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HOW DOES EMERGING FUEL TECHNOLOGIES AFFECT A MARINE INSURER?

A study into the attitudes and opinions surrounding the implementation of emerging environmentally friendly fuel and propulsion technologies.

Niklas Fabritius

Henrik Thyrén

Master's degree Thesis

Thesis for Master of Maritime Management

MMM21

Turku, 2025

DEGREE THESIS

Authors: Niklas Fabritius & Henrik Thyrén
Degree Programme and place of study: Master of Science, Novia University of Applied Sciences.
Specialisation: Master Maritime Management
Supervisor(s): Thomas Finne

Title: HOW DOES EMERGING FUEL TECHNOLOGIES AFFECT A MARINE INSURER?

Date: 02.05.2025 Number of pages: 112 Appendices: 3

Abstract

This thesis studies the impact that emerging new fuel technologies have on the marine insurance sector. Through a survey distributed to marine professionals across shipping companies, marine insurance, regulatory authorities and marine surveyors, this research investigates attitude, knowledge levels and perceptions regarding new fuel technologies. Participants represent different marine sectors, and the study highlights notable trends including knowledge gaps, readiness levels and collaboration dynamics.

Key findings include that most ship owners find themselves to be more knowledgeable than marine insurers regarding new fuel technologies and show greater desire to improve their understanding of new fuel technologies. Most respondents expressed optimism about the transition to sustainable fuels with 80% viewing the adoption of emerging fuel technologies positively.

The analysis further identifies regulatory barriers as a significant concern though perceptions vary by sector. Insurance professionals display a slightly more favorable position towards regulations compared to shipping companies' collaboration is sufficient regulatory frameworks are identified as critical areas to support and improve.

This thesis contributes to the understanding of the challenges and opportunities facing marine insurers in the decarbonation era, providing insights for enhancing sectoral knowledge, collaboration, and regulatory alignment.

Language: English
Key Words: maritime, insurance, sustainable, fuels, attitudes, feelings

EXAMENSARBETE

Författare: Niklas Fabritius & Henrik Thyrén
Utbildning och ort: Master of Science, Novia University of Applied Sciences.
Inriktning: Master Maritime Management
Handledare: Thomas Finne

Titel: HUR PÅVERKAR NYA OCH MILJÖVÄNLIG BRÄNSLETEKNOLOGI VARDAGEN FÖR EN ARBETSTAGARE I DEN MARINA FÖRSÄKRINGSBRANSCHEN?

Datum 02.05.2025 Sidantal 112 Bilagor 3

Abstrakt

Denna avhandling undersöker vilken möjlig inverkan av nya och miljövänliga bränsleteknologier har på marinförsäkringssektorn. Genom en digital enkät som distribueras till marinproffs, inklusive representanter från rederier, marinförsäkringbolag, tillsynsmyndigheter och marinsinspektörer – utforskar avhandlingen attityder, kunskapsnivåer och uppfattningar kring dessa nya teknologier. Deltagarna representerar en bredd av marina sektorer, vilket gör det möjligt för studien att belysa nyckeltrender såsom kunskapsluckor, beredskapsnivåer och samarbetsdynamik.

De viktigaste resultaten visar att de flesta redare anser sig vara mer kunniga än marinförsäkringsbolag om nya bränsleteknologier och uttrycker samtidigt en starkare vilja att förbättra sin förståelse om ny bränsleteknologi. Dessutom uttryckte 80% av deltagarna optimism kring övergången till mera hållbara bränsle och såg positivt på införandet av framväxande bränsleteknologier.

Avhandlingen identifierar regleringshinder som en betydande utmaning, även om uppfattningarna varierar mellan sektorer. Försäkringsproffs har generellt sett färre negativa åsikter om regleringsramar jämfört med anställda från rederierna. Studien betonar vikten av tillräckligt samarbete mellan sektorer samt robusta regleringsramar som avgörande för att stödja och förbättra införandet av hållbara bränslen.

Denna avhandling bidrar till att förstå de utmaningar och möjligheter som marinförsäkringsbranschen står inför i en tid av där reducerandet av koldioxidavtrycket är nödvändigt för marina sektorn. Den ger insikter om hur sektorns kunskap kan förbättras, samarbete förstärkas samt hur regleringar kan stödjas för att minska risker och ge nya möjligheter.

Språk: Engelska
Nyckelord: Marint, försäkring, miljövänlig, bränsle, attityder, känslor

OPINNÄYTETYÖ

Tekijä: Niklas Fabritius & Henrik Thyrén
Koulutus ja paikkakunta: Master of Science, Novia University of Applied Sciences.
Suuntautumisvaihtoehto: Master Maritime Management
Ohjaaja(t): Thomas Finne

Nimike: MITEN UUDET JA YMPÄRISTÖYSTÄVÄLLISET POLTTOAINETEKNOLOGIAT VAIKUTTAVAT MERIVAKUUTTAJAAN?

Päivämäärä 02.05.2025 Sivumäärä 112 Liitteet 3

Tiivistelmä

Tämä opinnäytetyö tutkii kehittyvien polttoaineteknologioiden vaikutusta merivakuutusalaan. Kysely, joka suunnattiin merialan ammattilaisille – mukaan lukien laivanvarustajien, merivakuutusyhtiöiden, sääntelyviranomaisten ja merikatsastajien edustajat – selvittää asenteita, tietotasoa ja käsityksiä näistä teknologioista.

Osallistujat edustavat eri merisektoreita, ja tutkimus tuo esiin keskeisiä trendejä, kuten tietämyksen puutteita, valmiustasoa ja yhteistyödynamiikkaa.
Keskeiset havainnot osoittavat, että useimmat laivanvarustajat pitävät itseään tietävämpinä kuin merivakuutusyhtiöiden edustajat uusista polttoaineteknologioista ja osoittavat suurempaa halua lisätä ymmärrystään. Lisäksi 80 % vastaajista suhtautuu optimistisesti siirtymään kestäviin polttoaineisiin ja näkee uusien polttoaineteknologioiden käyttöönoton positiivisena.
Analyysi tunnistaa sääntelyesteet merkittäväksi haasteeksi, vaikka näkemykset vaihtelevat sektoreittain. Vakuutusalan ammattilaiset suhtautuvat yleisesti ottaen vähemmän negatiivisesti sääntelykehyksiin kuin laivanvarustajat. Tutkimus kuitenkin korostaa, että riittävä yhteistyö ja vahvat sääntelykehykset ovat ratkaisevia tekijöitä kestävien polttoaineiden käyttöönoton tukemiseksi ja parantamiseksi.

Tämä opinnäytetyö lisää ymmärrystä niistä haasteista ja mahdollisuuksista, joita merivakuutusala kohtaa hiilestä irtautumisen aikakaudella. Se tarjoaa näkemyksiä sektorin tietämyksen vahvistamiseksi, yhteistyön edistämiseksi ja sääntelyjen mukauttamiseksi uusien riskien ja mahdollisuuksien tehokkaaseen hallintaan.

Kieli: Englanti
Avainsanat: Merenkulku, vakuutus, ympäristöystävällinen, polttoaine, asenteet, tunteet.

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1 Introduction

The shipping industry cherishes old traditions and is proud of its heritage. This embracing of traditions takes is evidenced in many aspects of the maritime life, from rituals and ceremonies during construction to everyday life on board the ships. For instance, shipbuilders still place a lucky coin under the keel during the start of construction, and old sailors do not whistle onboard, to avoid bad winds.

Deep respect for traditions is prevalent in every corner of the marine world, including maritime laws and modern insurance coverages. The Rhodian Sea Law originates from Greece around 900-800BC and is one of the earliest known writings of maritime law. It regulates cargo, salvage and responsibilities for ship owners. The principle of "general average" has roots in this law and regulates that losses are shared amongst all stakeholders involved in a maritime journey. This concept is still today a vital key concept in modern maritime law.

For thousands of years, ships were powered by the wind or by hand. During the 1800s, the industrial revolution introduced coal-powered steam as a means of propulsion, and this was changed to mainly diesel engines during the 1900s. The last 25 years present new challenges when new environmentally friendly technology is required to phase out the century-old fossil fuel technologies within the short future.

This thesis will research how new technology impacts the daily life of a marine insurance company and how new technologies affect the daily work of its employees. It further considers whether the employees feel that their knowledge levels are adequate for their work. This research will create a comparison between insurers and ship-owners, the latter which often find themselves at the front of the technological development due to being the ones purchasing and using the technology onboard their vessels.

This study has been made using a survey that has been sent out directly to shipping companies, marine insurance companies, maritime regulatory bodies and marine surveyors. In this study, we will see trends and differences between these sectors and continue with deeper analysis into demographical differences and trends.

The thesis business mentor is *Alandia Försäkring Abp*, a marine insurance company headquarters in Mariehamn, Finland, with offices in Helsinki and Stockholm. Alandia Försäkring Abp employs 130 marine insurance professionals and is a member of the Nordic Association of Marine Insurers (CEFOR).

2 Research questions and hypotheses

This is a study into attitudes and opinions on how new and emerging fuel technologies affect the everyday work of a marine insurer. The business mentor for this research is Alandia Försäkrings Abp, a marine insurer based in the Åland Islands in Finland.

This study set out to obtain a broader and deeper understanding about the attitudes and feelings towards new fuel technologies, and the knowledge surrounding them. There is plenty of research and documentation to be found regarding the new technologies, created by different sectors in the marine industry, and therefore we sought to find out how average employees, especially in the marine insurance sector, view this new technology. This study seeks to find out if the attitudes and feelings will be similar between each marine sector or vary extensively as well as to study some sectors find themselves completely comfortable whilst others struggle.

2.1.1 Hypotheses

The hypothesis has been developed together with their management and our mentor from Novia University of Applied Sciences.

We have split the hypothesis into categories, based themes. The hypothesis follows a numbered system to be referenced throughout the thesis.

The first category addresses perceived differences in knowledge and attitudes:

1. There is a knowledge difference between insurers and ship owners.
2. Technicians will be more negative in their willingness to adopt new and emerging technologies.
3. Employees with legal backgrounds will express fewer negative opinions towards new regulations and directives than professionals with other backgrounds.
4. Shipping companies will feel that they are more knowledgeable about technologies than insurers.
5. Shipping companies do not think that insurers have a comparable knowledge level compared to themselves.

The second category studies how the difference in knowledge, attitudes and opinions affect the business relationship between ship owners and insurers:

6. Shipping companies will choose an insurer with higher technical knowledge if given the option.

7. Shipping companies are not willing to pay higher premiums for an insurer with higher technical knowledge.

The final category studies feelings of the respondents by allowing self-evaluation of their knowledge and confidence levels:

8. Early-career and junior professionals are more interested in new technologies than senior and veteran professionals.

9. Employees in insurance might feel that they are not knowledgeable enough compared to shipping companies.

10. Feeling of preparedness between sectors regarding the impact of new fuel technologies in operation.

3 Previous research

The researchers have investigated if there has been similar research on how emerging fuels affect a marine insurer. However, no research has been found on this topic.

In the following subsection, the researchers will present a few studies in which we have found some similarities in the same field, but there is no study that can be directly referenced to be similar that the researchers have found.

3.1.1 Decarbonization of Shipping University of Piraeus

Decarbonization of Shipping, University of Piraeus

The master thesis focused on the reducing of greenhouse gases emissions in the maritime industry. It was discussing the importance of shipping trade and the regulations the International Maritime Organization (IMO) has set to achieve by 2050. It also investigated different technical solutions to reach the IMO goals. The thesis also discussed challenges in the way of excessive costs infrastructure gap and regulatory compliance. The thesis adopted a more technical approach tailored for ship owners, while lacking detailed content related to insurers or their perceived methodologies. (Sotirakos, 2023)

3.1.2 The role of insurance in shipping from World Maritime University

The role of insurance in ship and oil gas finance structured deals such as project finance and project bond from the World Maritime University

The master thesis explored laws, specifically international maritime law, that discuss the critical role of insurance in structured financial deals for ship and oil gas projects with project finance and project bonds. The study explored the interconnected roles of banks, shipowners and insurers in risk management and financial security. The emphasis was placed on how insurance reduce the risk associated with new buildings, operation, and third-party liabilities. Furthermore, the thesis analysed the impact of UK Insurance Act 2015 and the applicability of marine and energy insurance policies. (Souza, 2018)

3.1.3 Alternative fuels in Shipping from Copenhagen Business School

Alternative fuels in Shipping, a case study on Methanol and LNG from Copenhagen Business School

The thesis focused on the shipping industry and the way of transition to net-zero emissions and explained the lack of unified evaluation framework which complicates the fuel selection for ship owners. The thesis analysed the fuel chosen of some bigger companies like Maersk and CMA CGN and the analysis indicated LNG and renewable methanol as path to distinct the trade of emissions, stability, and implementation challengers. The study concluded with the need for cooperation and further research and potential impact for blending fuels to accelerate the transition. (Aagenæs & Oliegreen, 2022)

4 Research Methodology

This chapter will explore the research methodology and the planning of the study.

4.1 Aim and Objectives

The aim of the study is to conduct a survey with invited participants from the marine cluster. The survey should be conducted with participation being anonymous with the aim that no individual or individual company can be determined through the collected data.

As the subject of knowledge and knowledge level is both individual and can be sensitive in certain environments, the survey questions need to be thoroughly examined and reviewed before the survey is distributed. The survey will need to be tested on test participants and feedback provided on the quality and understanding of the questions. This will be done with the assistance of the project sponsor, Alandia Försäkring Abp. The quality gate will be guarded by both project sponsor lead and Novia University of Applied Sciences, to ensure quality, transparency and other key elements. Once the desired quality has been reached, the survey will be allowed to move forward with and distributed.

4.1.1 Sampling strategy

As this research will focus on a specific topic in an already specialized industry, the research survey methods need to be carefully chosen. Using the general population in the survey would have the disadvantage of introducing a lot of data and answers from participants that have never experienced the marine industry and have no knowledge on the basics in the industry. The participants need to be selected from a specific group

within the general population to minimize bad or non-relevant data. This selection requirement provides us with the following criteria:

A. *Working in the marine industry*
B. *Encountering new technology or marine insurances in everyday work.*

Criterion A will prevent the sampling from being *probability sampling* as we are limiting the population, and we need to look at *non-probability sampling* methods.

Next step is to establish a more detailed method of sampling. It was decided that to use the following non-probability methods for this study.

1. Convenience sampling
2. Purposive (Judgmental) sampling
3. Quota sampling
4. Snowball sampling
5. Volunteer sampling

Quota sampling requires the population to be divided into sub-groups and to be selected to meet a preset quotas for each group. As Criteria A states that it is not the general population the research is studying, this method is excluded. This will also exclude *volunteer sampling* as this would exclude the researcher's possibility for a detailed study.

The methods remaining are convenience, purposive and snowball sampling methods. Criteria B (selective and in a specific setting) will require specific selection process to be selected from the remaining methods. (Badia, January 1, 2004)

As we can see in Table 1, there are benefits and disadvantages to every method, and not any method seems to be a perfect fit. The optimal would be to combine all three methods and gain all benefits whilst the disadvantages would cancel each other out. We can identify three main disadvantages, one for each method. Further we need to find solutions to limit or remove the disadvantages.

Methods	Benefits	Disadvantage
Convenience	Easy, quick, low cost, good for early research	High bias, poor generalizability, overrepresents certain groups

Purposive	Target specific, relevant participants, good for specialized topics	Subjective selection, non-representative, may miss key perspectives
Snowball	Effective for hard-to-reach groups, cost efficient, expands through networks	Homogeneity risk, selection bias, limited control over the sampling process.

Table 1. Set of methods

In Research Design Qualitative, Quantitative, and Mixed Methods (John W. Creswell, 2018) the author suggests methods on how to minimize the risks identified in Table 1. Table 2 presents these methods adjusted for the specific research purpose in this study.

Method	Disadvantage	General strategies	Specific for this research
Convenience	High Bias	Diversify the convenience group Initial research	Use the convenience method only in the beginning and for the test survey.
Purposive	Subjectivity	Clearly defined criteria Peer review of selection process	Diversify the selected participants (large, medium, small companies) and review their stages of technology adaptation
Snowball	Homogeneity	Initial diversity Multiple referral chains Limited referrals	Ask the main participant from a company to refer a limited number of colleagues.

Table 2. Secondary set of methods

4.2 Background information

4.2.1 Age range

The categories of age groups are based on the commonly referred generational age groups. (McCrindle & Wolfinger, 2010) Maritime business is a business with long and old traditions and is not a business that a particular age group are flocking to, and therefore the full working age ranges can be utilized.

Age	Birth year	Generation nickname
60 – 78	1946-1964	Baby Boomers
44 – 59	1965-1980	Generation X, MTV Generation
28 – 43	1981-1996	Generation Y, Millennials
18 – 27	1997-2012	Generation Z, Zoomers

4.2.2 Education

The educational level is used to determine differences in opinions and assessments based on the participant's educational level. The levels are based on the European Education Area´s standardization of education levels (European Commission, Directorate-General for Education, Youth, Sport and Culture, 2024) and provide the following categories of education:

- High School diploma
- Vocational school
- Bachelor's degree
- Master's degree
- Doctoral degree

4.2.3 Occupation

This identifier is created to find differences between participants working in different fields of occupation. The fields of occupation are based on categories from the European Skills, Competences, Qualifications and Occupations (ESCO) classification. ESCO works as a dictionary, describing and identifying professions and occupations by the European Commission: (Directorate-General for Employment, 2024). The categories for this survey are as follows:

- Engineering & Technical
- Legal & Regulatory
- Finance
- Management & Administration
- Maritime Operations (including seafaring and logistics)

4.2.4 Work experience

The work experience intervals correspond with the stages of career development that Greenhaus and Callahan (Greenhaus & Callahan, 2006) argue to be stages in a normal career development in their book *Encyclopaedia of career development*. According to Greenhaus and Callahan, defined work experience intervals are essential in determining how much experience affects a person's opinions and thoughts. In their work they identify the following stages in the development of a person's career:

Early career professionals	Who may be more open to new technology but have limited experience with industry changes	0-5 years of experience
Mid-level professionals	Who are gaining expertise and may have a balanced view of traditional practices versus new trends	6-10 years of experience
Experienced professionals	Likely holding senior positions with a decision power and deeper understanding of industry shifts	11-20 years of experience
Very experienced professionals	Who may have seen significant technological and regulatory changes in their careers	20-30 years of experience
Veteran professionals	Whose perspectives might lean towards traditional practices, though some may also have adapted to significant changes.	30+ years of experience

4.2.5 Geographical identifiers

This research study is focused on the Nordic countries, and these are the limitations that have been selected. As the maritime industry is an international business, we have decided to include an option for a free text option. This is due to the possibility of working for a subsidiary of a Nordic company, but with the physical work location being outside of the Nordic region.

4.2.6 Company size

Company size is used to determine if there are differences in education levels or opinion between sizes of companies. Larger enterprises might have more spending power than small businesses. The categories are based on size categories by LinkedIn Business Marketing Strategies (Kimura & Kearns, 2024)

Small business	1 – 50 Employees
Medium Business	50 – 200 Employees
Enterprise	201 – 500 Employees
Large enterprise	500+ Employees

4.2.7 Sector determinator

One of the main identifiers is the maritime sector selection. This identifier allows us to distinguish participants per sector and find trends between sectors, inter and global trends.

Shipping company	“Ship Owner”, direct to Shipping questions
Insurance Company	“Insurer”, direct to insurance questions
Regulatory authority /Marine Surveying	“Authority”, direct to regulatory and surveying questions

The reason why this identifier is placed last on the general identifier page of the survey is due to technical limitations in the survey software that requires a determining question and answer be placed just before the action to be performed. In this case to direct the participants to their sector’s specific questions.

4.2.8 Emerging Fuels

This chapter will briefly go through the different emerging fuels or transition fuels that are needed to decarbonize the maritime industry to zero-emissions. This is required to fulfil the current IMO goals to decarbonize shipping by 2050.

There is different way to achieve zero-emissions as can be seen in Figure 1. Most of these new fuels can be inserted into categories:

1. Electro fuels

- Hydrogen,
- Ammonia
- Fuel cells
- Batteries
- Green methanol

2. Biofuels
    - Biogas
    - Biodiesel
3. Blue Fossil fuels
    - Can use fossil fuels like gasoil or liquified natural gas (LNG)
    - Use Carbon Capture (CC) and Carbon Capture & Storage (CCS) to achieve zero-emission by offsetting emissions.

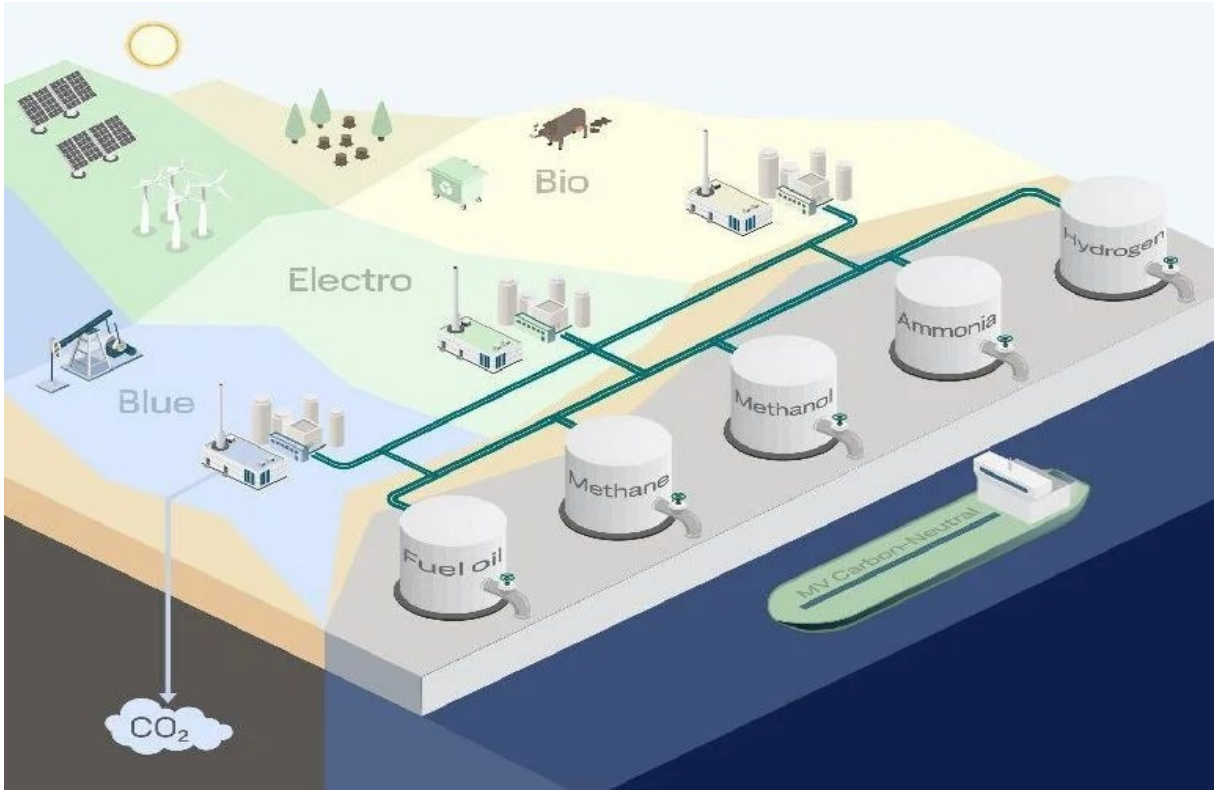

Figure 1 Different sources of fuel for zero-emission. (DNV, 2025)

4.2.8.1 Hydrogen

Hydrogen is the building block for production of new environmentally friendly fuels. It is produced from an electrolysis process. Hydrogen is CO2 neutral if the electrolysis is done using renewable energy. (DNV, 2025)

4.2.8.2 Ammonia

Ammonia is a renewable fuel and is also like hydrogen produced through an electrolysis process. If the ammonia has been produced from renewable hydrogen it will then be called green ammonia. Ammonia can also be produced from Fossil fuel, and it is then not a renewable energy source and is then called blue ammonia. Ammonia contains a high amount if nitrous oxide and toxic which in that part not good for the environment. (DNV, 2025)

4.2.8.3 Fuel cells

Fuel cell can be used as a renewable method for propulsion of ships if hydrogen is used as primary resource. Fuel cell uses electrochemical oxidation to produce electricity and heat. Fuel cells has no vibration like a usual combustion engine. (DNV, 2025)

4.2.8.4 Battery

A Fully electric or a hybrid ship operates vessel without combustion engines. The batteries store renewable energy in battery pack on the ship. So, the ship can use the energy for propulsion. With batteries vessels can achieve zero emissions for shorter distances. Long distance is not suitable due to batteries heavy weight. (Wärtsilä Ltd, 2025)

4.2.8.5 Methanol

Methanol can be produced many ways. Like from fossil fuel, hydrogen and biomass. To achieve zero-emission ethanol will need to be made of biomass and green hydrogen.

The biomass and the hydrogen are used to make a synthetic gas. Which transforms to methanol with a catalyst coated with copper and zinc oxides. (Department of chemistry, University of York, 2025)

4.2.8.6 Biogas

Biogas is produced from animal and food waste. The gas is developing when the organic material is broken with help of microorganisms in a non-oxygen environment. Biogases consist in some way also methane and carbon dioxide and hydrogen sulphide. But it depends mostly on which organic material has been used to produce the biogas. (NationalGrid, 2025)

4.2.8.7 Carbon capture and carbon capture storage.

A carbon capture captures the CO2 before it enters the atmosphere, which has been generated from burning fossil fuels. After the CO2 has been captured, it is transferred to a tank where it will remain until it is possible to transfer it to a storage facility. From this

facility, it is pumped back to an old underground oil and gas well. (Massachusetts Institute of Technology, 2025)

4.2.8.8 Fossil fuels

Fossil fuels like Heavy Fuel Oil, Light fuel Oil, Disel and (LNG) Liquefied Natural Gas are so-called non-renewable energy resources. Gas and oil have been produced by old remains animals and plants million years ago underground by high temperature and pressure. Fossil fuels are the dominant energy source today. When fossil fuels are burned, it will produce a high amount of CO2. (U.S. Department of Energy (DOE), 2025)

5 Survey

This chapter will discuss the survey in more details.

5.1 General

During the creation of the research plan, the researchers considered three possible ways of collecting data: interviews, survey or case studies.

The researchers find that this topic requires enough data and participants to get a statistically viable dataset. Interviews can give deeper insights but requires lot of time to complete and to analyse. The benefit of a survey is that is quickly brings a set of measurable data that can be cross-referenced to any other data in the dataset.

