, post-analyses of real accidents and exercises should be done more properly, and observations of development issues, including detailed information on communication difficulties, should be distributed to all relevant stakeholders. If lessons can be learnt from post-analysis of an accident or an exercise and, more importantly, the lessons absorbed, then it has beneficial impact on preventing or mitigating future accidents.

In conclusion, it can be said that there is need for forward-looking management to anticipate major accidents that are potentially foreseeable and potentially avoidable. It is clear that organizations with effective plans are able to react more quickly to problems and are able to respond more appropriately to the situation than organizations without such plans. Organizations should provide appropriate training and promote learning within and across networks, and personally involve organizational leaders in preparedness, who should be engaged in a continuous effort for future-oriented decision-making.

LITERATURE

- Bichou, K. (2008), Security and risk-based models in shipping and ports: Review and critical analysis, *OECD-ITF Discussion Paper, No. 20, December 2008*.
- CEC - Commission of the European Communities (2015), Action plan for the European Union strategy for the Baltic Sea Region, <http://www.balticsea-region-strategy.eu/component/edocman/17-action-plan-2015>. Accessed 18 August 2017.
- DFT - Department for Transport (2015), Port marine safety code, <https://www.gov.uk/government/publications/port-marine-safety-code>. Accessed 18 August 2017.
- Gordon, T., J. (2011), The Delphi method in futures research methodology-V3.0, <http://www.millennium-project.org/millennium/FRM-V3.html>. Accessed 10 September 2017.
- Haveman, J., D. and Shatz, H., J. (2006), Protecting the nation's seaports: Balancing security and cost, San Francisco: Public Policy Institute of California.
- Helmick, J., S. (2008), Port and maritime security: A research perspective. *Journal of Transportation Security, VOL 1, No. 1, pp. 15-28*.
- Kuusi, O. (1999), Expertise in the future use of generic technologies. Epistemic and methodological considerations concerning Delphi studies, Helsinki: HeSe Print.
- Laakso, K. (2014). Management of major accidents. Communication challenges and solutions in the preparedness and response phases for both authorities and companies. Turku School of Economics, Series A-7:2014, University of Turku. 271 p.
- Laakso, K. and Ahokas, I. (2013), Viranomaiset ja elinkeinoelämä samassa veneessä. Miten parannamme tiedonkulkua suuronnettomuustilanteissa ja niihin varautumisessa? Tutu-publications 1/2013. Finland Futures Research Centre, University of Turku. 97 p.
- Laakso, K., Rubin, A. and Linturi, H. (2012), The Role of regulation in the mobile operator business in Finland, *Foresight: The Journal of Future Studies, Strategic Thinking and Policy, VOL 14 No. 2, pp. 157-164*.
- Linstone, H., A. and Turoff, M. (1975), Introduction, Linstone, H., A. and Turoff, M. (Ed.) *The Delphi Method: Techniques and Applications*. Available from <http://is.njit.edu/pubs/delphibook/index.html#toc>, pp. 1-12.

HAZARD project has 15 full Partners and a total budget of 4.3 million euros. It is executed from spring 2016 till spring 2019, and is part-funded by EU's Baltic Sea Region Interreg programme.

HAZARD aims at mitigating the effects of major accidents and emergencies in major multimodal seaports in the Baltic Sea Region, all handling large volumes of cargo and/or passengers.

Port facilities are often located close to residential areas, thus potentially exposing a large number of people to the consequences of accidents. The HAZARD project deals with these concerns by bringing together Rescue Services, other authorities, logistics operators and established knowledge partners.

HAZARD enables better preparedness, coordination and communication, more efficient actions to reduce damages and loss of life in emergencies, and handling of post-emergency situations by making a number of improvements.

These include harmonization and implementation of safety and security standards and regulations, communication between key actors, the use of risk analysis methods and adoption of new technologies.

See more at: <http://blogit.utu.fi/hazard/>