A survey is quicker to distribute and gathering data from, this can also assist to create a larger number of responses, and this increases the correctness of the data. Especially with hypothesis that are analysis opinions and personal preferences, it is important with more data to not accidentally skew the data from a small number of selected interviewees.

We believe some of the subjects to be of somewhat sensitive nature, with opinions about oneself and their employers. Fully nuanced answers might be difficult to achieve in interviews or where the participants are known or can be identified. Therefore, it became very important that the answers could be delivered anonymously.

The researchers considered to use existing case studies as an input for data collection, but specific case studies into these topics could not be found. It´s possible that this topic has not been specifically examined in this way before, and that specific case studies do not exist. It could be that some case studies exist were some of trends could be correlated to, but these can be internal documents or redacted from public views, and this would render it close to impossible to achieve these in quantities that are required to do a throughout analysis. The option of using case studies was cancelled due to not being feasible.

5.2 Survey questions

The researchers decided early that the most efficient way to reach out to participants would be to host the survey online. Originally, Microsoft MS Forms program was

considered but found to be too simple and not providing enough tools to comprehend the survey size and complexity that was wanted. After reviewing multiple online options, the researchers found that the online platform SurveyMonkey ™ would be the best suitable tool when considering availability, customizability and pricing.

The development of survey questions was done based on the hypothesis as a baseline. Later, more questions were added that are not directly related to the original hypothesis but came up as comments or points of interest during discussion with the business mentor.

Table 3 shows the flowchart and order on how the survey was developed to function. From this table we can see that Chapters 3, 4 and 5 contain sector-specifical questions, and the survey contains a built-in logic module in Chapter 2 that separates this into separate workflows.

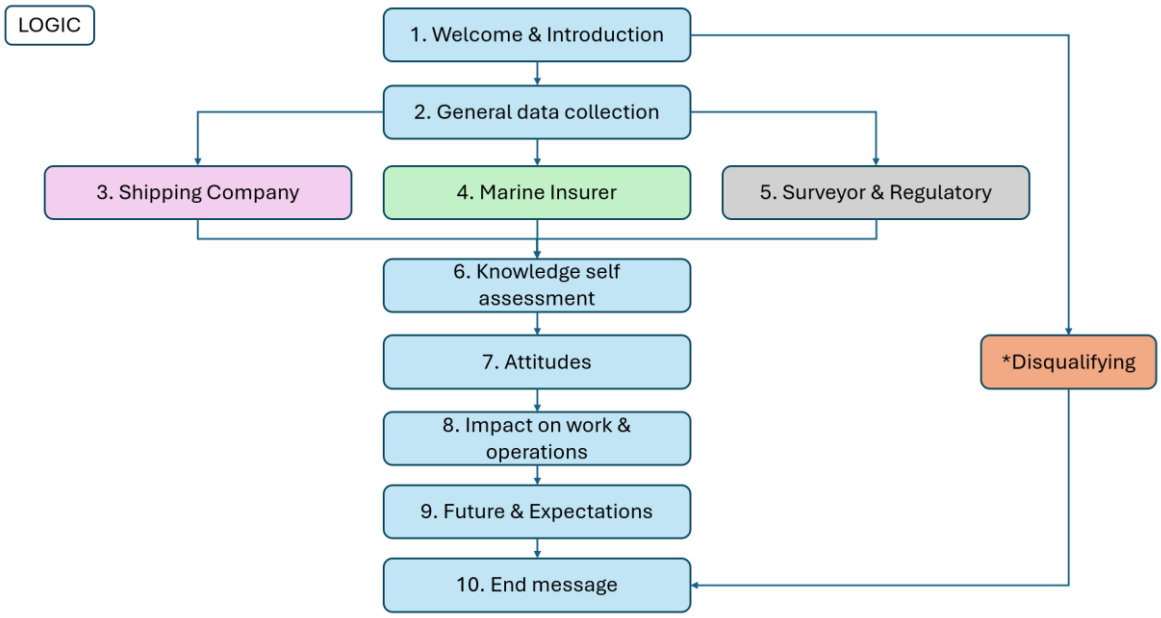

Table 3. Flowchart of survey chapters

In total we used ten different survey chapters, with a total of forty-five questions over all pages. The maximum number of questions for a single participant was thirty-seven questions, and this would be the marine insurers route, as shown in Table 3.

The demographic question alternatives have been discussed in the previous chapter and will not be repeated here. Most questions are following a 5-point Likert-scale (SurveyMonkey, 2025), with the options ranging from Strong Agreement to Strong disagreement. The scale includes a neutral option.

Six questions were multiple-choice questions, and these questions were specifically about technical knowledge, sources of information, risks, and challenges.

Below we will briefly go through each survey chapter, containing questions and intended purpose.

5.3 Survey chapters

This chapter will briefly go through the specific survey chapters and their content.

5.3.1 Welcome to the survey

This page included a welcome message to the participants, which explained the purpose of our research and the survey. Under the confidentiality section we reinstated the anonymous nature of the survey, and that it fulfils the requirements of GDPR for surveys. (Mapita Oy, 2022).

One of the requirements of GDPR includes a question if the participant accept to be a part of the survey. A negative answer would disqualify the participant from continue the survey and just display the final page of the survey.

5.3.2 General information

This section included all questions to collect demographical data of the participants. Researchers wanted to get enough usable identifiers to be finding different trends based on for example age or field of expertise. In this section we included questions to identify:

- Age
- Highest level of education
- Field of expertise

- Working experience
- Country of occupation
- Company size
- Marine sector

No further identifying questions were asked from the participants.

5.3.3 Shipping company

In this section we asked specific questions directed to participants who selected the "Shipping company" as their marine sector identifier. The purpose of these questions is to find out specific issues or concerns that arise from the shipping companies.

- Types of vessels are operated (multiple choice)
- Perceived lack of support from regulatory bodies
- Perceived difference in knowledge between ship owners and marine insurers.
- Importance of technical knowledge in marine insurance
- Preferential for a more knowledgeable insurers at the cost of higher costs.

5.3.4 Marine insurer

In this section we asked specific questions directed to participants who selected the "Marine insurance" as their marine sector identifier. The questions were developed to get insights into risks and concerns:

- Confidence changes due to new technologies
- Changes in risk assessment difficulties due to new technologies.
- Concern of insurability
- Key risks for insurers (multiple choice and free text option)
- Suitability of the Nordic Marine Insurance Plan (NMIP)

- Biggest challenges for new fuel transition. ((multiple choice and free text option)

5.3.5 Surveyors and regulators

In this section we asked specific questions directed to participants who selected the "Regulatory authority" or "Marine Surveying" as their marine sector identifier. The following items are addressed in the survey´s questions:

- Adequacy of current regulations
- Sufficiency of current collaborations between their sectors and others
- Perceived sector with highest challenges due to new fuel technologies

5.3.6 Knowledge of emerging fuel technologies

With this chapter we are asking participants to self-assess their knowledge levels and wishes. This is done to see if there are differences in assumed knowledge between different demographics and sectors. Cooperation between sectors is also asked to find out if there are any correlations with active collaboration and higher knowledge and comfortable. The following items are addressed in the survey´s questions:

- Self-assessment of knowledge level
- Wish to learn more about new fuel technologies
- Their knowledge levels compared to other sectors
- Perceived knowledge gaps between sectors
- Self-assessment of knowledge for specific technologies. (Multiple choice and free text)
- Primary source of new knowledge
- Collaboration with other sectors
- Self-preparedness for the transition

5.3.7 Opinions towards new fuel technologies

This chapter is created to identify trends in opinions and attitudes and how they differ between sectors and demographical groups. This includes also the perceived willingness for the participants organisation. The following items are addressed in the survey´s questions:

- Favour for transition towards new fuels
- Perception of regulatory barriers
- Younger generations willingness and openness.
- Own organisations openness for transition.

5.3.8 Operational and day-to-day work

This chapter contained questions into daily work and operations, as well as some questions specifically linked to confidence in marine insurances as well as training and learning. Items addressed in the survey questions for this section included:

- Effect of decision making due to new fuels
- Effect on risk management due to new fuels.
- Confidence in insurance coverage
- Concerns in relation to the transition (Multiple choice and free text)
- Frequency of training opportunities
- Willingness to learn

5.3.9 Future expectations

With this chapter we wanted to find out if companies and employees feel comfortable with the future and the coming and on-going transition. Following questions were included:

- Concerns for company readiness
- Willingness to invest more

- Cost concerns for the future
- Which technology will be the future (Multiple choice and free text)
- Optimism towards the future.

5.3.10 End of Survey

This was the last page of the survey. Here the researchers included a message thanking for participation and gave the participants the opportunity to include themselves in a mailing list to receive a copy of the final thesis. Seven participants opted to add themselves onto the mailing list.

5.4 Testing of survey and releases

Figure 2 shows the flowchart of the planned development of the survey. This includes input from external sources shown in grey boxes, while the workflow is shown in white. The circles are representing gates, which each one presenting a criterion to be filled or compared to before continuing the path.

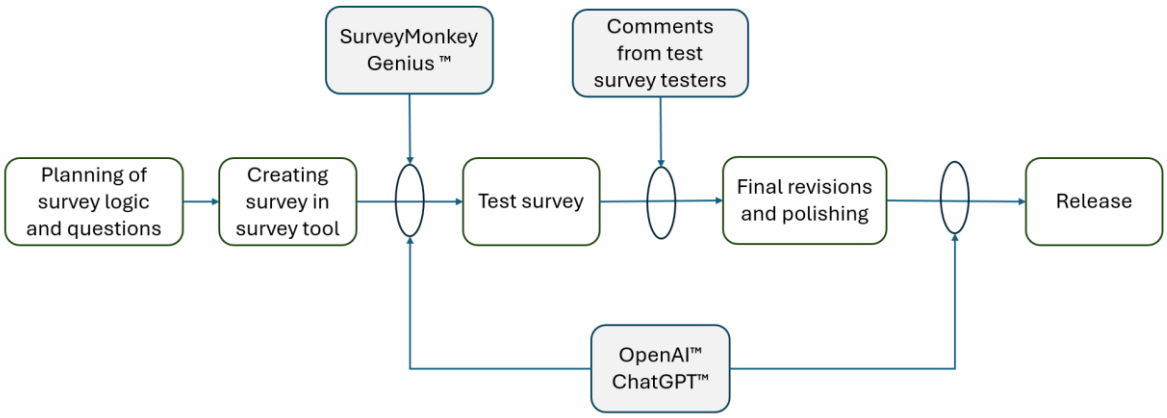

Figure 2 Release progress

5.4.1 Feedback from artificial intelligence

We decided to incorporate modern AI tools available on the internet for the first reviews of the survey.

SurveyMonkey Genius

AI tool provided by the survey engine provider. This AI tool is embedded in the survey creation space and gives instant feedback. It mainly consists of checking for language and grammatical errors or logical errors in the survey itself. This tool was used concurrently during the development of the survey. (SurveyMonkey, 2024)

OpenAI's ChatGPT

A large language model provided by OpenAI. After the survey had passed the SurveyMonkey Genius checking with zero remarks, the whole survey was then exported as a pdf to ChatGPT tool. The researchers prompted the tools to create a scale of readiness and completion of the survey. The language model was to focus on language use, understandability of questions and answers, and overall readiness in comparison. (OpenAI, 2024). The survey analysis returned with an overall score of *excellent*, with a score of 98% readiness score. This version was the final release.

5.4.2 Feedback from business mentors

The survey was sent for review to select participants at *Alandia Försäkrings Abp*. The reviewers selected to assist with the test survey hold senior positions in the company, such as directors, head of departments or vice-presidential positions. Due to safety and data protection regulations, the names or positions will not be disclosed in this document.

The version sent to the reviewers was the version before final AI-checking.

The review comments from the business mentors found:

- Minor spelling comments
- Two similar questions and the suggestion to merge the two and re-word it to avoid confusion between the two questions
- Split one question into two as the question included two different statements
- One question having inconsistent answering alternatives with the expected answer options
- Add "none of the above" option for two multiple choice questions

5.4.3 Releases of survey

In Table 4, we have presented the development of our survey, and its different versions (releases) before reaching the final version. In the “review score” field we are presenting the score of readiness that we have received from various tools. The tools used are SurveyMonkey™ Genius (SMG), that is provided from the survey tool provider and is used to quickly support the surveyors with a score for readiness and clarity. The other computer tool used have been OpenAI’s™ ChatGPT™, that have been used as a final review after each version has been deemed ready to check by the researchers. This score has then been used to develop and finetune questions, answering options and assisted with language to be concise and clear.

Version	Reviewer/tool	Review score
Draft Versions (non-revisional)	Researchers	N/A
Survey V1	Novia Supervisor	N/A
Survey V2	SurveyMonkey Genius (SMG)	95% SMG
Survey V3	SurveyMonkey Genius OpenAI ChatGPT	100% SMG 70-75%
Survey V4	OpenAI ChatGPT	80-85%
Survey V5	Business mentors feedback	N/A
Survey V6 (released version)	OpenAI ChatGPT	98%

Table 4 Survey release history

5.5 Sampling and distribution

The purpose of the distribution was to obtain a spread, as large as possible, in the marine sector, for example company size and sectors. Target audience for the survey were individuals that hold account managing positions, management, or supervisory position in companies, which deals with decision making within their organization. The positions included superintendents, operational managers, insurance directors, claims executives

and handlers, technical directors, etcetera. With this selection of possible participants, we targeted individuals who are involved in management, risk assessment, preparing and taking decisions regarding investments and insurances. Even if insurances are not their main work focus, these groups and positions will make these individuals encounter insurances or insurers during their work.

The shipping companies that were offered possibilities to be part of the survey were found through trade associations, and their list of members. For example, the list of Finnish shipping companies was obtained from Finnish Shipowners association (Finnish Shipowners' Association, 2024). Similarly, the insurance companies were found through the Nordic association of marine insurers (Cefor - The Nordic Association of Marine Insurers, 2024). Surveyors were picked of the public correspondents list of associates from Alandia Försäkrings Abp website (Alandia Försäkring Abp, 2024) and is a common practice amongst insurers to publish similar lists for their customers. For regulatory bodies, we selected the national traffic regulators as well picked selection from the Nordic association of marine insurers. (Cefor, 2024)

Distribution of the online survey was done through email to all the possible participants. The first group of emails and the online link were sent on 11th of November 2024 to twenty-five recipients. The second batch of emails were sent out on 20th of November 2024 to fifty nice recipients. Total amount of recipients was eighty-four individual recipients. On 25th of November, we distributed a kind reminder to participating in our survey to the participants.

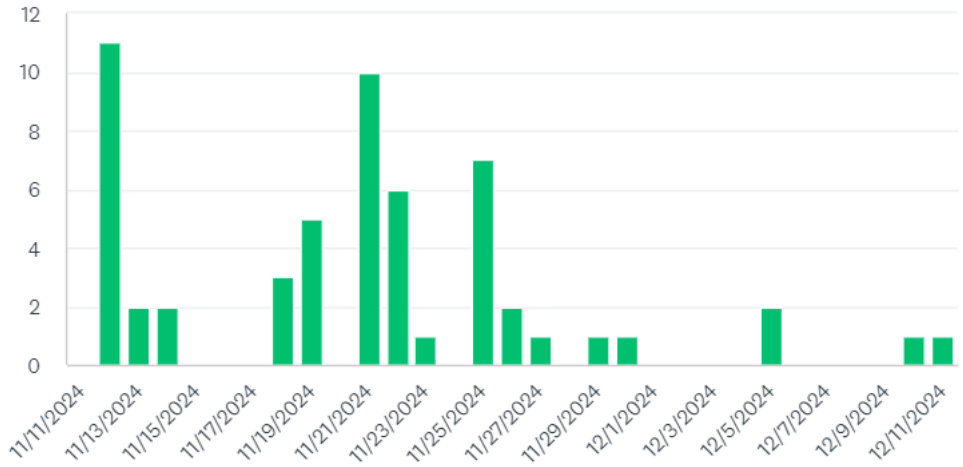

Figure 3 Responses per day 11th of November 2024 until 11th of December 2024

As shown in Figure 3, we had three peaks in responses to the survey, one after each batch of emails and the reminder. There was also a slow influx of some answers in December, and the survey was kept open for participation until 20th of December 2024.

In total, we received 56 responses to the survey out of 84 email requests. This gives a participation percentage of 67%. It must be noted that we asked participants to forward the survey and link within their organisation to increase the participation. This is not considered in the participation percentage calculation, as the anonymous nature of the survey renders is severely difficult to examine forwarded survey links. The typical time spent to complete the survey was 8 minutes and 7 seconds per participant.

5.6 Testing of hypothesis and analyse tactics.

The following chapter explains the tactics of creating an analysis table for the hypothesis presented in an earlier chapter. The purpose is to aid in the analysis by providing a table tool to follow, as well as assist in the final stages of the survey development. Questions will be referenced to as QXX, where Q stands for “Question” and XX is the numbering used in the survey. (Please see list appendices)

Identifier: Background information that can identify a group of participants that the hypothesis is testing against.

Primary analysis: will be the questions that are directly and primarily in focus to test the hypothesis.

Secondary Analysis: Will be questions that partially can be included in the hypothesis testing or can provide a broader spectrum of the analysis.

5.6.1 Hypothesis 1

Hypothesis that there is a knowledge difference between insurers and ship owners. The applicable questions for this hypothesis are presented in Table 5.

Question in Survey	Analyse
Q4 Field of expertise	Secondary selector
Q8 Professional sector identifier	Main identifier

Q10 Lack of support from regulatory and insurance companies (Ship Owner specific question)	Secondary analysis. The feeling of adequate support can correlate with the feeling of other parties having less interest or knowledge (Q11)
Q11, Noticeable difference between ship owners and insurers (Ship Owner specific question)	Primary analysis ship owners' opinions on their relationship with insurers.
Q14 Confidence after introduction of new fuel technologies (Insurer specific question).	Secondary analysis Analyse for trends in confidence compared to ship owners
Q23 Self-assessment, good understanding about new technology	Secondary analysis. Filtering and comparing answers based on marine sectors (Q8)
Q24 Feeling of inadequate knowledge	Secondary analysis. Filtering and comparing answers based on marine sectors (Q8) combined with knowledge assessment (Q28)
Q29 Collaboration with other sectors	Secondary analysis

Table 5 Analysis questions for Hypothesis 1

5.6.2 Hypothesis 2

Hypothesis that technicians will be more negative in their willingness to adopt new and emerging technologies. The applicable questions for this hypothesis are presented in Table 6.

Question in Survey	**Analyse**
Q4 Primary occupation/Field of expertise	Main identifier
Q30, self-preparedness	Secondary analysis Comparing self-assessed preparedness between different demographics.
Q31, favour in adopting technologies	Primary Analysis

	Comparing favourability towards adoptions between different demographics.

Table 6 Analysis questions for Hypothesis 2

5.6.3 Hypothesis 3

Hypothesis that employees with legal backgrounds will be showing fewer negative opinions towards new regulations and directives than professionals with other backgrounds**.** The applicable questions for this hypothesis are presented in Table 7.

Question in Survey	**Analyse**
Q4 Primary occupation/Field of expertise	Main identifier
Q8 Professional sector identifier	Main identifier
Q10 Lack of support from regulatory and insurance companies (Ship Owner specific question)	Secondary analysis. The feeling of adequate support can correlate with the feeling of other parties having less interest or knowledge (Q11)
Q20 Adequacy of current regulations	Primary Analysis Checking against if current regulations feel adequate
Q21 Sufficient collaboration between regulatory and the industry	Secondary Analysis Testing if collaboration is more common in participants with legal background
Q22 Most challenged sector	Secondary analysis
Q23 Self-assessment of knowledge of new technologies	Secondary analysis.
Q32 Regulatory barriers	Primary Analysis Directly testing the opinion if regulatory obstacles pose a major obstacle

Table 7 Analysis questions for Hypothesis 3

5.6.4 Hypothesis 4

Hypothesis that shipping companies will feel that they are more knowledgeable about technologies than insurers. The applicable questions for this hypothesis are presented in Table 8.

Question in Survey	Analyse
Q8 Professional sector identifier	Main identifier
Q25 Sector knowledge compared to others	Primary Analysis Checking the attitude towards other sectors
Q29 Collaborations with other sectors	Secondary analysis

Table 8 Analysis questions for Hypothesis 4

5.6.5 Hypothesis 5

Hypothesis that shipping companies do not think that insurers have a comparable knowledge level compared to themselves. The applicable questions for this hypothesis are presented in Table 9.

Question in Survey	Analyse
Q8 Professional sector identifier	Main identifier
Q11, Noticeable difference between ship owners and insurers (Ship Owner specific question)	Primary analysis ship owners' opinions on their relationship with insurers.
Q23 Self-assessment, good understanding about new technology	Secondary analysis. Filtering and comparing answers based on marine sectors (Q8)
Q24 Feeling of inadequate knowledge	Secondary analysis. Filtering and comparing answers based on marine sectors (Q8) combined with knowledge assessment (Q28)
Q29 Collaboration with other sectors	Secondary analysis

Table 9 Analysis questions for Hypothesis 5

5.6.6 Hypothesis 6 & Hypothesis 7

Hypothesis that shipping companies will choose an insurer with higher technical knowledge if given the option and that shipping companies are not willing to pay higher premiums for an insurer with higher technical knowledge. The applicable questions for this hypothesis are presented in Table 10.

Question in Survey	Analyse
Q2 Age of participant	Identifier
Q3 Level of education	Identifier
Q4 Field of expertise	Identifier
Q5 Working experience	Identifier
Q6 Country of occupation	Identifier
Q7 Company size	Identifier
Q12 Importance for technical expertise from insurance companies.	Primary analysis
Q13 Willingness to choose an insurer based on expertise and cost	Primary Analysis

Table 10 Analysis questions for Hypothesis 6 & 7

5.6.7 Hypothesis 8

Hypothesis that early-career and junior professionals are more interested in new technologies than senior and veteran professionals. The applicable questions for this hypothesis are presented in Table 11.

Question in Survey	Analyse
Q2 Age of participant	Identifier
Q3 Level of education	Identifier
Q4 Field of expertise	Identifier

Q5 Working experience	Identifier
Q6 Country of occupation	Identifier
Q8 Marine sector	Identifier
Q23 Self-assessment, good understanding about new technology	Secondary analysis.
Q24 Feeling of inadequate knowledge	Secondary analysis.
Q31 Opinion in favour of adopting	Secondary analysis
Q33 Generational attitudes	Primary analysis
Q39 Training opportunities	Secondary analysis
Q41 Concern for company adaptation	Secondary analysis
Q45 The show of optimism towards new technologies	Primary analysis

Table 11 Analysis questions for Hypothesis 8

5.6.8 Hypothesis 9

Hypothesis that employees in insurance might feel that they are not knowledgeable enough compared to shipping companies. The applicable questions for this hypothesis are presented in Table 12.

Question in Survey	**Analyse**
Q2 Age/Generational identifier	Main identifier
Q4 Field of expertise	Main identifier
Q8 Professional sector identifier	Main identifier
Q23 Self-assessment of knowledge of new technologies	Primary analysis.
Q24 Desire to know more about new fuel technologies.	Primary Analysis
Q29 Collaboration with other sectors	Secondary analysis
Q39 Training opportunities	Secondary analysis

Q40 Desire to know more about new technologies	Secondary analysis
Q45 The show of optimism towards new technologies	Primary analysis

Table 12 Analysis questions for Hypothesis 9

5.6.9 Hypothesis 10

Hypothesis that how prepared do sectors feel regarding the impact of new fuel technologies on operations. The applicable questions for this hypothesis are presented in Table 13.

Question in Survey	**Analyse**
Q8 Professional sector identifier	Main identifier
Q30 Impact on decision-making processes	Primary analysis
Q41 Concern for company adaptation	Secondary analysis

Table 13 Analysis questions for Hypothesis 10

6 Data

The survey was sent out to selected participants on 17th November 2024. A second round was sent out 25th of November 2024.

The survey was closed 22nd of December 2024 and at the time it had collected 56 individual responses. The completion rate of the survey was 79%, with 44 out of 56 respondents completing the full survey. Twelve participants partially completed the survey, with one participant only opening the link and not providing any answers. The average completion time was 8 minutes and 7 seconds.

6.1 Age

Question 2 was an age determination question and grouped as per generational groups as previously shown in section 4.2.1. No participants were under the age of 26, which is not surprising, as this age group would still be in schools or being in entry positions in the industry. The distribution between the other age groups was consistent with older GenX being the largest group with 29% of respondents belonging to this group. Age groups 36-43 and 44-50 were equally distributed with 20% of respondents, and age groups 26-35 and 60+ both had 16% of respondents, as shown in Figure 4.

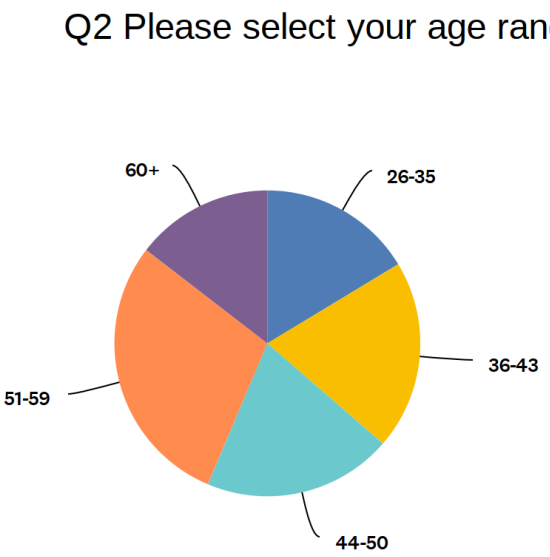

Figure 4 Age distribution.

6.2 Level of education

Participants were asked their highest level of education. As shown in Figure 5, most respondents hold a master's degree in their field, with 31 of respondents (56%) holding such a degree. Bachelor's degree is held by 19 participants (35%) while 5 respondents (9%) are holding a high school diploma as their highest level of education. It must be noted that no participant selected vocational school as their level of education and the researchers believe that this term can be confusing for many. The selected option of high school education is internationally recognized to be equivalent to the Nordic "Gymnasium" level and should not be confused with higher elementary school.

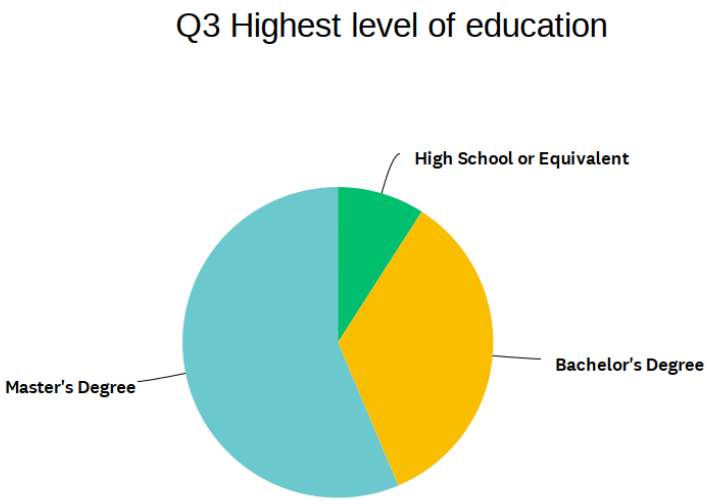

Figure 5 Levels of education.

6.3 Field of expertise

The participants were asked for their primary field of expertise, and the distribution is shown in Figure 6. As expected, the largest group is the engineering and technical field, with 21 participants belonging to this field. Three participants have selected the Other and free text option. Two of the responses were Crane vessel operation and environmental science with the third participants describing it as "Seafaring, management/Admin, Engineering/technical". These answers have been left in the other category, even though they fall under another of the existing categories.

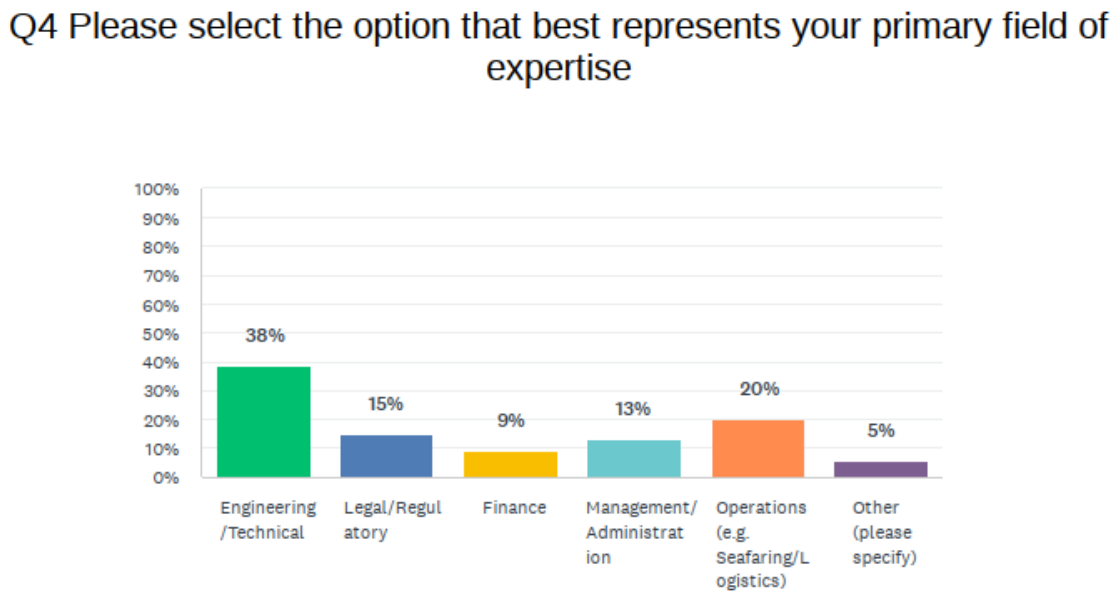

Figure 6 Primary field of expertise.

6.4 Work experience

To evaluate experience levels, the participants were asked about their time working in the marine industry. Presented in Figure 7, the most common working experience is being 21-30 years in the industry with 42% of respondents selecting this option. Second most common is 11-20 years in the industry with 22% of respondents selecting this option. Being over 31 years in the industry is selected by 18%. Smallest participating group by years of experience is the 0-5 years group, which again reflect that these employees are in their entry level years and are thus not as likely to hold positions of considerable power within a company.

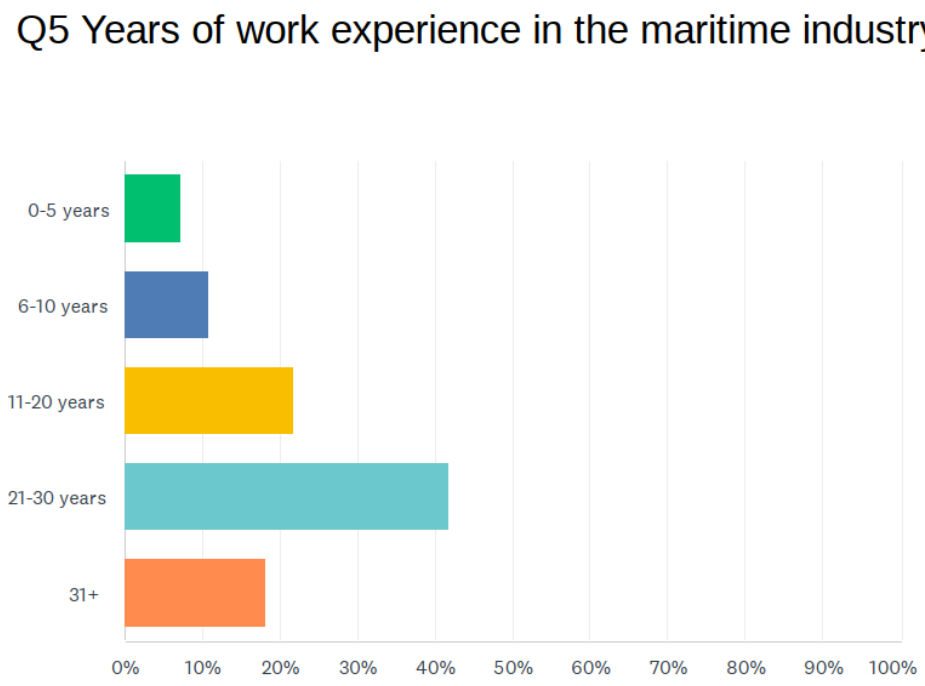

Figure 7 Working experience.

6.5 Country of work

As shown in Figure 8, a large group of participants have Finland as their main country of work, with 53% and 29 of respondents are working from Finland. Nine respondents are from Norway and five are from Sweden. Out of the ten respondents selecting the other category, five are from Netherlands, two are from Germany, one from Belgium, one from Estonia. One participant incorrectly opted to answer Sweden as a free-text answer during the survey instead of pre-filled option answer.

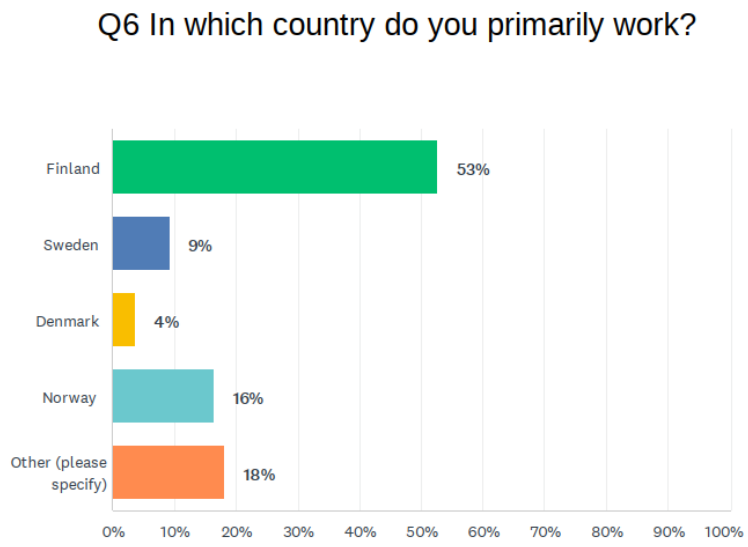

Figure 8 Country of occupation.

6.6 Company size

Most of respondents (40%) work in medium size businesses with 51-200 employees, as shown in Figure 9. Over a quarter of respondents work in large enterprises with more than 500 employees. Small business respondents are selected by ten participants, whilst the large business /small enterprise option was only selected by 8 or participants.

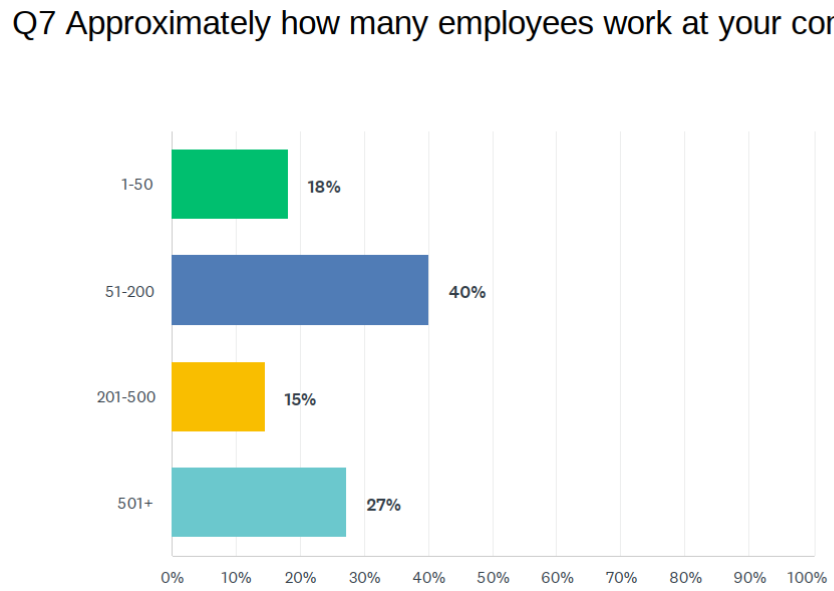

Figure 9 Company size.

6.7 Marine sector

During the survey logic section, we decided to have three main categories for the sectorial selector, with regulatory and surveying being combined into one main category called regulating bodies. As shown in Figure 10, the respondents were spread over the sectors, with 42% being in insurance, 35% from shipping companies and 23% from regulating bodies. The regulating bodies are fewer in numbers than insurers and shipping companies, and the researchers are satisfied with the received spread.

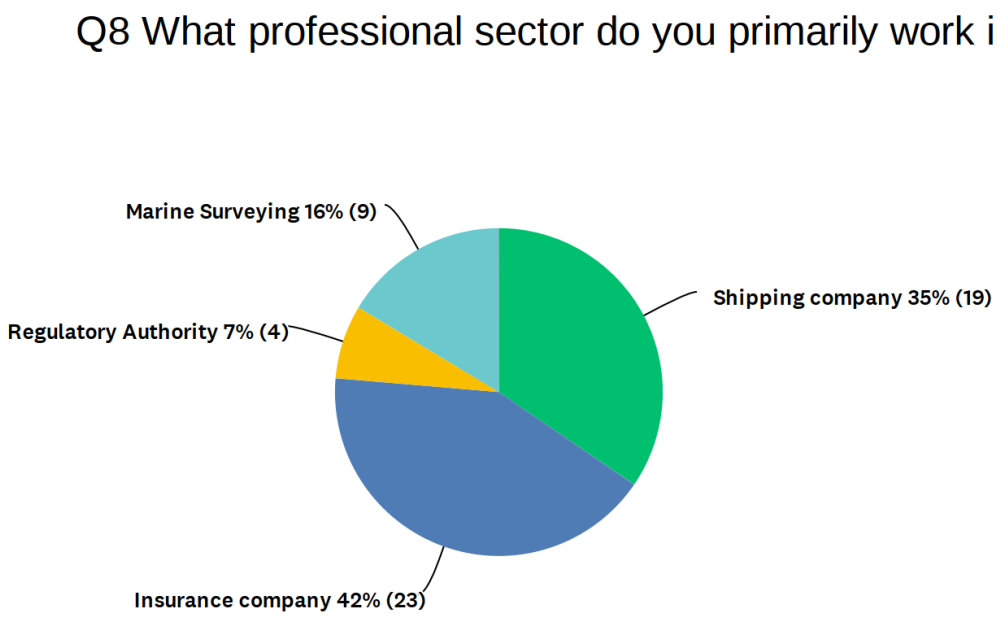

Figure 10 Marine sector of participants.

7 Results

This chapter will contain all analysis of hypotheses in their own sub-chapter.

7.1 Hypothesis 1

This chapter discusses analysis of hypothesis 1 whether there is a noticeable difference in knowledge between insurers and ship owners.

We will first review the Question 10 and Question 11, which are specifically targeted to ship owners only to get a deeper understanding on ship owners' view. In Figure 11, we can see the participants answers to Question 11.

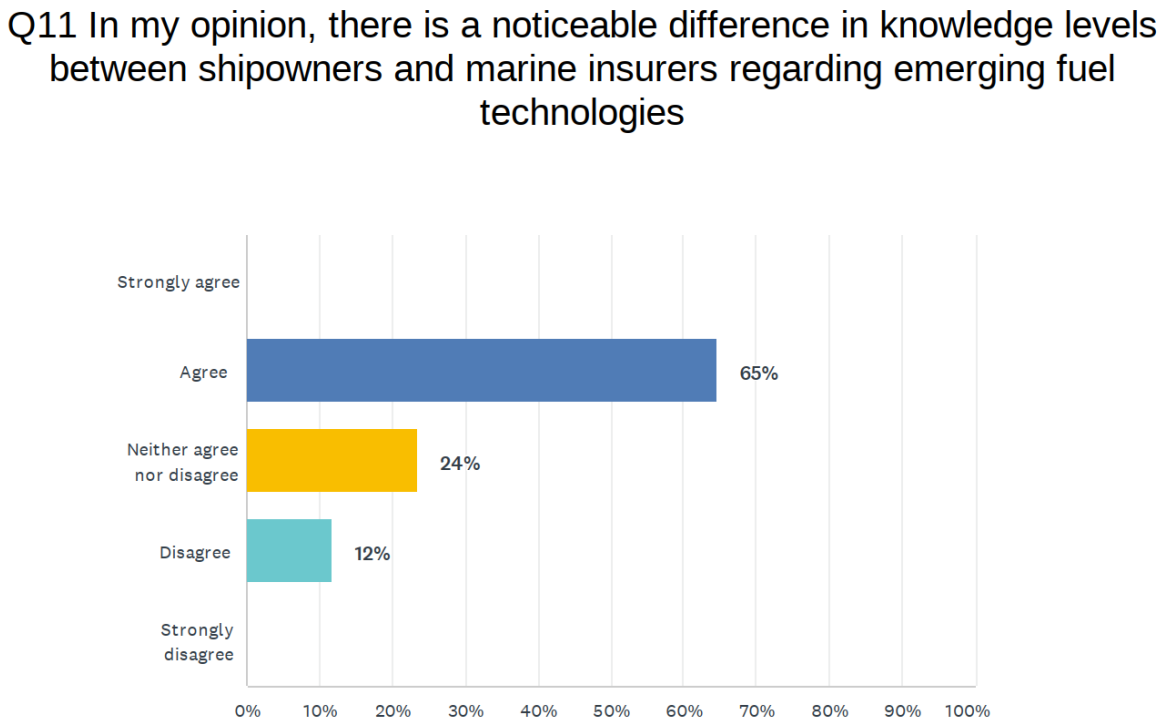

Figure 11 Shipping companies' responses.

Firstly, we asked the participating ship owners if they feel that there is a noticeable difference between them and insurance companies based on their experience. This question was specifically directed only to participants that selected the ship owner's category in the identifier page (Survey logic module). From the participants answers we can see that most ship owners (65%) find that there is an existing knowledge gap compared to insurers.

A quarter of the participants selected a neutral position to the question. This might be because they have limited cooperation or insight with insurers in their daily work tasks and thus do not feel sufficient to answer the question.

Only 12% find that there is no difference in knowledge levels, and this points to the conclusion that these participants find ship owners and insurers to be equal in knowledge.

No participants selected strongly agree or strongly disagree as their survey answer. The researchers believe that this lack of selection can stem from the survey question itself, as the question statement does not directly necessitate a need for a nuanced answer.

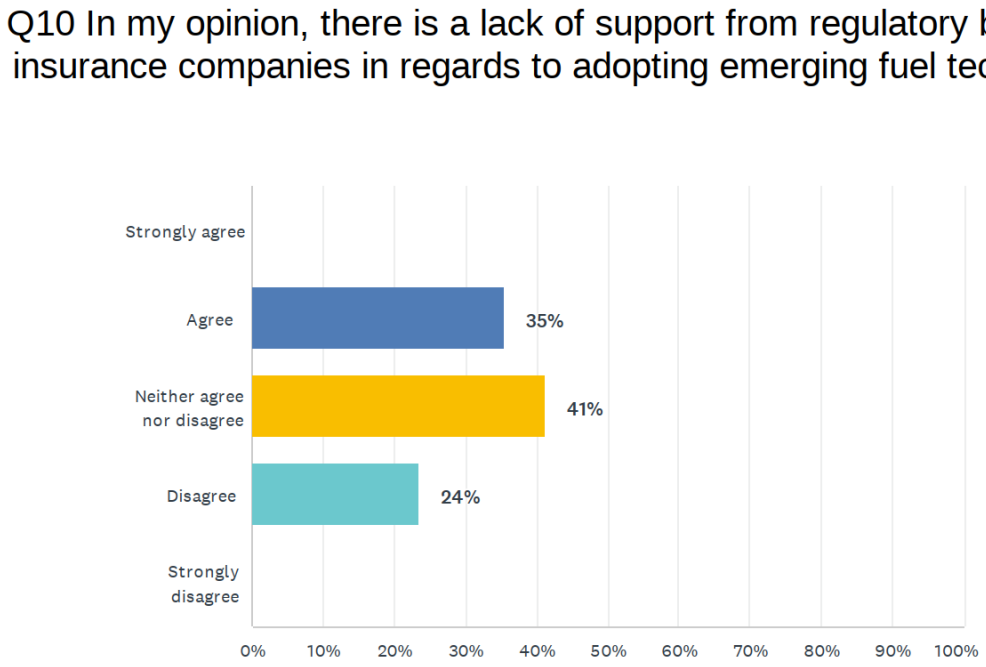

Figure 12 Feeling of lack of support.

Question 10 is investigating the ship owners feeling of being adequately supported by the other sectors. As shown in Figure 12, most ship owners (65%) answers that they disagree or are neutral to the statement and thus do not find a lack of support from the other marine sectors prevalent. This can be seen as a positive trend for the marine sector as whole. Slightly over a third of participating ship owners (35%) feel that they are not receiving adequate support from insurers or regulatory bodies for their transition to adopting new fuel technologies.

We wanted to analyse if the is selected due to ship owners not being in transition and thus do not need to collaborate with other sectors. This is a sub-analysis of Hypothesis 1.

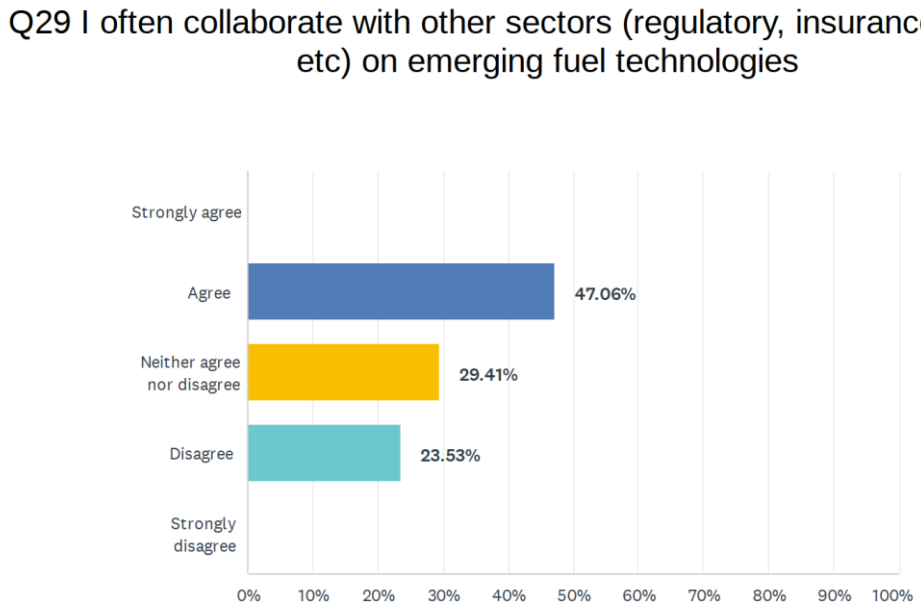

Figure 13 Collaboration.

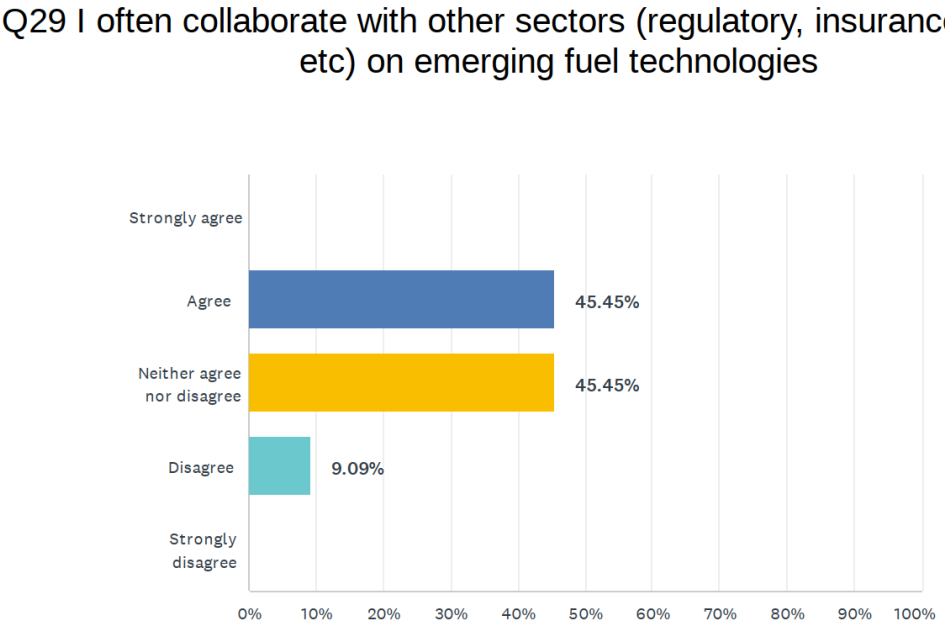

Figure 14 Collaboration rate for neutral or lack of support.

Figure 13 shows the collaboration rate for all ship owners, and Figure 14 shows the collaboration rate for ship owners that selected neutral or no lack of support in question 10 (Q10). We can see almost no difference in percentage for collaboration (47%) for compared to the general population (45%).

A much larger difference is noted in the non-collaborating answer (*disagree, strongly disagree*), which indicates no collaboration with other marine sectors. The participants

that answered no lack of support from insurers and regulating bodies answer with much higher percentage (23,5%) that they are often collaborating with other marine sectors than the general population (9%).

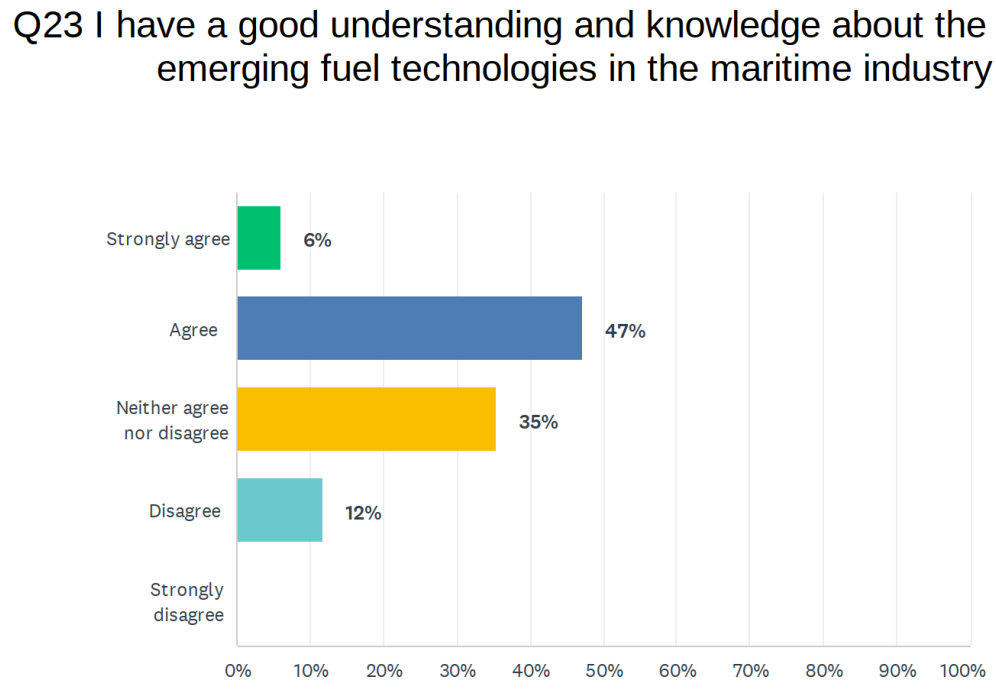

Figure 15 Self-assessment from ship owners.

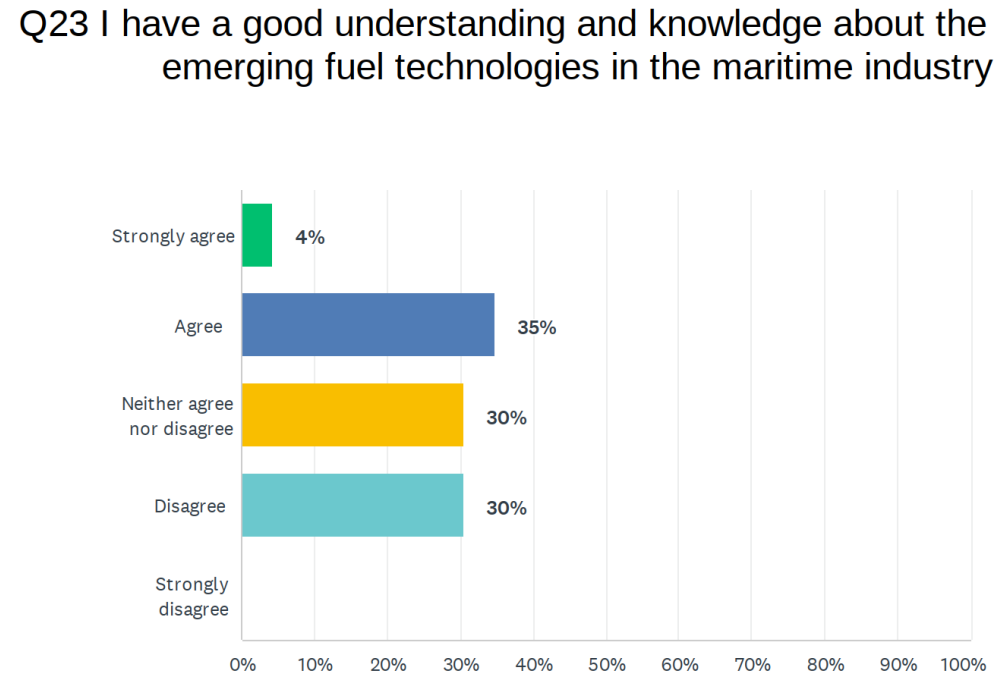

Figure 16 Self-assessment from insurers.

Figure 15 is self-assessment of knowledge from ship owners and Figure 16 is from the insurers.

Ship owners (53%) feel generally more knowledgably and comfortable (*agree, strongly agree*) than insurers (39%) for emerging fuel technologies. What is outstanding is the difference statement that participants are not feeling knowledgably with emerging fuel technologies. Insurers are almost three times more likely (30%) to answer that they do not have a good understanding of new technologies than ship owners (12%)

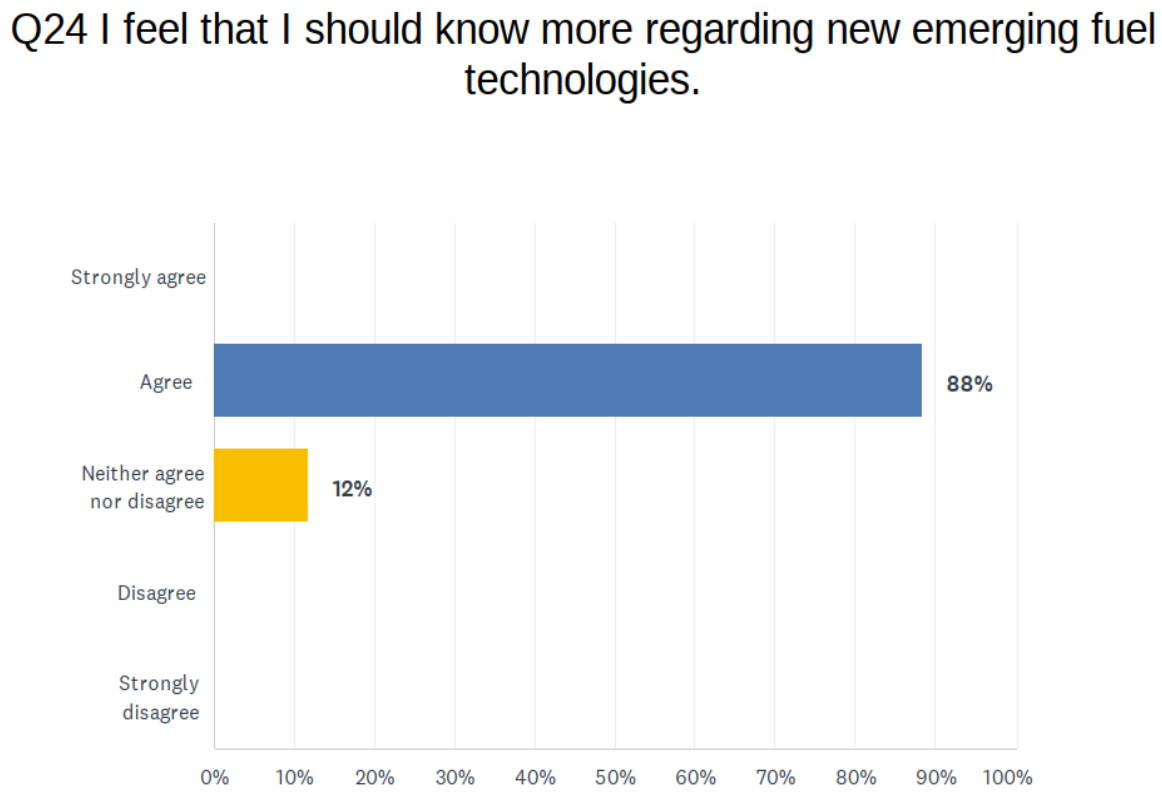

Figure 17 Ship owners.

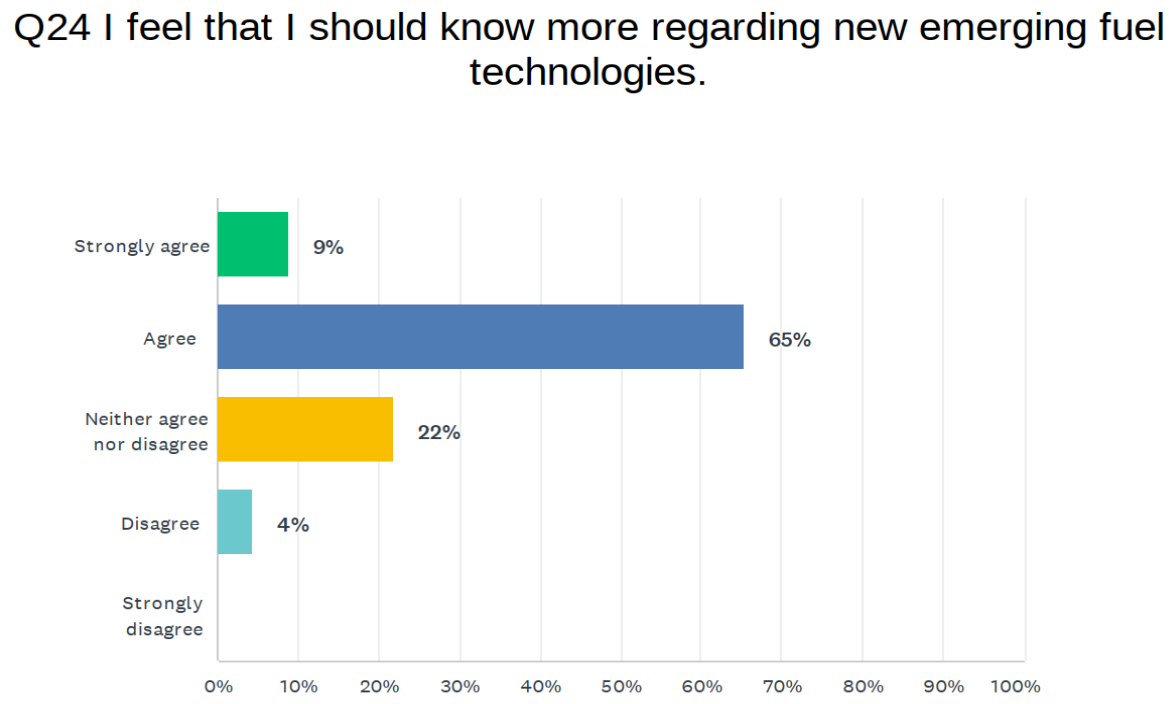

Figure 18 Insurers.

Figure 17 shows ship owners and Figure 18 insurers on the question if participants feel they need to know more on emerging technologies.

No ship owners feel that they already know enough (*disagree, strongly disagree*) with only 12% being neutral. Insurers are showing a greater spread in their opinion with answers ranging from strongly agree to disagree and a larger portion selecting a neutral stance (22%).

A strong majority of ship owners (88%) are stating their feeling or wish to know more about emerging technologies, whilst a lesser percentage (74%) of insurers are stating the same. This can be reviewed against the previous question, where a lesser percentage of insurers feel to have a good understanding of technologies. The differences are small, but show a trend that insurers generally feel less knowledgeable and at the same time feel that they do not need to learn more.

Q4 Please select the option that best represents your primary field of expertise

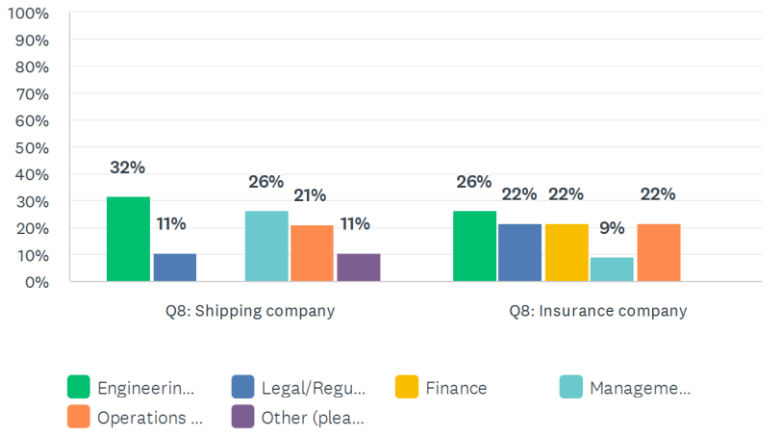

Figure 19 Shipowners (left and insurers right)

Figure 19 shows that the insurers and ship owners have almost the same number of participants with technical field of expertise (26% vs 32%), there is a larger gap in other fields. Ship owners show larger portion of management positions (26% vs 9%) whilst insurers have a higher portion of participants with legal and finance background (22% each). This can directly be contributed towards the perceived knowledge gap between the sectors.

Working with legal and finance specialization does not directly bring a necessity to be involved in knowledge of new technologies. This can also be related to the statements that less of insurers feel that they need to know more about technologies, as a direct link to that they are not encountering it as often in their work routines that ship owners, which are directly affected by this transition. The insurers show a more diverse group of participants, which most likely is because the need for a broader level of expertise to handle insurance contracts, operations and claims.

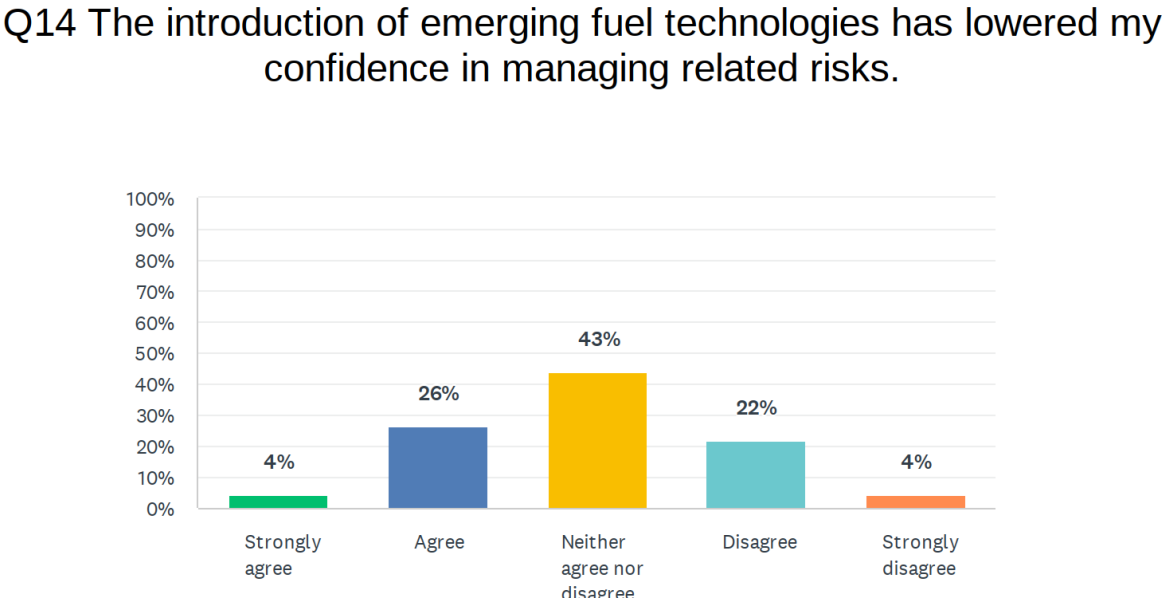

Figure 20 Confidence levels.

Figure 20 shows the distribution of answers if the insurers participants have gotten lowered confidence in managing risk due to emerging technologies. The distribution projects a normal distribution curve. With statistical values the curve will give a mean weighted value of 0.04 and a standard deviation of 0.89, projecting a minor deviation from the Gaussian distribution.

This outcome could be interpreted that insurers on average feel neutral to the transition towards new technologies in risk related matters, and it is more about personal feelings than a general trend.

7.1.1 Hypothesis summary

In this chapter, we have explored the possible or perceived knowledge gap between ship owners and insurers, regarding emerging fuel technologies. We discovered that the Hypothesis 1 is supported by the findings:

- Knowledge gap: 65% of ship owners perceive a noticeable knowledge compared to insurers. A quarter of participants remain neutral, potentially due to limited interaction within marine sectors.
- Support: Majority of ship owners (65%) do not find lack of support from insurers or regulators. 35% feel inadequately supported in the transition to new fuel technologies.

- Technological understanding: Ship owners generally rate their understanding of new technologies higher than insurers, with 53% feeling knowledgeable compared to 39% of insurers. Insurers are almost three times more likely to lack confidence in their understanding. The differences in professional expertise are the most likely contributor to the perceived knowledge gap, as the insurers' role may require broader but less technology-focused expertise.
- Desire to learn: 88% of ship owners express a desire to improve their knowledge on emerging technologies, compared to 74% of insurers.
- Risk confidence: Insurers show a neutral average stance in their confidence in managing risks associated with new technologies, with results indicating more to be personal variability than an overall trend.

7.2 Hypothesis 2

This chapter analyses Hypothesis 2, whether technicians will be more negative in their willingness to adopt new and emerging technologies.

The survey question posed to specifically test this hypothesis is Question 31. The participants were asked to take a stance on whether they were in favour of adopting new fuels in the maritime industry.

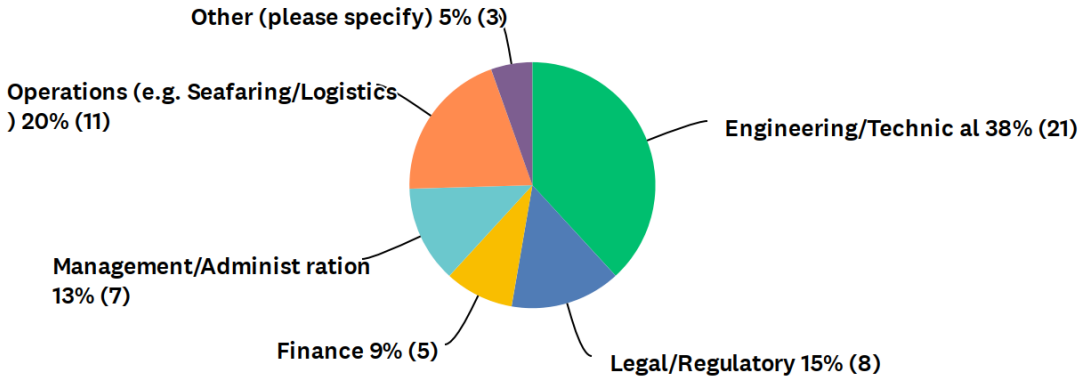

Figure 21 Question 4 Marine sector distribution.

As shown in Figure 21, 38% of participants are answering that they have technical background. Operations were selected by 20% of participants. Legal followed with 15% of participants and closely followed by management on 13%. Least selected option was

finance with 9%. Three participants selected the *other* option. The responses from the last group were as follows:

- Crane vessel operation
- Environmental science
- Seafaring, management, admin, engineering, technical.

The researchers have not included these responses into any other groups, even if their answers in nature can be diverted to already existing groups (Operations, technical, management). They have been included in the general population but not analysed as a separate group. The spread on responses shows a diversity over the groups, and their impact of not including them in their respective group can be considered negligible.

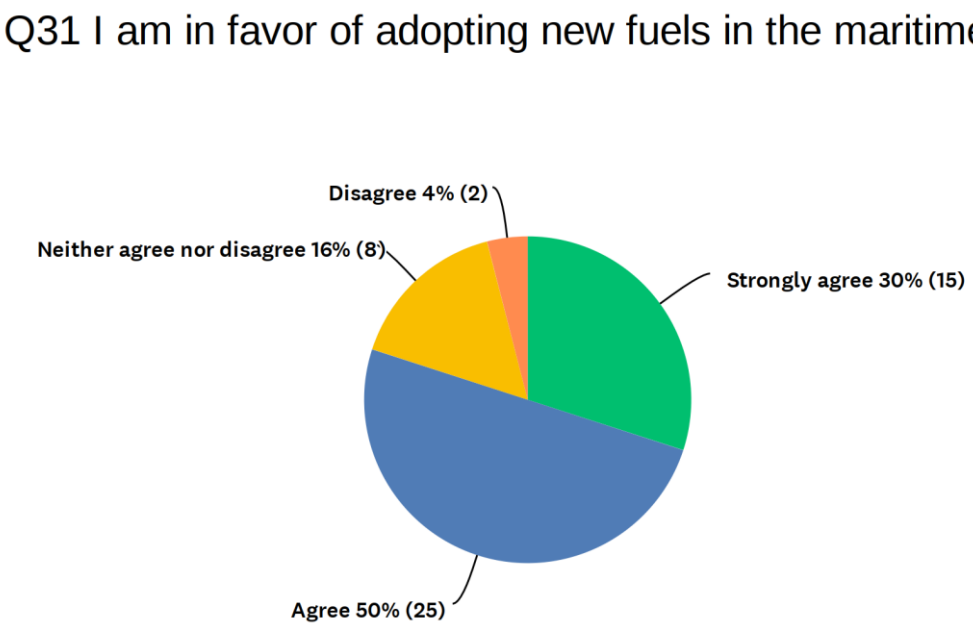

Figure 22 In favor of new fuel technologies.

Figure 22 show the views in favour for adopting emerging fuel technologies for the general survey population. It clearly shows an absolute majority of the population to view new fuels favourably with 80% of participants selecting a positive view. 30% are in strong favour of adopting new fuel technology. 16% remain neutral, whilst only 4% view new technologies negatively.

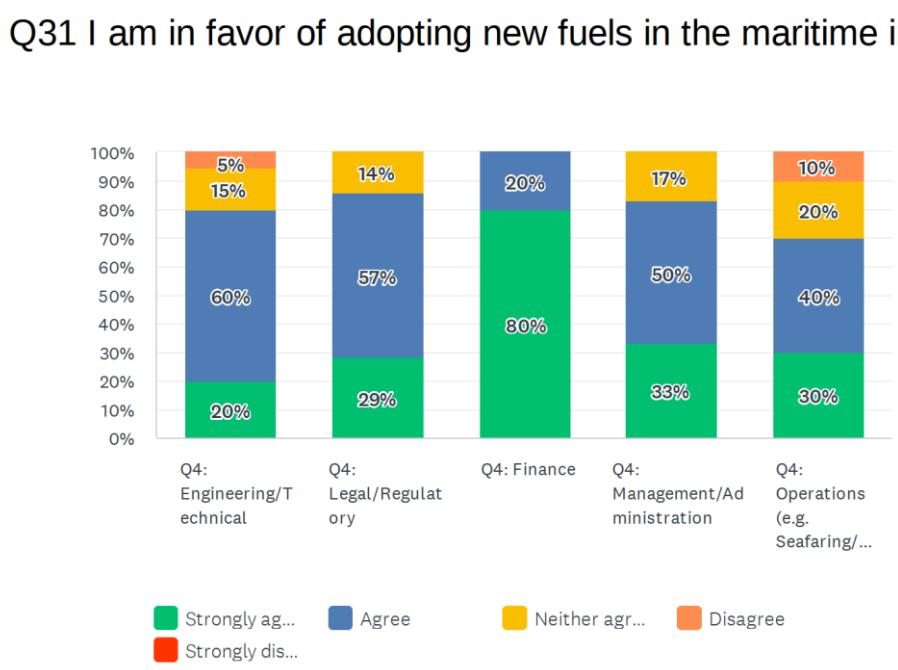

Figure 23 Optimism towards adopting new fuel technology.

Figure 23 shows the distribution of how positive views divided by professional groups. Participants with technical background or field of expertise have overall the same number of positive answers (80%) as the population general, but with a slight drift towards moderate end of the scale. They show less on *strongly agree* (20%) than the general population (30%), whilst more *agree* with the statement (60% vs 50%). The neutral and negative views are very close to the ones of the general population, with only one percent difference within the groups.

This gives a conclusion that participants with technical field of expertise does not harbour more negative views towards adopting new fuel technologies than the general population of participants. The technicians are showing a bit more reservation in their views.

Other groups that show similar selection of views as the general population are the legal and regulatory backgrounds and management and administration backgrounds, both showing no negative views towards the transition.

Finance background participants express very positive views towards the transition, with 80% of participants expressing to be strongly in agreement with the statement, while 20% agree. No neutral or negative views were recorded.

Participants with operational background overall show a positive view (70%) towards the transition, but with a slightly higher percentage of participants showing negative views towards adoption than the general population. Participants that strongly agree are the same (30%) as the general population, but the views showing moderate positivity (agree) are fewer (40%). More participants of this group show neutral (20% vs 16%) or hold negative views (10% vs 4%).

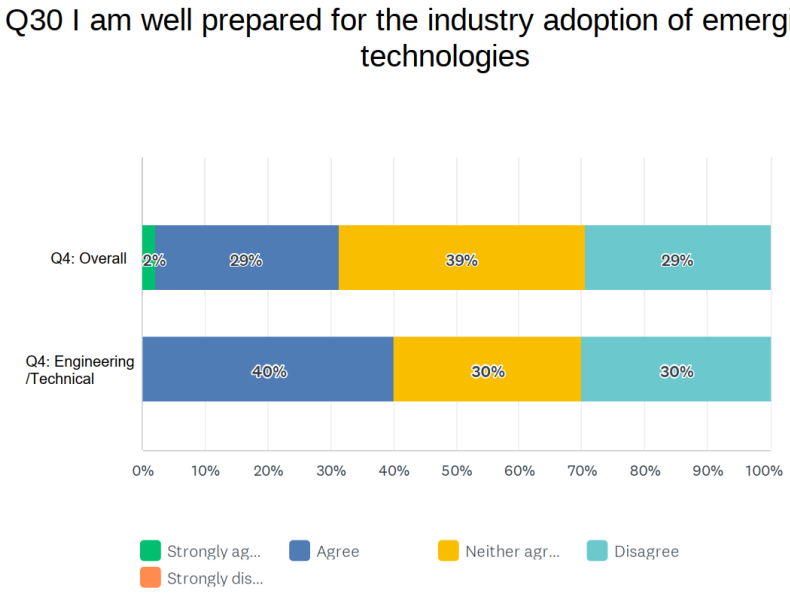

Figure 24 Preparedness of general population compared to the participants with technical background.

In relation to self-assessing the level of preparedness for the industry adoption of new fuel technologies, answers from participants with technical background does not deviate considerably from the answer from the general population. As we can see in Figure 24, technicians have a slight skew towards feeling more prepared (40%) over the general population (31%), whilst the participants from both groups that assess themselves unprepared are same, showing only one percent difference.

7.2.1 Hypothesis Summary

This hypothesis chapter analysed whether technicians harbour more negative attitudes towards adopting new and emerging fuel technologies.

Key findings include:

- Survey demographics: Of survey respondents, 38% identified as having technical background or field of expertise, followed by operations (20%), legal (15%), management (13%) and finance (9%).
- General attitudes: An overwhelming majority of 80% of participants expressed positive views toward adopting new fuels, with 30% strongly favouring adoption of new fuels. 16% remains neutral and only 4% hold negative views towards adoption.
- Technicians' attitudes: Technicians display similar attitudes as the general survey population, with 80% in favour of adoption. However, they are leaning towards a more moderate agreement (60%) than a strong agreement (20%). Neutral and negative views were nearly identical to the general population.
- Preparedness: Technicians self-assessed their preparedness for adopting new fuel technologies slightly higher (40%) than the general population (31%), with similar levels of perceived unpreparedness (approximately 1% difference).
- Comparison across groups: Other professional backgrounds, such legal, management and finance, show strong favourability toward adoption, with finance being in strong favour (80%) of adoption of new fuel technologies. Operational professionals, while still largely positive, showed a higher rate of neutral (20%) and negative attitudes (10%) compared to the general population.

In conclusion, technicians do not exhibit more negative attitudes toward adopting new technologies. Their responses suggest a slightly more reserved optimism, potentially reflecting their deeper technical understanding and thus understanding the technical challenges to overcome.

7.3 Hypothesis 3

In this analysis we will investigate hypothesis 3 whether employees with legal backgrounds will be showing fewer negative opinions towards new regulations and directives than professionals with other backgrounds.

We will begin with analysing question 32, which specifically asked participants if they find regulations to be a major obstacle for adopting new fuel technologies.

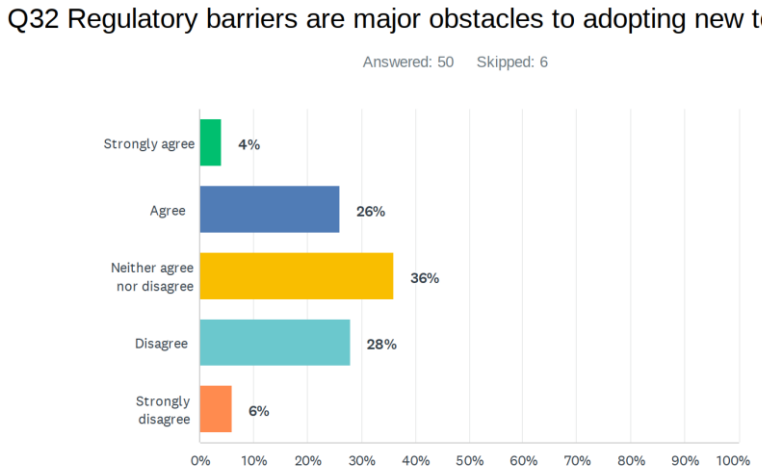

Figure 25 Perceived regulatory barriers.

Figure 25 is showing the views of the general population regarding if they find regulatory barriers to be a major obstacle in adopting new fuel technology. The distribution of answers is close to a normal distribution (standard deviation 0.97, skewness-0.20 left), and show that largest selected option is neutral position with 36% of answers. 30% of participants find that regulations are a major obstacle for implementation, with 4% finding strong agreement with the statement. 34% of participants find that regulations are not blocking the adoption of new fuel technology.

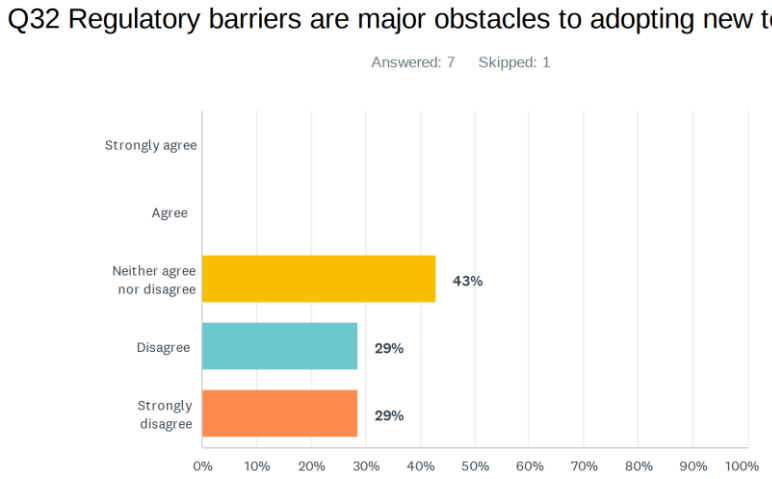

Figure 26 Participants with legal background opinions.

Figure 26 shows the same question filtered for participants with legal background. The participants with legal background show no answers in the agreement section, and thus no one view regulations as an obstacle towards adoption. 58% of participants disagree or strong disagreement with the statement of regulations being obstacles. Slightly more are in the neutral position (43%) compared to the general population (36%). Participants with

legal background are showing a much more positive view towards regulations than the general population. This initiated further questioning into these findings:

1. What is the self-assessed knowledge level of new technologies for participants with legal background and can this affect the positive views?
2. Which groups are viewing the regulations most negative?
3. What does regulatory bodies and marine surveyors think about the current regulatory framework?

We filtered the participants with legal background to check which marine sector they are currently working in and show this in Figure 27. Of these participants, 63% are working in the insurance sector, 25% in shipping companies and 13% in regulatory positions.

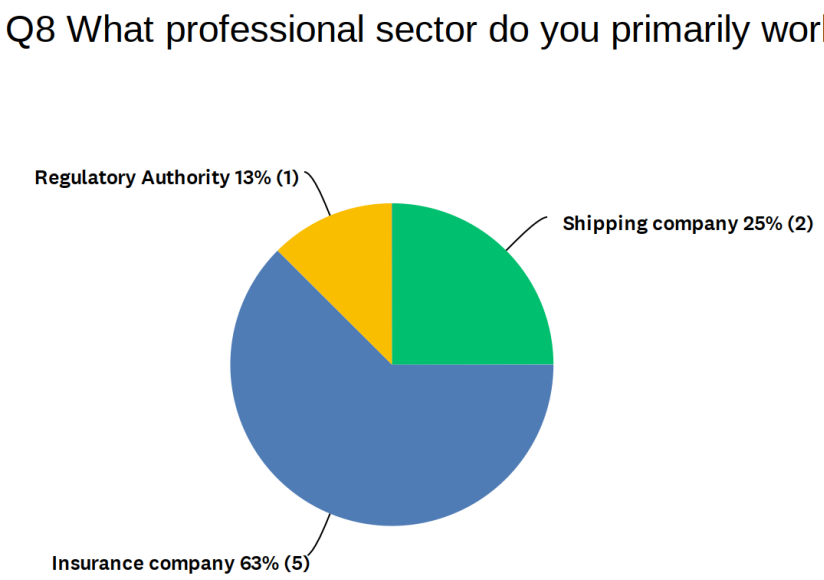

Figure 27 Marine sector distribution.

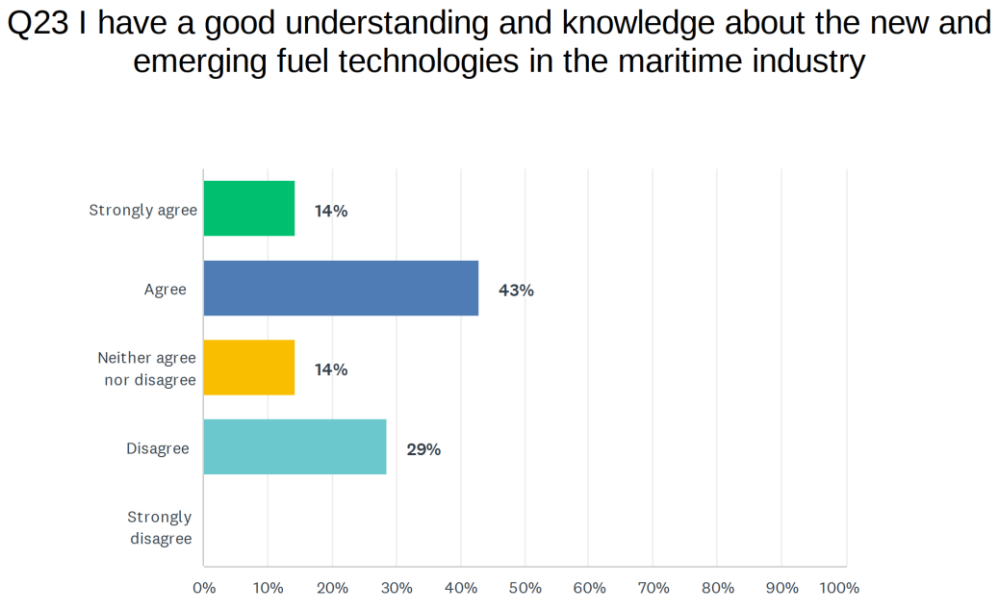

Figure 28 Self-assessment of knowledge.

As shown in Figure 28, self-assessed knowledge level of the participants let know that 57% of participants find that they do have a good understanding of new technologies, whilst 43% report a neutral stance or not having a good understanding of new technologies. Filtering for participants that are reporting good or very good understanding of new technologies into account, and checking back with the regulatory barrier question, we receive a much more positive view towards regulations. It shows that participants that report a high level of understanding of the emerging technologies are less likely to see regulations as an obstacle in the transition (Figure 29)

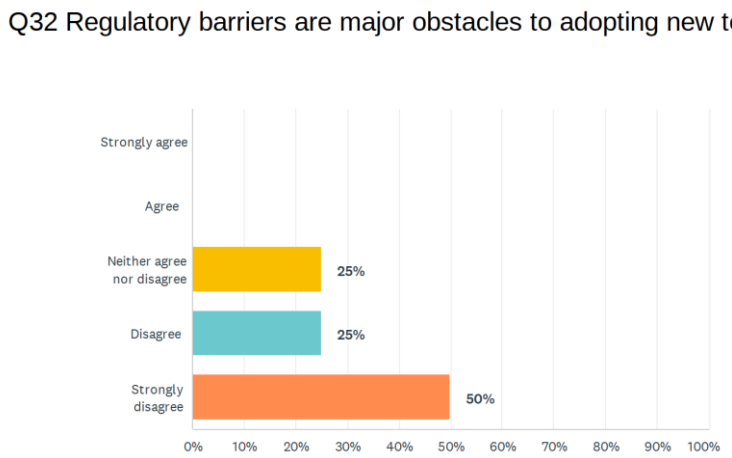

Figure 29 Regulatory barriers.

Which groups are regulations in the most negative view towards regulations? Filtered answers using the participants holding most negative views (in agreement with the statement of question 32) towards regulations we see the following information.

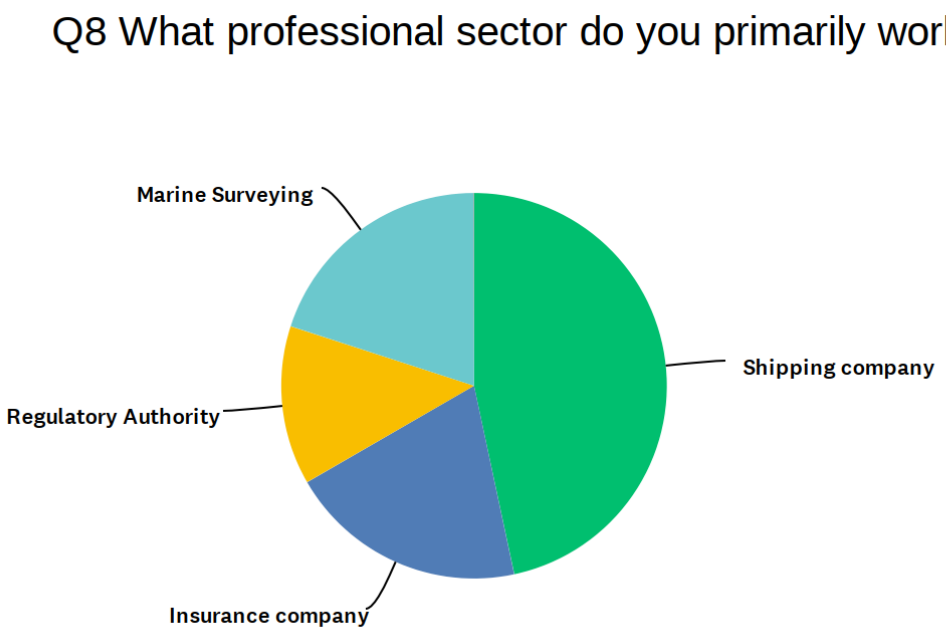

Figure 30 Negative views.

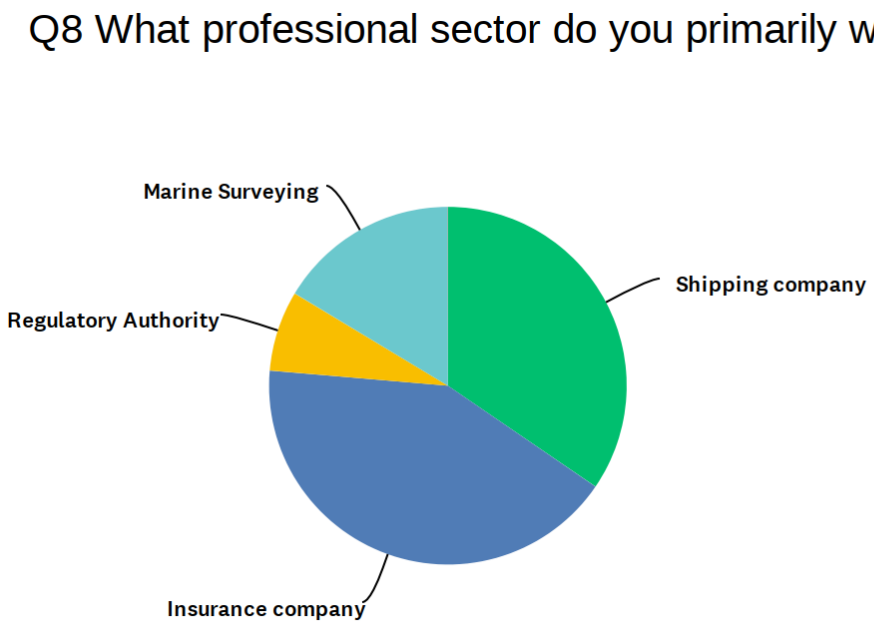

Figure 31 General views.

Compared to the general population (Figure 31), participants holding a negative view (Figure 30) have an overweight from shipping companies (12% increase), regulatory bodies (6% increase) and marine surveyors (4% increase). The group with least negative

views towards regulations are insurance companies, showing a decrease of 22%. It shows that participants working in insurance have the least negative view of regulations and possible obstacles these regulations create, even less negative view than the regulators implementing and inspecting the regulations.

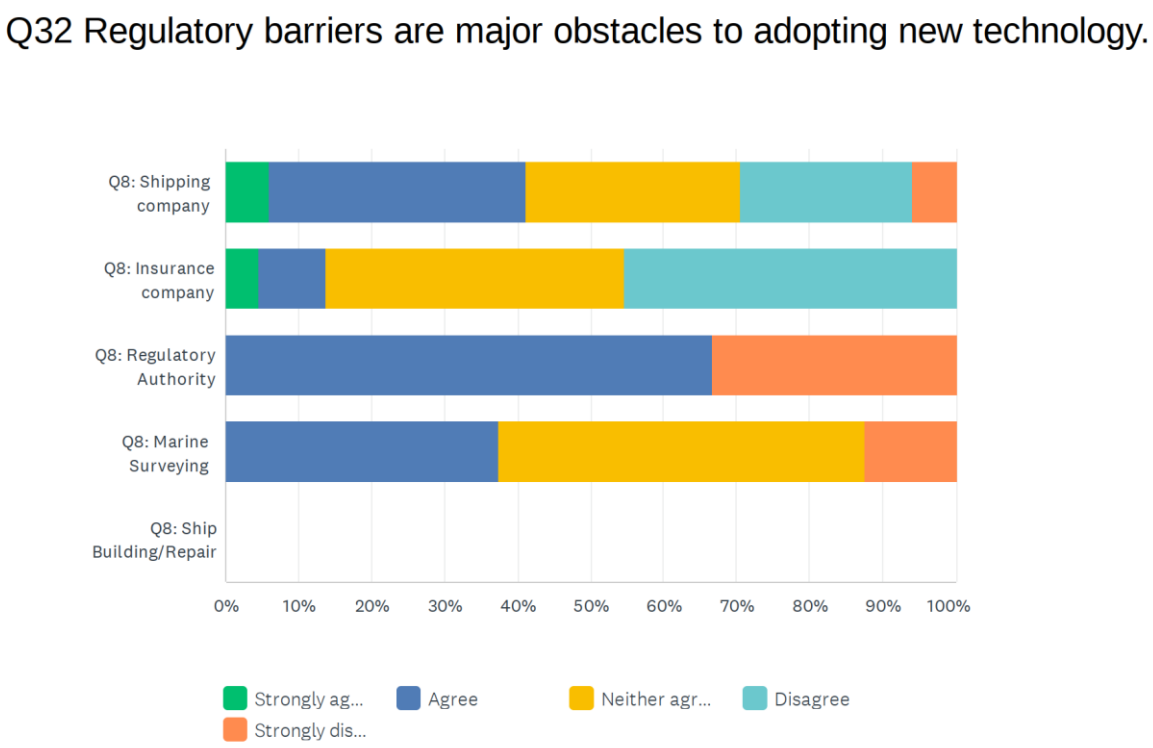

Figure 32 Regulatory barriers across sectors.

Comparing the views of different marine sectors to one another brings that the most positive group towards regulations are insurance companies, as shown in Figure 32 and Table 14. Most positive views are displayed by insurance companies with a much higher level than the general population. Shipping companies and marine surveyors show a similar level of positive views, whilst the most negative views are held by the regulatory authorities, with only 33% finding regulatory barriers not being a barrier for adoption of new technologies. It is worth to point out that the sample of regulatory authorities was small (three participants) and that the answers are polarized (agree, strongly disagree) and cannot as such be directly transferred to their sectors as a whole. This might be due to a spin-over effect that stems from regulators only receiving feedback from other sectors when there is something questionable or unclear in the regulations. This could create a skewed view about the attitude towards the sufficiency of regulations. We will not investigate this further in this thesis document.

Marine sector	Regulatory barriers are a major obstacle	
	agree/ strongly agree	neutral or disagree/ strongly disagree
Shipping company	41%	59%
Insurance company	14%	86%
Regulatory authorities	67%	33%
Marine surveying	38%	62%

Table 14 Opinions on regulatory barriers per sector

This analysis will dive into specific section of answers given to regulatory bodies and marine surveyors. This section can be seen in the previous chapter of survey logic.

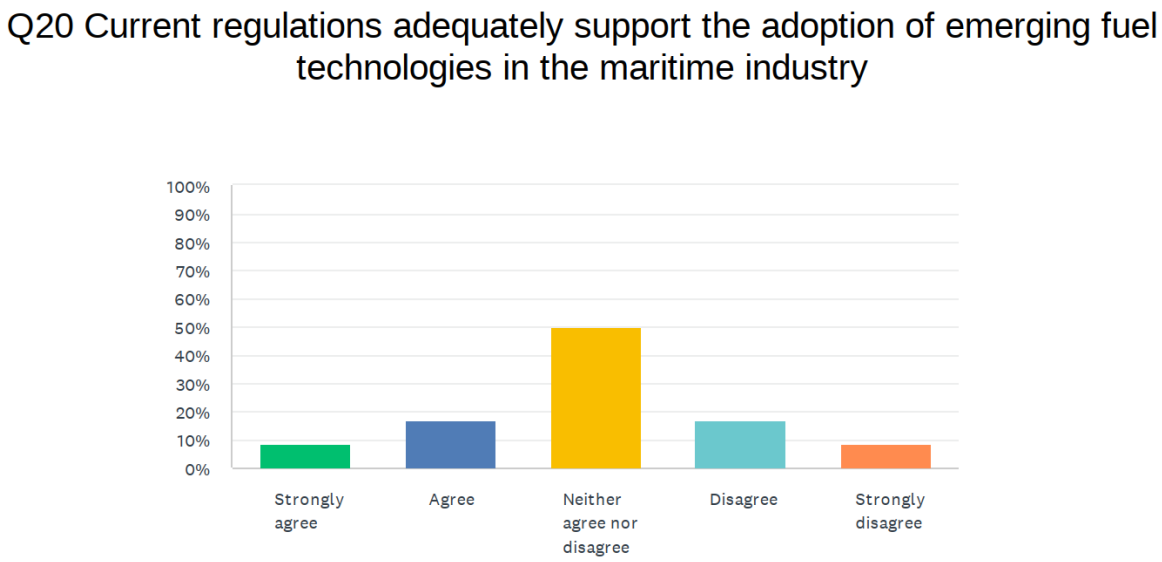

Figure 33 Feeling of support from current regulations.

The question whether current regulations support the transition towards new fuels is shown in Figure 33 and return a broader range of answers. The answers approach closely the normal distribution curve, with a weighted standard deviation of 0.96 and skewness of 1.0 (perfect symmetrical).

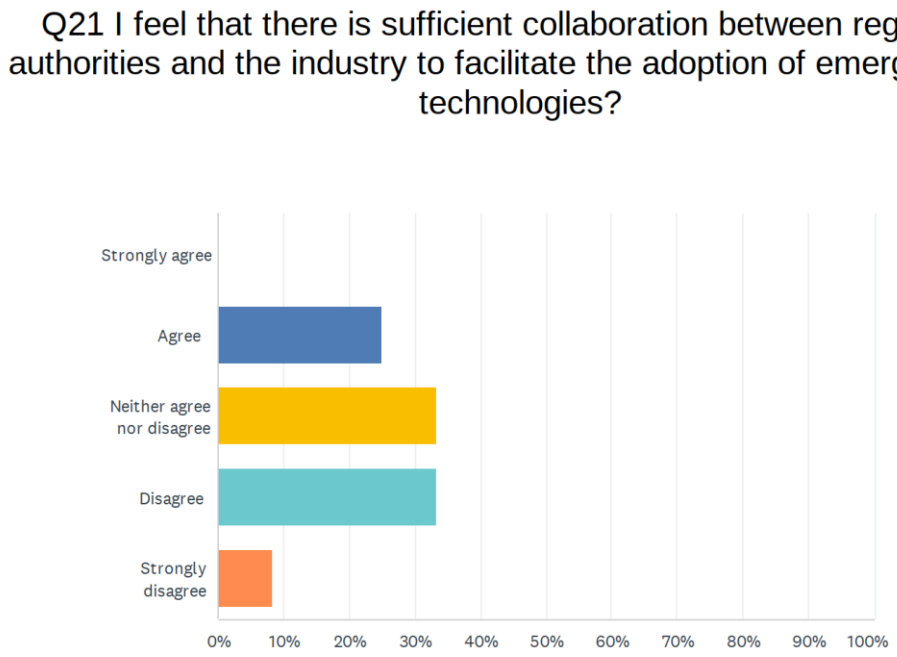

Figure 34 Feeling of sufficient collaboration.

The same groups were asked if they find an existing sufficient collaboration between regulatory bodies (their own group) and the rest of marine sector. As presented in Figure 34, only a quarter of participants answers that they think there is sufficient collaboration between these marine sectors. Three quarter of participants hold a neutral or negative stance, with 41% finding collaborations to not being on adequate levels.

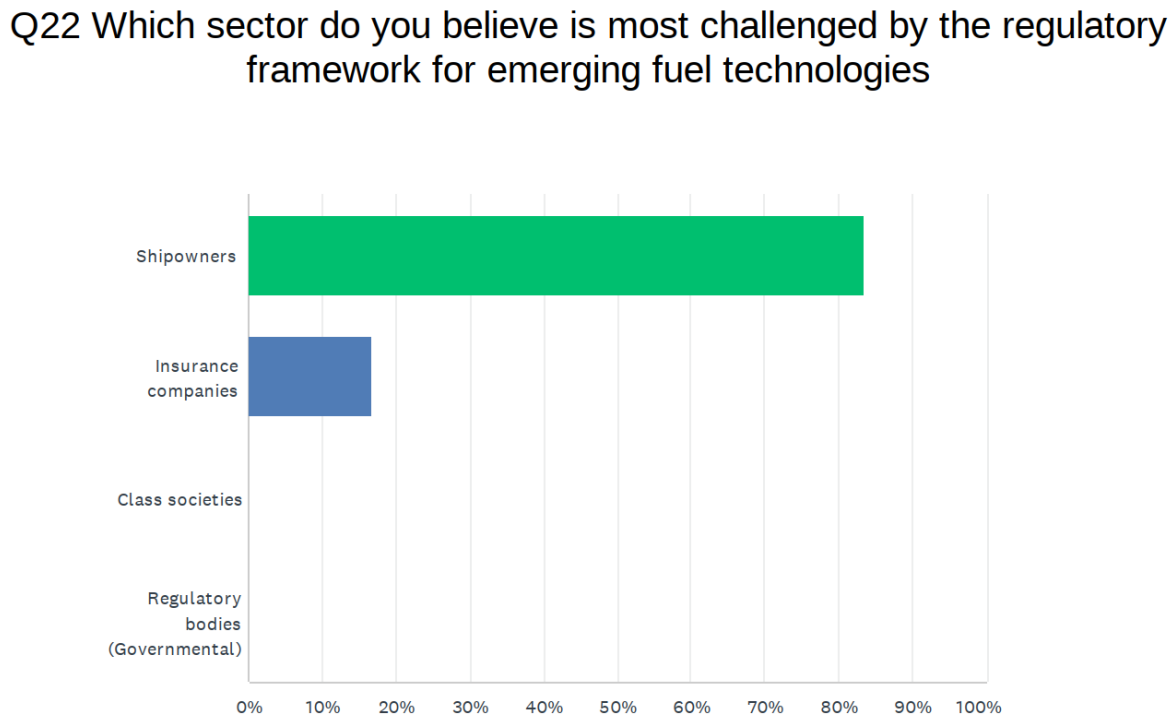

Figure 35 Sector most challenged.

While asked for which group they believe to be most challenged by the regulatory frameworks, most participants from this group believe that shipowners are the group most challenged by regulations. This is shown in Figure 35 above.

When cross-checking with the views of participants from shipping companies, a third of participants find there to be a lack of support from regulatory bodies, Figure 36, and insurance companies towards their sector whilst 41% of shipping companies find regulatory barriers to be a major obstacle, Figure 37, for the adoption of new fuel technologies.

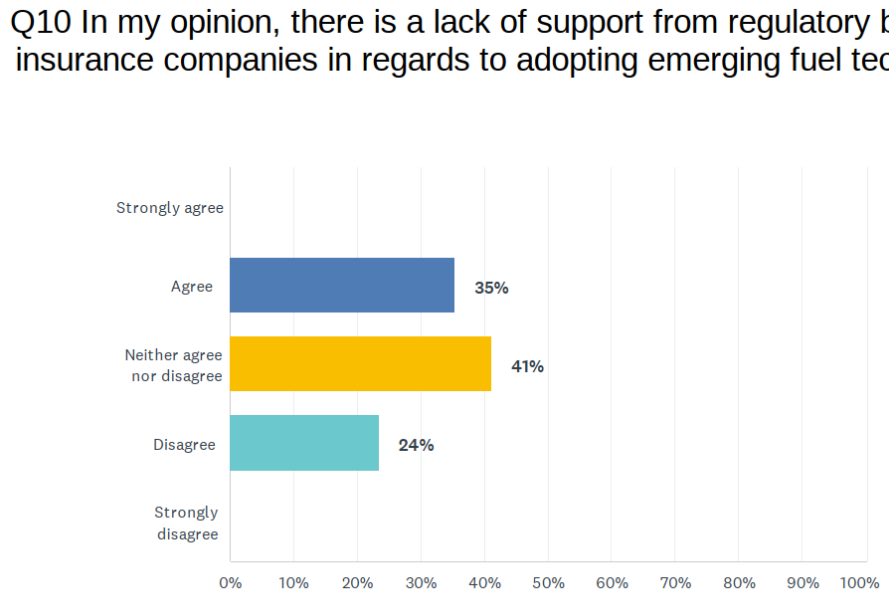

Figure 36 Feeling of lack of support.

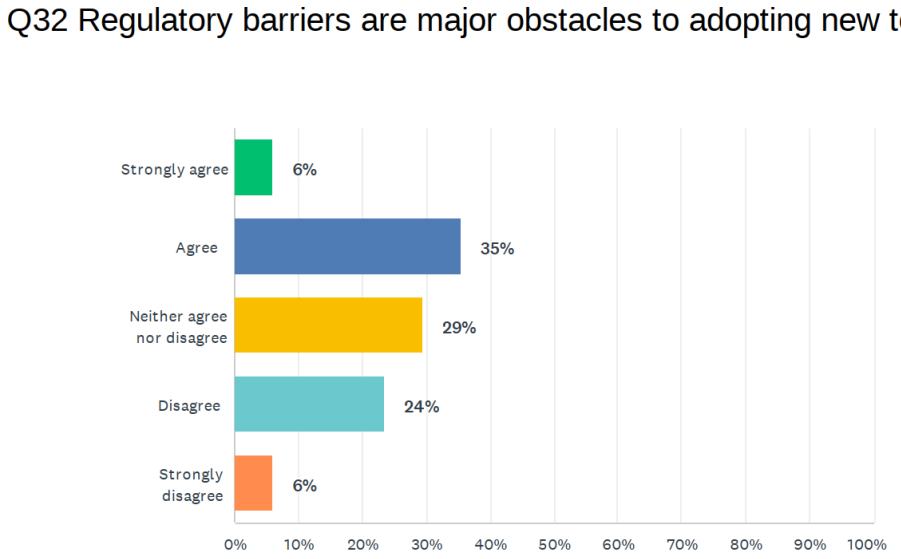

Figure 37 Regulatory barriers.

7.3.1 Hypothesis summary

In this hypothesis chapter we examined whether employees with legal background express fewer negative opinions towards regulations compared to professionals from other fields.

Key findings include:

- Demographics: Of participants in the survey, 15% identified as having legal background, whilst other participants came from technical (38%), operations (20%), management (13%), and finance (9%).
- Regulatory barriers
    - General population: 30% of participants view regulations as a major obstacle, 36% held neutral views and 34% disagree that regulations are a barrier.
    - Legal professionals: No legal professionals agreed that regulations are an obstacle. Instead, 58% disagreed or strongly disagreed while 43% remained neutral. This groups showed a significantly more positive attitude towards regulations compared to other marine professions.
- Influence of knowledge levels: Among legal professional, 57% rated their knowledge of emerging fuel technologies as good or very good. This sub-group displayed even higher positivity towards regulations, underlining the impact of knowledge and expertise on perceptions.
- Sector attitudes
    - Most positive views were displayed by insurance professionals, with only 14% agreeing that regulations posing barriers for adoption of new fuel technologies.
    - Most negative views were displayed by regulatory authorities, with 67% in agreement that regulations are posing obstacles for fuel transition. Shipping companies and marine surveyors showed mixed attitudes, with 41% and 38% respectively, agreeing regulations were barriers.
    - Note: The small sample size of regulatory respondents (four participants in total) suggests their perspectives can be individual preferences and may not represent the sector as whole. Also, the impact of a possible spin-over effect should be considered in further analysis.
- Perceived challenges: Ship owners were identified as the groups most challenged by regulatory framework by the regulatory bodies and marine surveyors.
- Collaboration: Only a quarter of respondents from shipping companies believe that collaboration between regulatory bodies and the rest of marine sectors was sufficient. A significant portion (41%) found collaboration inadequate, highlighting an area for improvement.

7.4 Hypothesis 4

In this chapter we will analyse if shipping companies feel themselves to be more knowledgeable about new fuel technologies than insurers.

We begin analysing Question 25, “my sector has a higher knowledge of fuel technologies than other marine sectors”. Generally, only a quarter of participants find that their sector would have a higher knowledge than other sectors, with 74% reporting a neutral or negative stance to the statement.

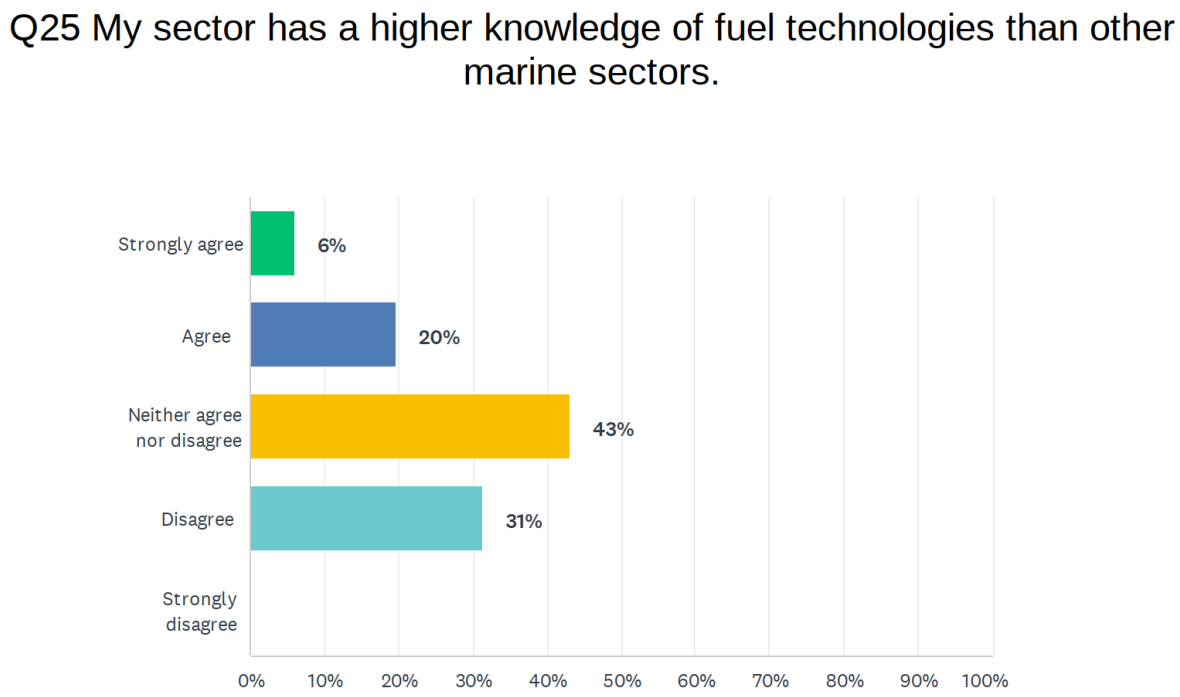

Figure 38 General population.

Figure 38 shows that a quarter (26%) of participants feel that their sector has a higher knowledge than other sectors regarding new fuel technologies. When breaking down the same question into sectorial groups, we receive the following data, shown in Figure 39.

Q25 My sector has a higher knowledge of fuel technologies than other marine sectors.

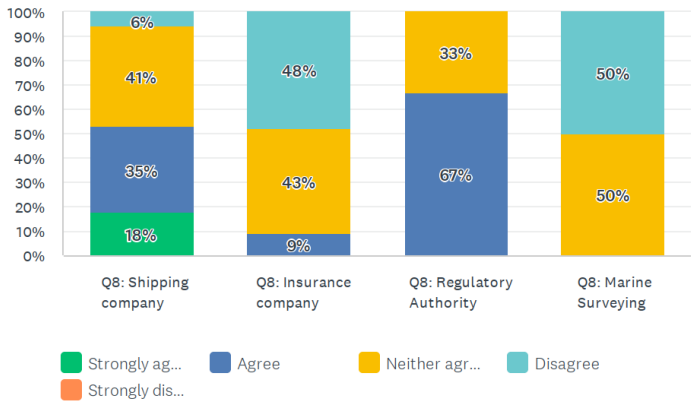

Figure 39 Feeling of superior knowledge.

Marine sector	My sector has higher knowledge (Agree or strongly agree)	My sector does not have higher knowledge (neutral, disagree, strongly disagree)
Shipping companies	53%	47%
Insurance companies	9%	91%
Regulatory authorities	67%	33%
Marine Surveying	0%	100%

Table 15 Feeling of superior knowledge across sectors.

As we can see in table 15, shipping companies reporting higher level of knowledge is at 53%, double that of the general population. Whilst half of participants from shipping companies find that their sector has a higher knowledge than the other sectors, a fifth (18%) reporting that they strongly agree with the statement. No other sector report strong agreement with the statement.

The sector with highest agreement and thus feeling their sector have the most knowledge is the regulatory authorities. It must be noted that the sample size of this sub-group is small (four participants), and it may not be fully representative of the sector as whole.

Insurance companies stay neutral or disagree with the statement, with 91% not finding their sector to have higher knowledge than others.

Marine surveyors are split between being neutral or in disagreement with the statement, however, no participants from this sub-group report that they find their sector to have higher knowledge than any other sector. This can possibly be because of their position in the marine sector, which requires frequent contacts between the different sectors, and the requirement to remain neutral in their line of work. This could show as an increased level of collaboration between the marine surveying group and the other sectors. This can be analysed using question 29.

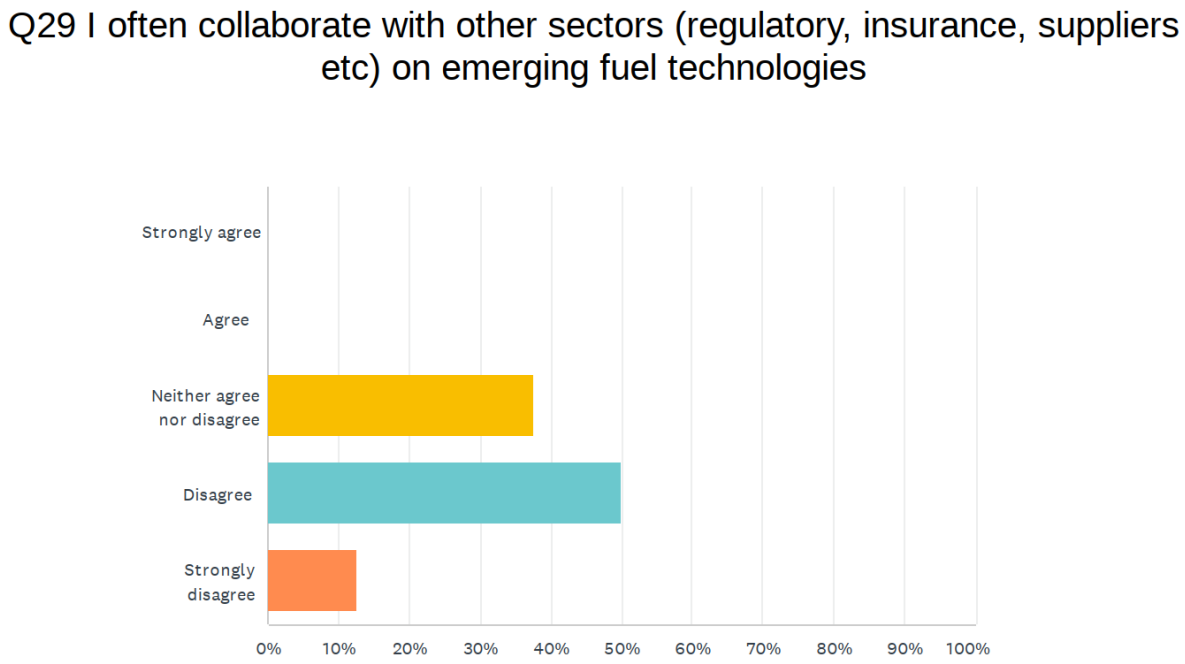

Figure 40 Collaboration rate for marine surveyors.

As seen in Figure 40, the marine surveying sub-group reports no answers for often collaboration with other marine sectors. The most answers came in the disagreement column, with 63% reporting that they do not collaborate often with other marine sectors, and 13% in strong disagreement with the statement. Conclusion is that marine surveyors are not more neutral to the self-assessed sectorial knowledge level due to a higher level of collaboration with other sectors.

7.4.1 Hypothesis summary

In this chapter we analysed whether shipping companies perceive themselves as having greater knowledge of new fuel technologies compared to insurers and other marine sectors

Key findings include:

General perception across all sectors

- Overall, only a quarter of respondents believed their sector had a higher knowledge than other sectors. The majority (74%) either in disagreement or in a neutral position, reflecting widespread modesty or uncertainty about their sectors compared to other sectors.

Sectorial breakdown

- Shipping companies:
    - 53% agreed their sector has superior knowledge, with 18% strongly agreeing, double the confidence level of the general population. This suggest that shipping companies perceive themselves as the leading sector in technological expertise within the marine industry.
- Regulatory authorities
    - This sub-group showed the highest proportion among all sectors to feel superior in their knowledge. However, the small sample size makes it difficult to generalize these findings onto the sector.
- Insurance companies
    - 91% of respondents were either neutral or disagreed with the statement, indicating that most insurance professionals do not view their sector as particularly knowledgeable about new fuel technologies.
- Marine surveyors
    - All the respondents were neutral or disagreed, with none believing their sector hold superior knowledge. This neutrality may reflect their role as intermediators, requiring objectivity and broader interaction across sectors.
    - Marine surveyors are often assumed to be neutral due to high collaboration levels with other sectors, However, only a quarter (24%)

responded that they collaborate often, while 63% disagreed and 13% strongly disagreed with the statement that they often collaborate with other sectors.

  - This suggests their neutrality stems more from professional role than frequent inter-sector collaboration

- Comparison and sector-specific dynamics
  - Shipping companies' confidence may stem from their direct involvement in implementing and utilizing new fuel technologies.
  - Regulatory authorities' high agreement rates suggest a belief on their role as oversight and policy-making knowledge, though this perception requires caution due to small sample size.
  - Insurance professionals and marine surveyors' low agreement rates indicate these sectors either lack confidence in their expertise or emphasize their impartial roles.

Conclusion

Shipping companies demonstrate the highest level of confidence in their knowledge of new fuel technologies, positioning themselves as sector leaders. Marine surveyors' neutrality reflects their intermediary role rather than increased collaborations with other sectors. These findings highlight diverse perceptions shaped by sectoral roles, with shipping companies and regulatory authorities standing out as the most confident, and insurers as the least confident.

7.5 Hypothesis 5

We have previously in chapter on Hypothesis 1 expanded on further attitudes and opinions about how shipping companies feel about their knowledge compared to other sectors, insurance sector included. The Hypothesis 5 is closely correlated to Hypothesis 1 and the extent of Hypothesis 5 has already been analysed in the chapter for Hypothesis 1.

With above in mind the researchers have decided to not include a second hypothesis analysis, as this would be mere repetition and thus exclude this hypothesis from its own chapter.

7.6 Hypothesis 6 and hypothesis 7

In this chapter we will analyse two hypotheses due to them being close to one another and thus analysing them in parallel is logical.

Hypotheses 6: *Shipping companies will choose an insurer with higher technical knowledge if given the option* and

Hypotheses 7: *Shipping companies are not willing to pay higher premiums for an insurer with higher technical knowledge.*

We will review these against the identified primary analysis questions and later do a deeper analysis into the demographics of the separate answer options.

To begin, we will analyse question 12. This question was only given to participants that selected shipping company as their marine industry selector (question 8). In Figure 41 we can see their answers for question 12.

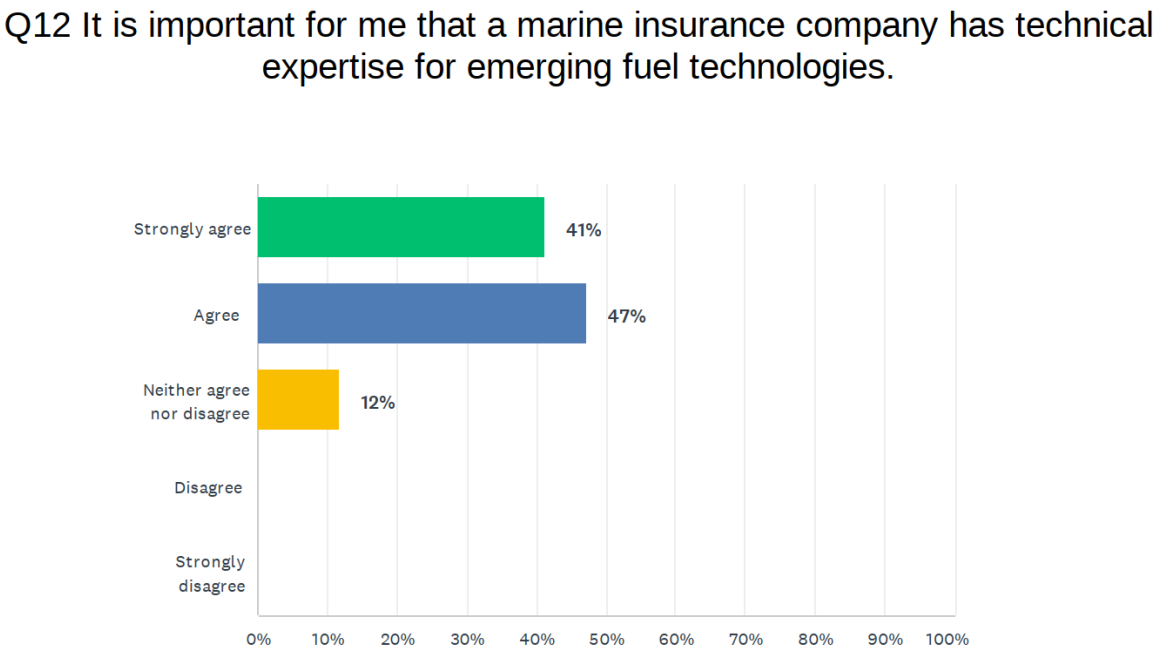

Figure 41 Importance of technical knowledge for insurers.

From Figure 41 we can see that a strong majority of shipping companies, 88% of respondents, find it important for them to have insurance companies with a technical expertise in emerging fuel technologies. 12% of survey respondents gave a neutral answer, while none of respondents found it to be irrelevant or not important (disagree with survey statement).

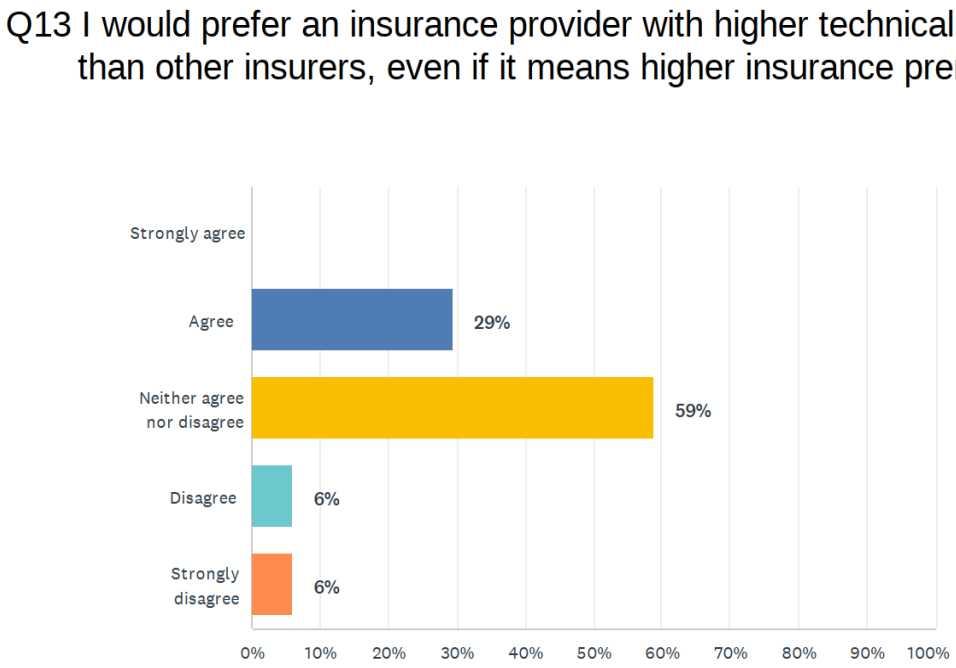

Figure 42 Preference of a more knowledgeable insurer.

The same participants from shipping companies were asked if they would prefer an insurance provider with higher technical knowledge, even if it would increase their insurance premiums. The results are presented in Figure 42.

Surprisingly, only 12% of respondents are displaying negative views to this statement, equally shared between disagree and strongly disagree. These are participants that are not willing to pay for higher technical expertise from insurance companies.

It must be noted that the disagreement respondents are only two in total, and thus their opinions might be more a personal preference than generalization. We will note on this further later in this chapter.

From the respondents, 29% agree with the statement, and are in principle willing to pay a higher insurance premium for a higher technical expertise and support provided from the insurance companies regarding new fuel technologies. This can further be checked towards question 10, (Hypotheses 1) were 35% of respondents found a lack of support from regulatory bodies and insurance companies regarding the adoption of new fuels. This would point towards that shipping companies feel left alone for the transition, and that they would like to get a higher support from the other marine sectors, and some are even willing to pay extra for this added feeling of support.

Neutral stance was selected by 59% of respondents stated to the question. We can combine this with question 12, which asked for the importance of technical expertise for insurers, were 88% of respondents answered that they find the technical expertise important from their point of view. We can draw a conclusion that if given the choice, if premiums are similar, these participants would likely prefer an insurance company with even a marginally higher technical expertise.

The participants were filtered against their country of occupation, question 6, to see if there are any regional differences in their attitudes towards paying for higher service.

As we can see in Table 16, most shipping company participants in this study are Finnish (68%), with smaller groups from Norway and Denmark (11% each), and smallest group of participants from Sweden and Estonia (5% each).

Finland	68%
Sweden	5%
Norway	11%
Denmark	11%
Other (Estonia, Germany, Netherlands and Belgium)	5%

Table 16 Distribution over countries

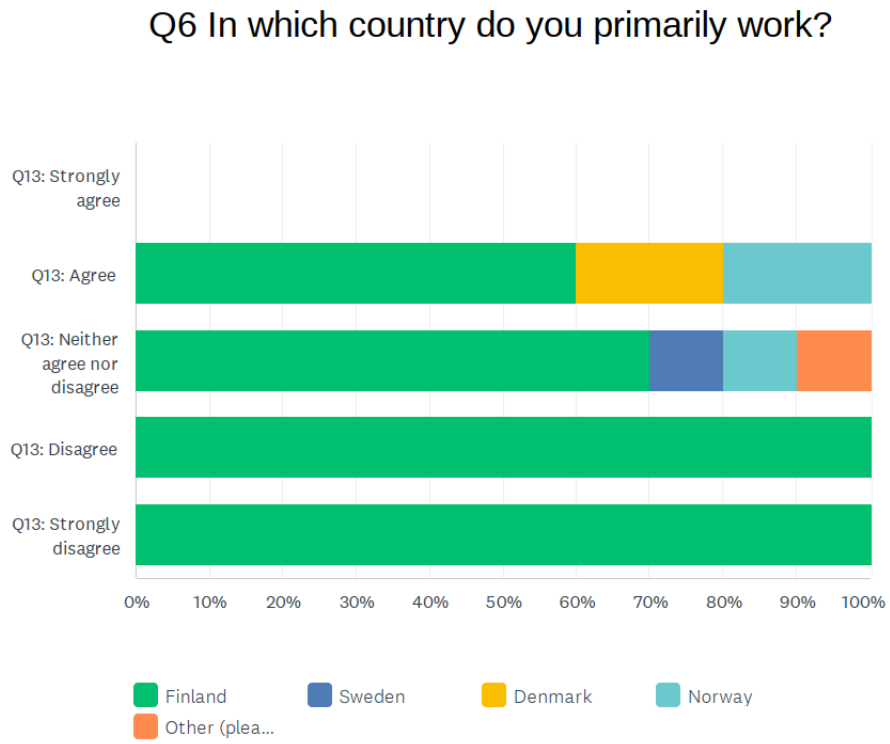

Figure 43 Primary country of occupation.

In Figure 43 we can see this distributed according to the response on question 13. We need to separate groups as Finland and non-Finland due to the large number of participants from Finland. We can see a trend that in the groups negative towards higher premiums are only Finnish companies and the trend from Finnish companies are less in favour of higher premiums overall, but closely correlation to the opinions of the general population. Shipping companies from all other regions that participated, show a neutral or positive stance towards the statement. From this we can see a slight trend that shipping companies from other Nordic and Baltic regions are slightly more inclined or willing to pay for higher technical expertise as part of their insurance relationships than their Finnish counterparts.

Disclaimer: To continue with further demographic analysis of these participants, the researchers have decided to limit the analysis from the participants that answered to disagree or strongly disagree with the statement of question 13 for further analysis. This is motivated with that the sample size is small with only two participants displaying these views and might be more opinions of personal preference than generalization of a group. We will mention this during sub-analysis discussion, and we will continue to show them in the Figures displayed.

We decided to check further into the demographics of the respondents that are neutral or positive for question 13. Selected for age, this gives us data in Figure 44

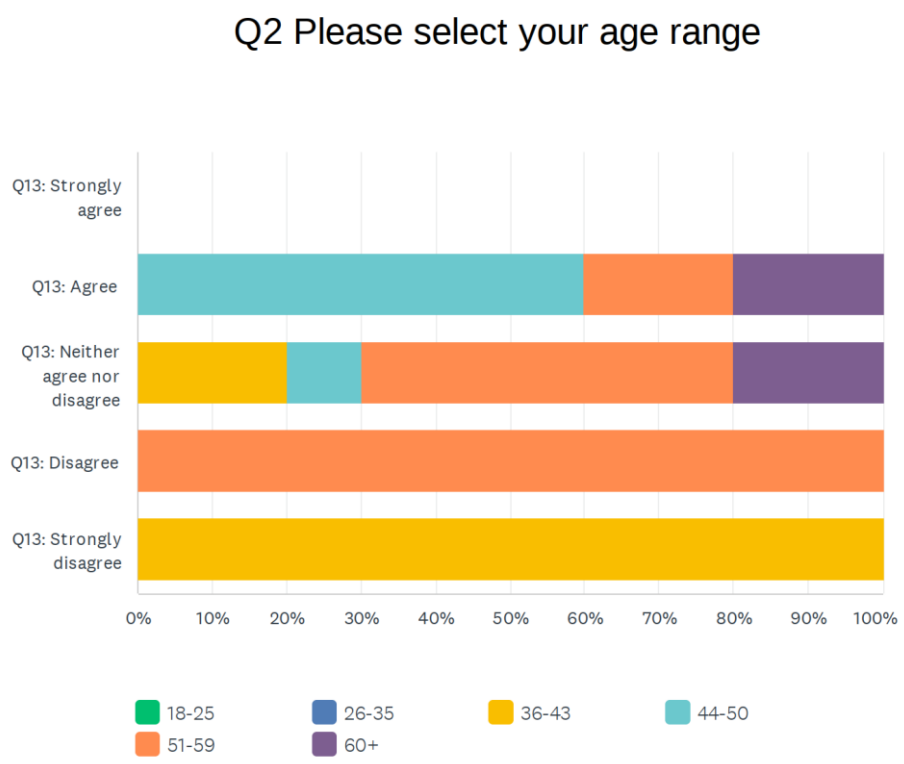

Figure 44 Age ranges.

For the group of 60 or above years of age, the distribution between neutral and positive is equally distributed.

The most positive views can be seen in the generation X group with 80% of the positive answers coming from this generational group. Especially the younger part with 44–50-year-olds show the most positive views towards paying higher premiums for higher technical expertise. This generational group seems to be split, as the older generational X show more restrain and are more neutral in their position.

Millennials are also showing more caution, with no one giving a positive answer. The correspondent showing least willingness for paying for higher expertise also belong to this group.

This can be assumed that generally, older participants are more willing to pay for technical expertise, and younger are slightly more neutral or negative towards it.

This correlates closely to the working experience within the maritime sector, as seen in question 5 and Figure 45. Respondents with longer working experience within the sector

are slightly more inclined towards paying higher premiums for an increased level of service.

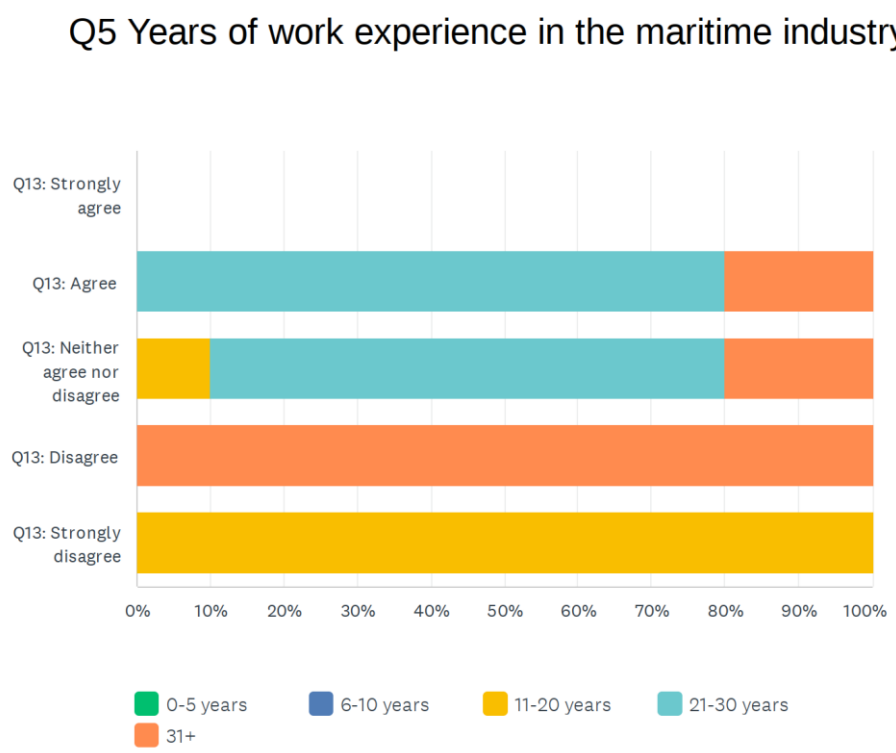

Figure 45 Years of working experience.

As we have seen in the previous Figures, generational differences and working experience correlates closely to one another. We will now check this for further demographic selectors, beginning with level of education, as shown in Figure 46

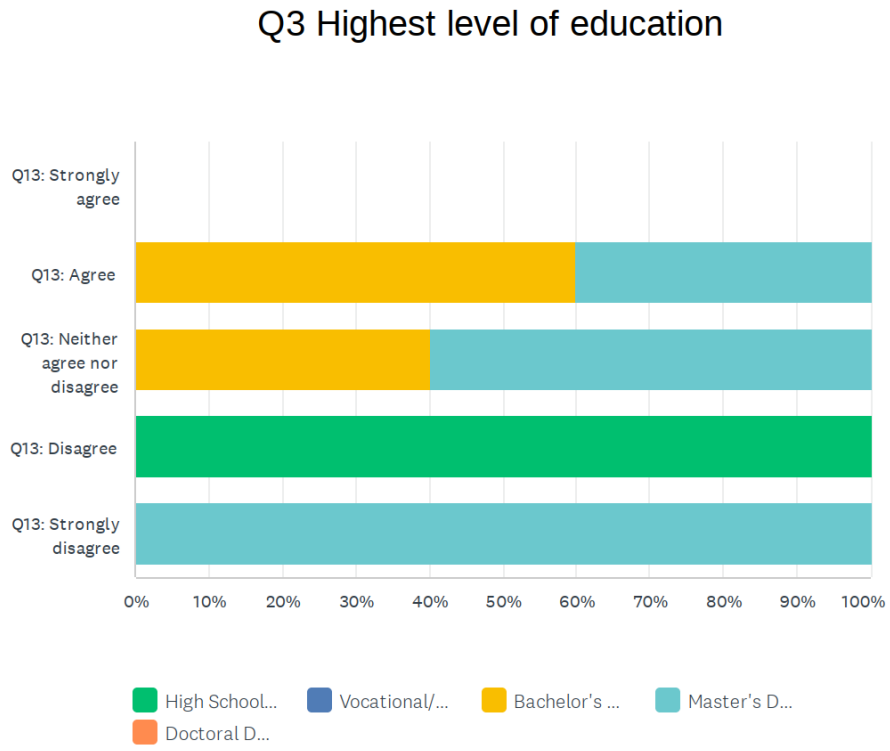

Figure 46 Level of education.

Here we can see those respondents holding a bachelor's degree are more likely to hold a positive view towards the statement in question 13, whilst holders of master's degree are more neutral in their stance, with one respondent being in strong disagreement. This can indicate that higher level of education brings a familiarity and comfort with new technology. This is counteracted with a participant holding a high-school diploma as the highest level and simultaneously being negative in their opinion. As stated before, this is one participant's opinion, and should be taken with caution, but not dismissed.

Q4 Please select the option that best represents your primary field of expertise

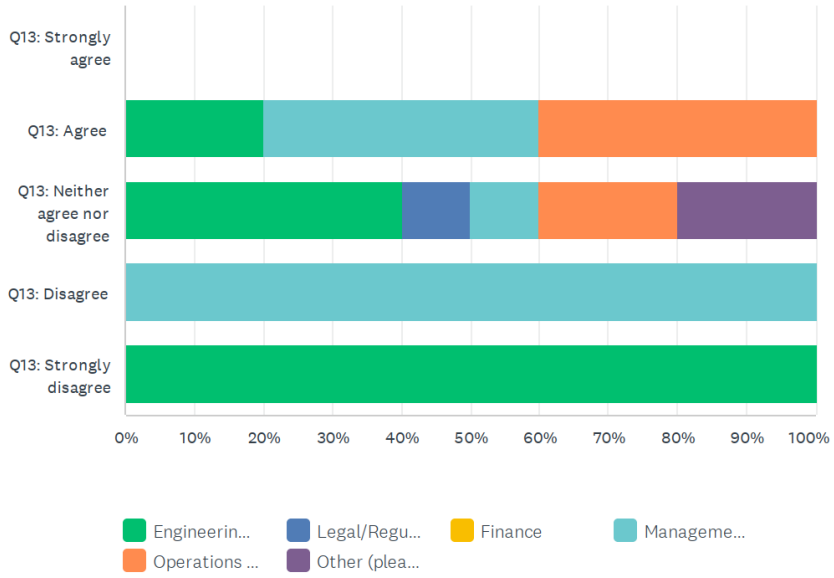

Figure 47 Primary field of expertise.

We will next review this against the field of expertise and to see trends in this as shown in Figure 47. Here we can see that respondents with occupation in management and operations are more inclined towards agreeing with the statement than respondents with technical background. Technical background field of expertise is generally half as likely to be willing to pay higher premiums for higher technical expertise from insurers. This can be directly related to that the implementation of new fuel technologies are in the technical field and that technicians generally feel more comfortable with technology and thus less intimidated by it. Legal background participants are comfortably in the neutral position.

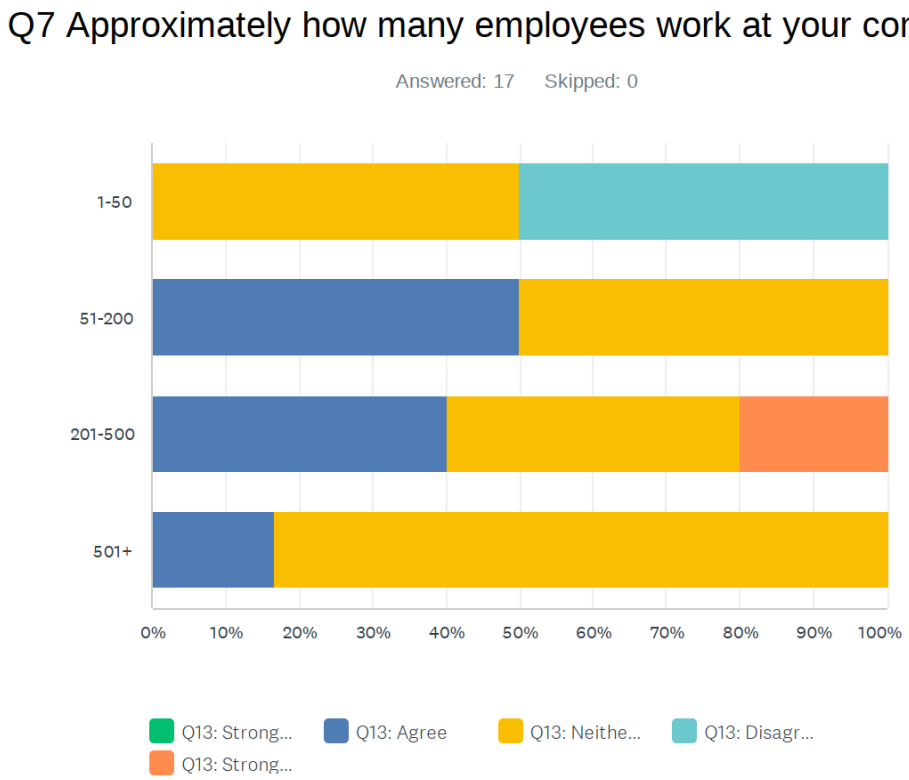

Figure 48 Company size.

Sorted by company size, we can see in Figure 48 that medium sized companies and small enterprises (51-500 employees) are more likely to be positive, even though small enterprises are displaying a minority in strong disagreement (20%).

Large enterprises with over 500 employees are holding a more neutral stance, with more than 80% selecting a neutral stance. This can be as large enterprises have a larger technical expertise internally, and thus not needing to rely on external parties, such as insurance companies or regulators. This would mean that larger the company, less positive towards paying for higher external expertise in business partners.

This can be directly disproved by the smallest size of companies (1-50 employees) also selecting a neutral stance or even a negative stance in one instance. This small size of companies operates a limited number of vessels and thus the onshore organization is also small and require more multi-skilled employees onshore, with less specialization and broader knowledge into areas of operation, technologies and management, for example insurance contracts, drydock planning and spare parts ordering done by a single person.

Larges companies have the possibility for a larger ship support organisation with team members being more specialized in their tasks. These companies will in many cases not

find it feasible to afford not afford further deeper or specialized technological knowledge in-house, and are willing to hire in the expertise needed to complete projects or tasks, as these might not be executed on a continuous schedule

Large enterprises tend to have more projects run on a continuous schedule, and in these cases, it is more affordable and gives better availability to have the expertise in-house than to outsource it.

7.6.1 Hypothesis summary

In this chapter we have examined 2 hypotheses related to shipping companies' preferences and willingness to pay for higher technical expertise from insurance companies. Key findings include:

7.6.1.1 Value of technical expertise Q12

When asked about the importance of technical expertise from insurers, 88% of shipping companies considered it important for insurance companies to possess technical expertise in emerging fuel technologies. Twelve percent of respondents were neutral.

Notably none of the participants deemed it unimportant to have technical expertise for insurance companies. This indicates that technical knowledge is a highly valued quality in insurance providers.

7.6.1.2 Willingness to pay for expertise Q13.

Participants were asked if they would prefer an insurer with higher technical expertise even if it meant paying higher insurance premiums.

- Twenty-nine percent were willing to pay more.
- Fifty-nine percent remained neutral, indicating they value expertise but are not willing to accept increased costs.
- Twelve percent disagreed and would not be to pay higher premiums.

Interestingly this aligns with earlier findings from question 10 that 35% of shipping companies feel unsupported by regulators and insurers in the adoption of new fuel technologies. This suggests some companies would value, and even pay for, additional technical support.

7.6.1.3 Demographic and Regional trends

The survey revealed distinct regional attitudes and differences.

Finnish companies (68% of respondents) were less inclined to pay higher premiums for technical expertise compared to other shipping companies from Nordic and the Baltic regions.

From Norway Denmark Sweden and Estonia leaned more neutral to positive indicating slightly greater willingness to invest in specialized technical expertise from insurance companies

7.6.1.4 Generational and experience-based insights

Generation X (especially aged 44 to 50) showed the highest willingness to pay more with 80% positive responses coming from this group.

Millennials were more neutral or negative with no one expressing a willingness to pay higher premiums.

Participants with extensive experience in the maritime sector were more inclined to value and pay for technical expertise than participants with less experience.

7.6.1.5 Educational background

Participants' willingness to pay for their expertise also varied by education level.

Respondents with bachelor's degrees were more likely to agree with paying higher premiums for technical expertise while those holding a master's degree tended to adopt a neutral stance, possibly reflecting a greater familiarity with technical challenges and a more cautious approach to cost.

A single respondent with a high school diploma strongly disagreed with the idea of paying more though this can be more personal preference than outline a broader trend.

7.6.1.6 Professional expertise and role

Respondents' roles within their companies influence their attitudes.

Those in management and operations were more inclined to value and pay for insurers technical expertise reflecting their focus on strategic support and risk mitigation.

Participants with technical backgrounds are less willing to pay extra likely due to their comfort and familiarity with new fuel technologies.

Legal professionals maintain their neutral stance potentially focusing on contractual and regulatory matters over technical ones.

7.6.1.7 Company size.

The size of company also seemed to have had an impact on the responses. Medium-sized companies with 51 to 500 employees were the most willing to pay for higher technical expertise.

Larger companies (500+ employees) were more neutral as they often have internal teams with specialized expertise, reducing their reliance on external parties for technical guidance.

Small companies with one to fifty employees leaned neutral or negative, reflecting their habit of having to be reliant on single and multi-skilled employees due to limited budgets.

7.6.1.8 Observations and implications.

1. Internal expertise versus external support.
    a. Larger companies with extensive in-house expertise see less value in outsourcing technical knowledge to insurers. Smaller and medium-sized companies often rely on external expertise but are cautious about added cost.
2. And experiential differences.
    a. Older, more experienced professionals tend to see a greater value in technical expertise and are more willing to invest in it. Younger participants, particularly millennials, may perceive these costs as less justifiable.
3. Regional variations
    a. Finnish companies displayed a consistent reluctance to pay higher premiums while other Nordic and Baltic participants demonstrated a slightly more positive stance, reflecting a difference in cultural and economic priorities.

7.7 Hypothesis 8

In this chapter we will analyse hypothesis 8 that discusses if young and early-career professionals have a more positive attitude towards emerging new fuel technologies.

To begin, we will discuss the findings from question 33 and shown in Figure 49, with asking participants if they find that younger generations are more positive towards adopting new fuel technologies. We begin by checking the data for the general population of the survey.

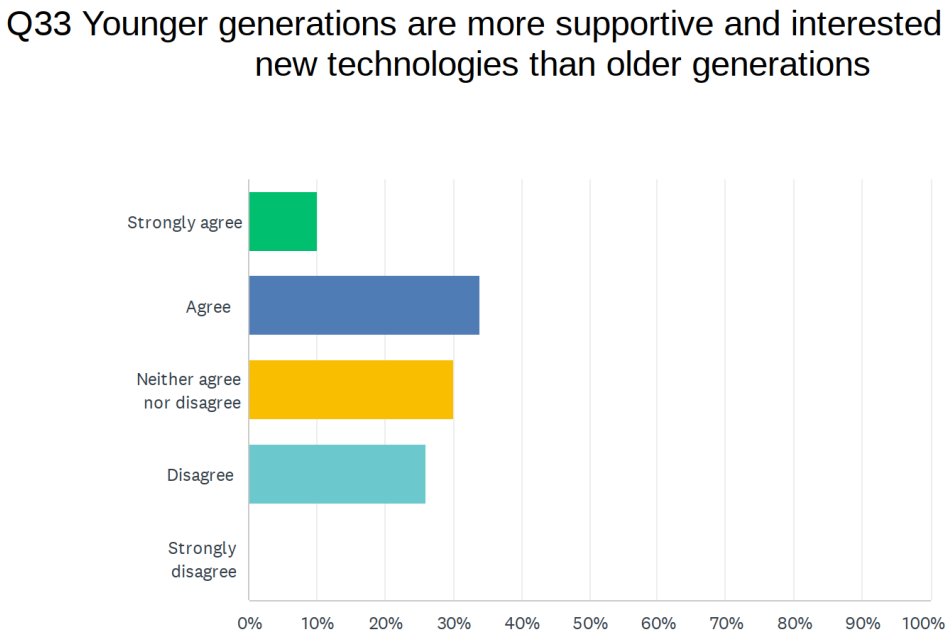

Figure 49 General population.

From the general population, 44% of respondents agree with this statement that the younger generations are more supportive and interested in adopting new technologies than older generations. Of these, 10% strongly agree with the statement. Thirty percent are neutral while 26% of respondents disagree with the statement. No participants are strongly in disagreement with the statement. In this question, having a neutral stance towards the statement would indicate that they do not support the statement, but do not have strong opinions. Combining neutral and disagreement sections, would show that 56% do not believe that younger generations are more supportive whilst 44% do believe that younger generations are more supportive. This is close to a half-split, with a lean towards not believing the statement to be true.

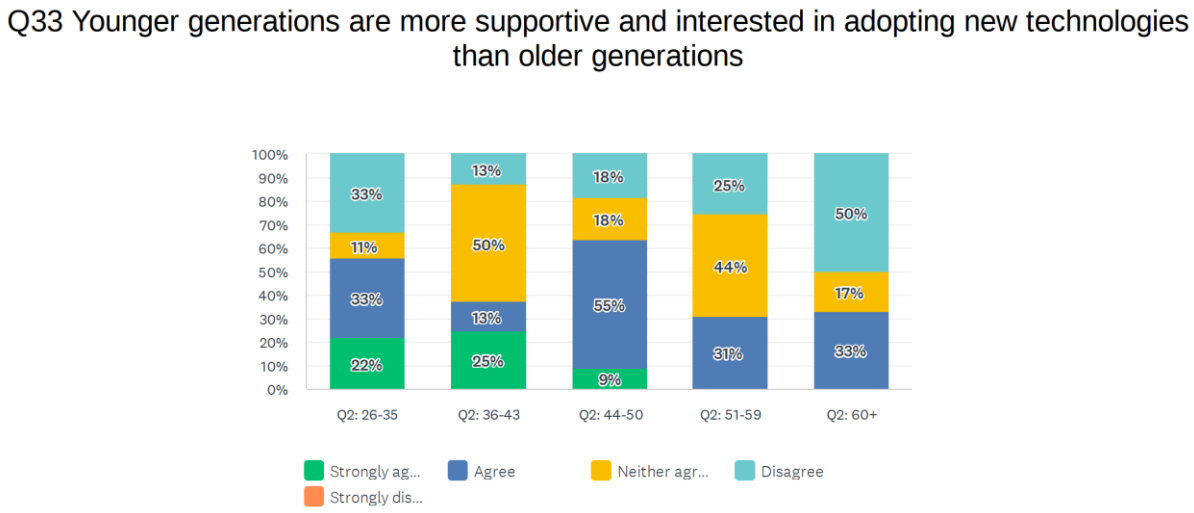

Figure 50 Comparison over age groups.

When dividing by age group we can see following insights from Figure 50. The groups are split in their opinions, and generalizations are hard to be concluded from the data we achieved. Below we have some detailed insights of these specific groups.

Ages 26 - 35

This group is split between agreement (55%) and disagreement (33%) with a small portion being neutral (11%). Younger participants tend to be more in strong agreement with the statement, thus indicating that the youngest people tend to feel themselves more open and supportive of newer technologies than their older counterparts. This can suggest confidence among some of that younger generation to adopt technology more easily, but also part of the group feeling insecure about the same technology.

Ages 36 - 43

Half of this group is neutral, with moderate agreement being selected by 13% of participants and strong agreement by 25%. Additionally, this group has low disagreement rate with 13%. This group is more cautious than other groups, showing the highest rate of neutrality of all groups. While 38% do believe that younger people are more supportive of new fuel technologies, this group shows the strongest support for the statement, with a quarter of respondents selecting the strongest agreement option. This shows less polarization amongst participants compared to the youngest group and overall, a caution towards this statement.

Ages 44 - 50

This is the age group that show strongest support for the statement, with almost 2/3 of participants believing that younger generations are more supportive for new fuel adoptions. This can indicate that this group are already further away in the generational gap and can see younger people generally having it easier to adapt new technologies.

Ages 51 – 59

This group do not believe that younger people are more supportive of new technologies. This age group are mainly in the neutral position with 44%, and only 31% in agreement. A quarter are negative to this belief. This suggest that these older employees might not see the younger groups as a resource to be of great assistance in a transition, and they might generally show more conservative opinions towards the whole transition.

7.7.1.1 Experience impact

We analysed the same question and compared it towards the level of experience in the marine sector. This is somewhat correlated with the age group opinions, as older people tend to have more experience within their fields. As before, generalization is hard to achieve, as the groups are split in their opinions. The oldest people tend to be most negative towards the belief that younger are more supportive and in favour, but this can only be applied in the highest groups of both working experience and age and not applied as a rule in the middle age groups.

The group with lowest amount of experience, the 0-5 years group, the participants are the most positive of all, with no one expressing any disagreement with the statement, shown in Figure 51. This might indicate a strong positiveness for entry-level employees for the future adoption of new fuels.

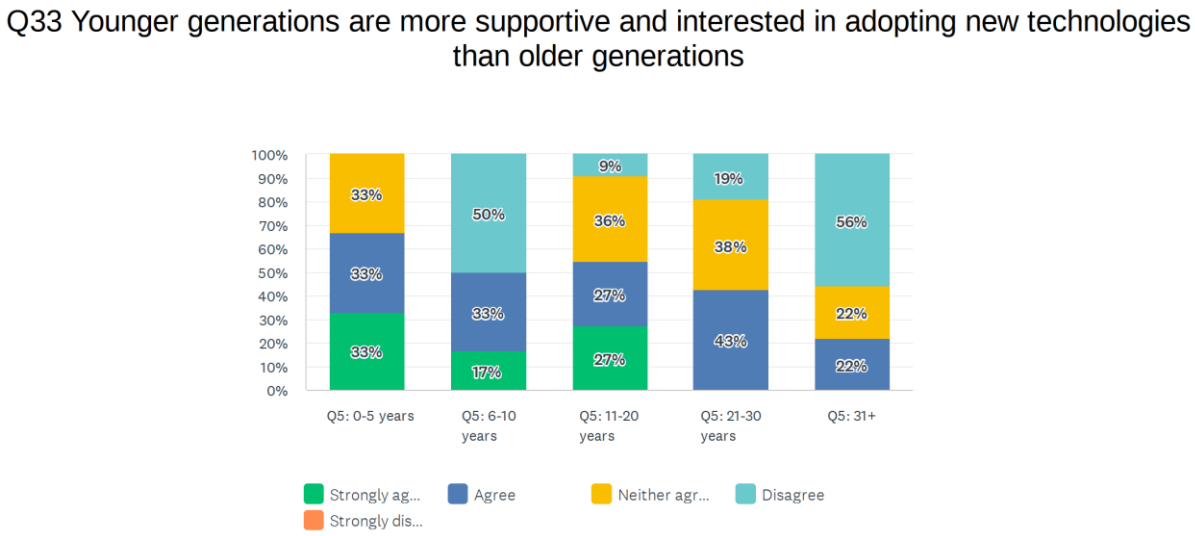

Figure 51 Comparison of working experience.

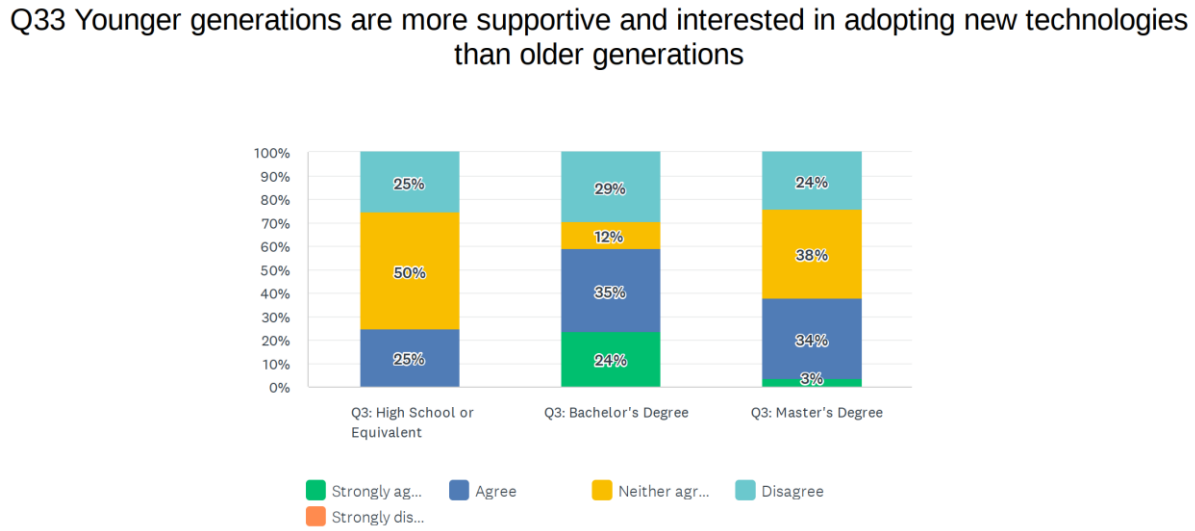

Figure 52 Level of education.

Disagreements rate seems to be equally spread between different educational levels, and thus not showing any trends as presented in Figure 52.

Respondents holding a bachelor's degree have a clear preference for agreement, with 59% sharing the belief that young people are more likely to be supportive, with 24% being in strong agreement. Respondents holding a master's degree and high school diploma have similar spread of opinions. Generally, we cannot conclude any general rules or trends from these statistics.

Field of expertise

As we have seen so far, no broader trends regarding these opinions have been found and we continue with the professional field to further try to identify trends or insights. From Figure 53 we can see that the technical group is strongly polarized in their opinions, with neutral being selected only by 15%, and the ones in favour or against being almost equally split.

The group holding most positive views would be the management and administration sub-group, with the group equally split between neutral and in favour, and no one in disagreement. This might indicate that the management teams see the younger generation as supportive and a potential resource for the future transitions in a more positive light than other groups.

Finance and operations groups are also split in their opinions, with operations being slightly more in favour of the belief. Least positive views are held by the legal and regulatory sub-group, with only 28% in agreement or strong agreement with the statement. A total of 72% remain neutral or in disagreement. This could possibly indicate that legal departments might not encounter the new technologies in the same ways or as often as other departments and thus being more conservative.

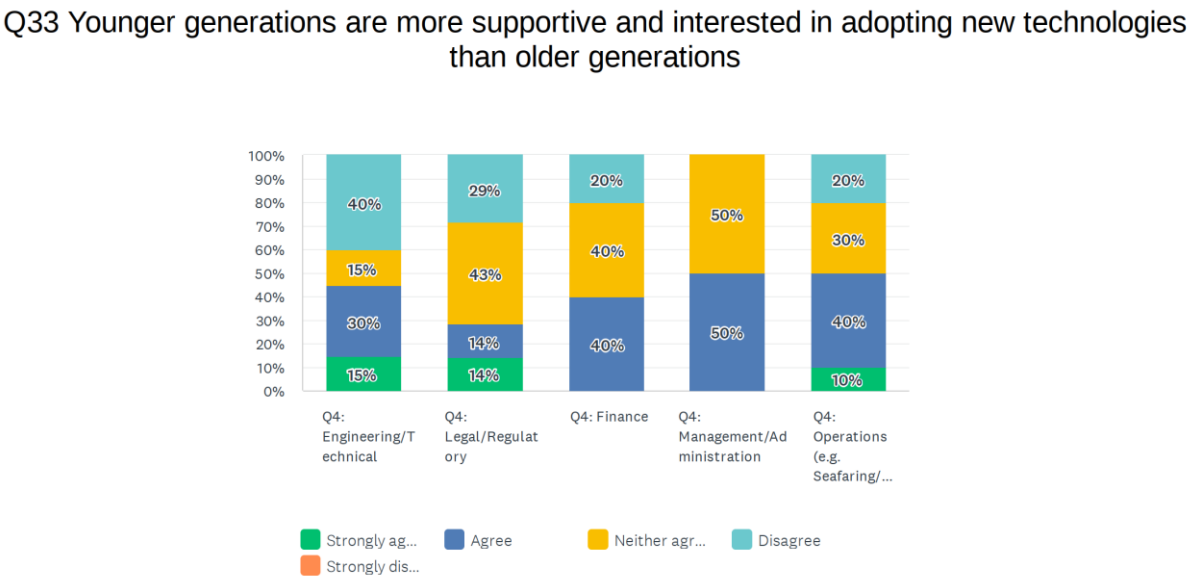

Figure 53 Professional fields.

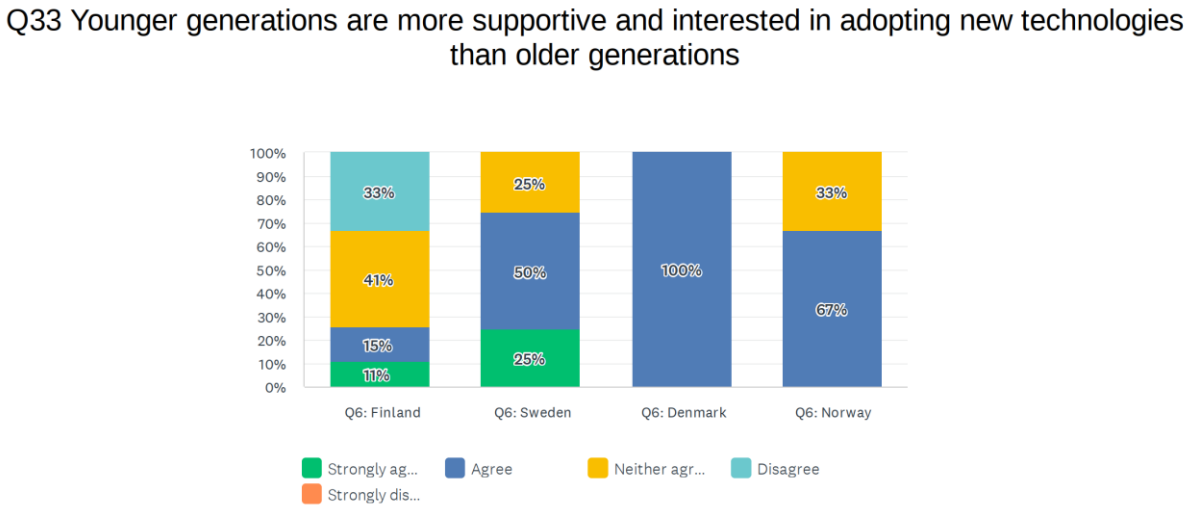

Figure 54 Country of occupation.

We furthered out analysis with dividing according to country of occupation and shown in Figure 54. Here we can see that respondents from Scandinavia are much more in favour of the belief that young people are more supportive towards adoption of new technologies. No participants from these countries disagree, with Sweden being in clear top amongst positive opinions. The study had only one participant from Denmark, and thus this has been excluded from analysis due to a too small sample size to make a comparable analysis on.

Finnish participants show the most negative and neutral views, with 41% holding a neutral stance and a third holding negative views towards the statement. Only a quarter (26%) are holding positive views towards the statement. This can be compared to Sweden where 75% of participants held the same views. It seems that there can be a strong cultural influence and difference between the Nordic countries, with Finnish marine sector being much more averse to the belief that younger people are more supportive towards new fuel technologies.

We further checked if there are any trends suggesting differences between marine sectors. From Figure 55 we have selected only participants holding a disagreement with the statement. We can see an almost equal distribution between marine sectors, with shipping companies (38%), insurance companies (31%) and marine surveying and regulatory bodies (31%). These insights that there are no trends that any marine sector would be more of less inclined in believing younger people are more likely to support new technologies.

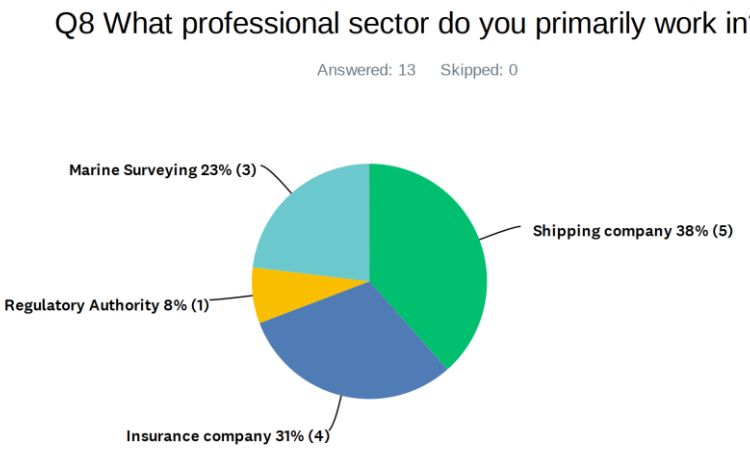

Figure 55 Distribution of disagreement of the statement if younger people are more supportive of new fuel technologies.

Broader opinions from age groups

We will next dive into further opinions and attitudes compared between age groups. We have so far seen not many trends in correlation with the statement that younger people are more supportive of new fuel technology, and certainly nothing that can be seen as a revelation. Our intention is to analyse if there are any trends that are present between age groups, and to find this, we have selected questions

23. I have a good understanding and knowledge about the new and emerging fuel technologies in the maritime industry
24. I feel that I should know more regarding new emerging fuel technologies
31. I am in favour of adopting new fuels in the maritime industry
34. I feel that my organization is open to adopt new fuel technologies and knowledge
39. How frequently does your company provide training on new and emerging technologies.
41. I am concerned that my company is not ready for the adoption of emerging fuel technologies
42. I think we should invest more into new maritime technology in my company
45. I am optimistic about the potential of new technology to improve the future of shipping.

We have in an earlier chapter seen that 80% of respondents are in favour of adopting new fuel technologies, with only 4% being against the adoption. We begin with the participants opinions and attitudes with questions 31 and 45, shown in Figures 56 and 57. Compared by age groups we can see that the age group least in favour of adopting new fuels are youngest millennial age group with ages 26-35. In this group, 22% of respondents are not in favour of adopting new fuel technologies, and this is the only group holding negative views towards the adaptions. This group is five times more likely to hold negative views towards new fuel technologies than the general population. Simultaneously, the same age group displays the highest and strongest in favour of adopting, with 44% being in strong favour, while at the same time not displaying any neutral views. Figure 57 shows a similar pattern, with this age group being most pessimistic, whilst overall holding an average attitude that new technologies will improve shipping. This shows a clear polarisation within the group, with a smaller majority being negative and pessimistic about new fuels and technologies.

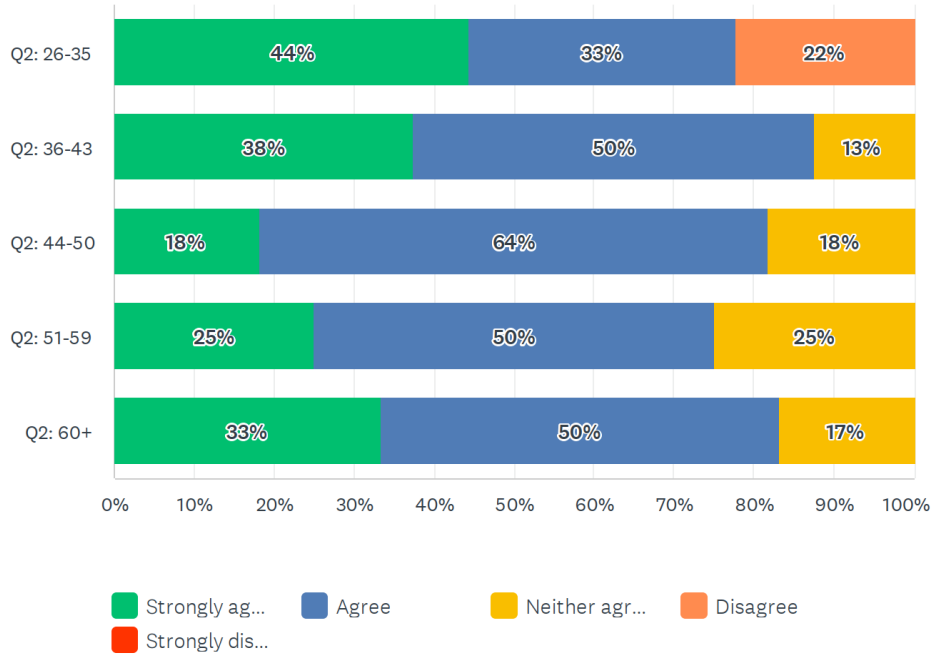

Figure 56 In favor of adopting new fuel technologies Q31.

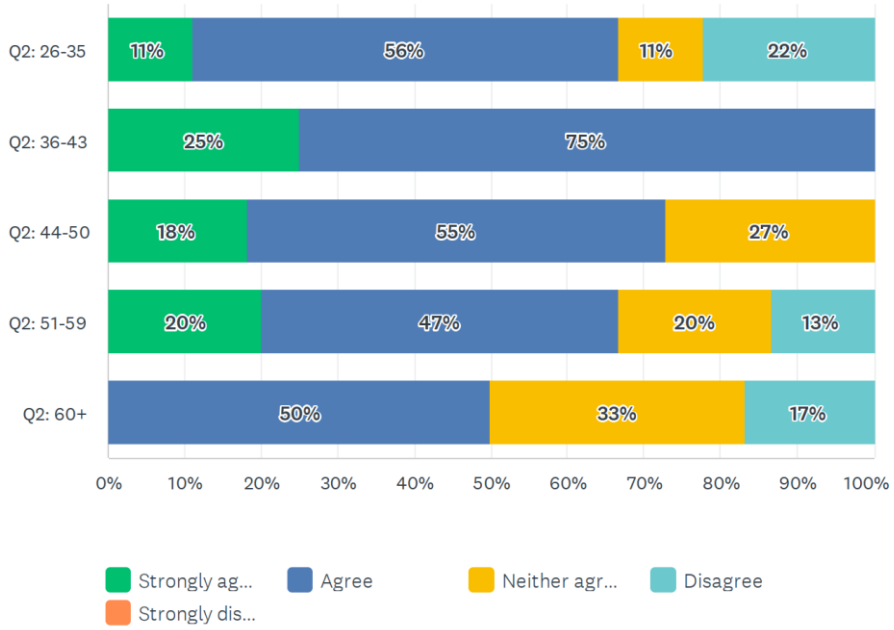

Figure 57 Optimism for implementing new fuel technologies Q45.

In general, the older age groups show more neutral and balanced opinions. The researchers believe that these differences stem from the reasons that younger people might be more swayed by their feelings and affecting their opinions, while older people are having a larger pool of experience and history to draw their conclusions from. This can be seen in Figure 57, with more balance and lean towards neutral than other groups.

In questions 23 and 24 we further see this polarization within the youngest groups. When asked if they have a good understanding and knowledge of new technologies (Figure 58), 44% answered that they do not, whilst 44% answered that they do, with half the ones in agreement being in strong agreement that they have a good understanding. Other groups show a much more neutral position, except the oldest age groups that display a similar, but not as extreme polarisation.

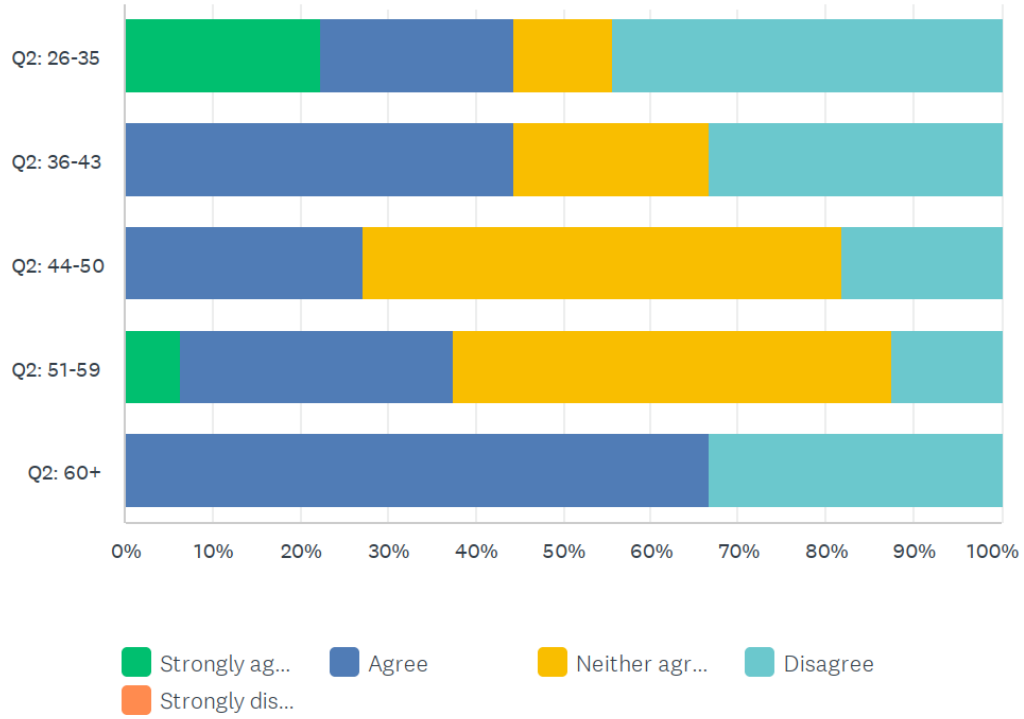

Figure 58 Self-assessment of knowledge Q23.

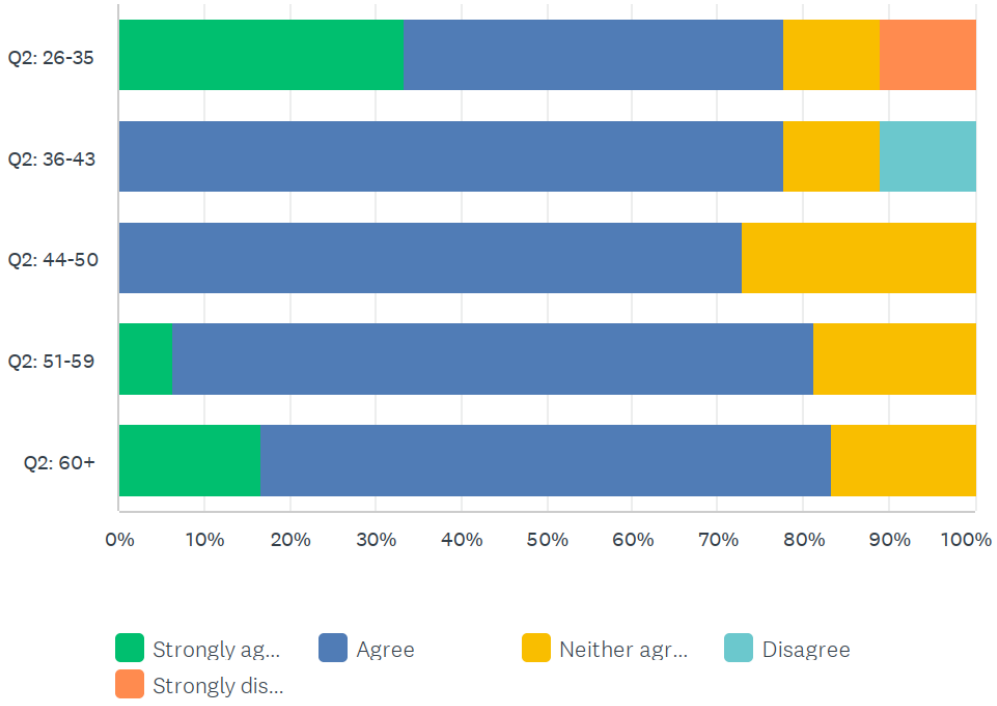

Figure 59 Feeling of inadequate knowledge Q24.

When asked if they feel that they should know more about the new technologies (Figure 59) the polarisation is further cemented within the youngest generations. Only the millennial group (ages 26-43) have participants that do not find that they should learn or know more about new technologies. This is in stark contrast with the Generation X and

Boomer generation, with them showing a clear pattern that the older they are, the more they find that they should learn or know more about the new technologies.

We wanted to analyse if there are further backgrounds for these findings and to see if this can have something to do with training and education.

Q39 How frequently does your company offer training on emerging fuel technologies.

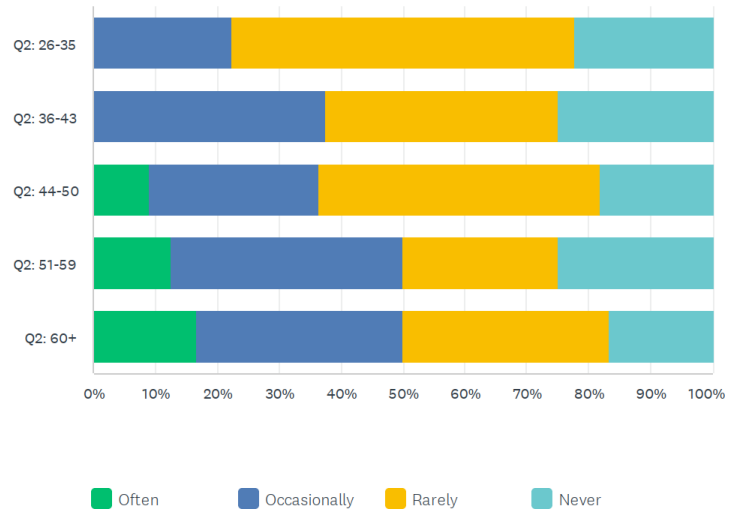

Figure 60 Training opportunities given.

As we can see in Figure 60, we can see a clear pattern that younger generations are not offered training opportunities on new technologies as frequent as the older generations. The number of participants finding that their companies are never providing any training are consequent over the age groups. Millennial age group are more prone to rarely have training opportunities and overall, in this generational group, 29% finding that their employer offers occasional opportunities for training. No one in the generational group find that there are ample opportunities to achieve training. The older generations find that they are given more occasional and often training opportunities regarding new and emerging technologies than the younger groups.

This might show a somewhat trend that companies might not value or want to invest in younger generations and their future. The polarization in this group might be because of personal interests and some individuals pushing for new knowledge, whilst others are not as active.

Disclaimer from researchers: This research and question does not take into any specific and universal intervals for training. The terms, “never, rarely, occasionally, often” are up

to personal opinions and feeling and the researchers point out that this question is deliberately formed in this way to capture the feelings and opinions. It might well be that a certain amount of training opportunities for a younger person might be selected as rarely given opportunities, whilst and older person might opt for the feeling of an often-given opportunity. This study will not detail this further, as we have encompassed the given research plan with this.

Finally, we will analyse how respondents feel about their company readiness for adoption of emerging fuel technologies, shown in Figure 61. Here we see that 63% of the youngest age group find that their company is not ready for the transition to new fuels, and that they feel concerned about this.

As we have seen in other question, the youngest age group and the oldest group are more aligned in many opinions than the middle age groups. This is again displayed in question 41. The older Millennials are showing a more neutral or indecisiveness with 43% being neutral and 43% not being concerned. Least concerned are the ages groups 44-50 and 51-59, with 80% and 86% respectively not being concerned with their company's transition towards new fuels.

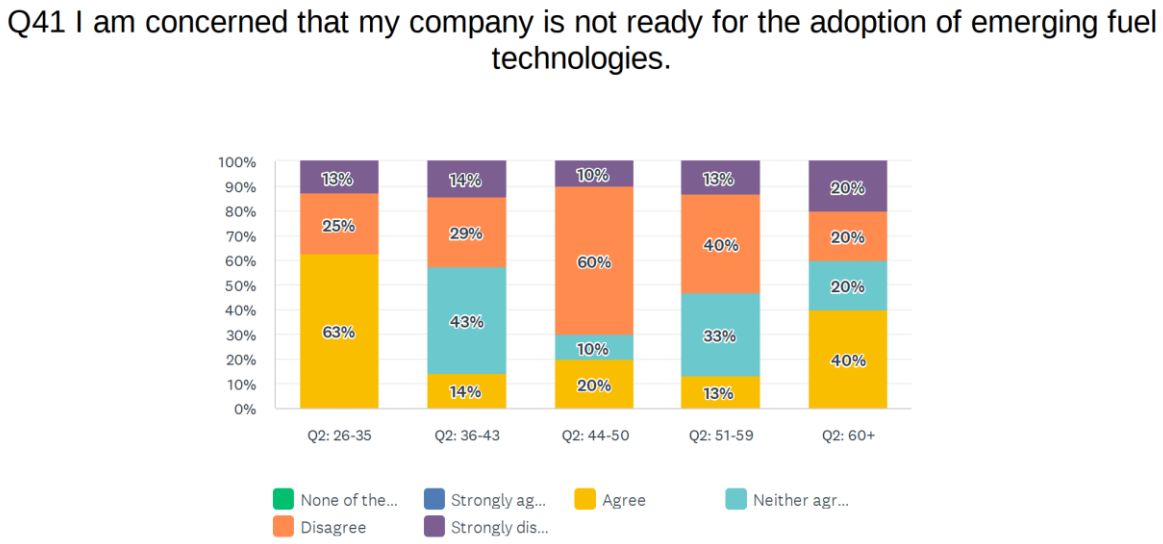

Figure 61 Concern for not being ready.

7.7.2 Hypotheses summary

In this chapter we have analysed the hypothesis that early-career and junior professionals are more interested in new technologies than senior and veteran professionals. Key findings include:

Generational Attitudes (Q33):

- Among the general population, 44% agree that younger generations are more supportive of adopting new technologies, while 56% are neutral or disagree.
- Ages 26–35 show the highest polarization, with 55% agreeing, 33% disagreeing, and only 11% neutral. This group displays both strong enthusiasm and scepticism toward new technologies.
- Ages 36–43 lean toward caution, with 50% neutral and only 13% in strong agreement.
- Ages 44–50 are the most supportive, with two-thirds agreeing that younger generations are more inclined to adopt new technologies.
- Ages 51–59 are predominantly neutral (44%) or disagree (25%), reflecting a more conservative outlook.

Experience (Working Years):

- Entry-level professionals with 0–5 years of experience are the most positive, with no participants disagreeing that younger generations are more supportive.
- Participants with greater work experience tend to align with the older age groups, showing more neutral or negative opinions.

Education Levels:

- Holders of bachelor's degree are the most supportive, with 59% agreeing and 24% in strong agreement with the belief that younger generations are more supportive.
- Disagreement rates are distributed evenly across educational levels, and there are no clear trends among participants with master's degrees or high school diplomas.

Professional Fields:

- Management and administrative professionals are the most positive, with no respondents disagreeing that younger professionals are more supportive of new technologies.
- Legal and regulatory professionals are the least supportive, with 72% either neutral or in disagreement.
- Operations and finance professionals are split, with operations leaning slightly more positive.

Country cultural differences

- Scandinavian respondents, particularly Swedes, are highly supportive of the idea that younger generations are more inclined toward new technologies.
- Finnish respondents are the least supportive, with 41% neutral and only 26% agreeing. This suggests cultural differences within the Nordic region.

Training Opportunities (Q39):

- Younger generations report fewer training opportunities, with 29% of Millennials stating their employers rarely provide training on new technologies.
- Older generations perceive more frequent training, possibly contributing to the polarization within younger groups.

Company Preparedness (Q41):

- Ages 26–35 are the most concerned about their company's readiness for adopting new technologies, with 63% expressing doubts.
- Older groups (ages 44–59) are more confident, with 80–86% indicating little concern about organizational preparedness.

Summary conclusion:

The hypothesis is partially supported.

Younger and less experienced professionals seem to express higher enthusiasm and optimism about new technologies. However, significant polarization within younger groups complicates the analysis and picture, as does variation across cultural and professional contexts. Factors such as training availability, organizational support, and

exposure to technology also play crucial roles. Addressing these gaps could help achieve more consistent engagement across age groups.

7.8 Hypothesis 9

In this chapter we will analyse the statement: *Employees in insurance might feel that they are not knowledgeable enough.* We have chosen to analyse this statement because it might be that employees in insurance companies might not be as directly involved in implementing fuel technologies as shipping companies or marine surveyors, which are more directly attached to these technologies. Insurance companies might firstly be involved with these technologies once an incident or accident has occurred. We also want to analyse if there is a difference in age and working experience. We also want to see if the background and fields of expertise might be impacted the feeling or comfort with new fuel technologies.

We will begin with analysing Question 4. We will first see if the respondents from the insurance sector differ in general metrics from the general survey population. In Figure 62, we can see that insurance companies have a much more evenly distributed field of expertise within their teams, compared to the general survey population in Figure 63. We see that the general marine sector population have higher percentage of technical background (38%) than insurers (26%), while insurers employ more finance (22%) and legal teams (22%) than the general population do for their finance (9%) and legal (15%). This is most likely due to the reason that insurers need a broader field of expertise within their teams to support their business model that for example shipping companies.

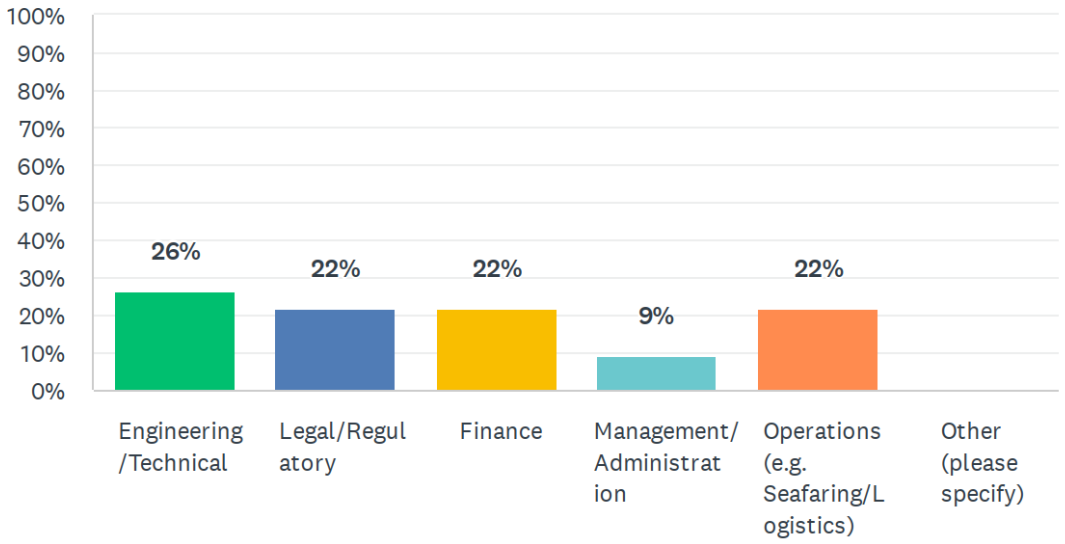

Figure 62 Participants from insurance companies Q4.

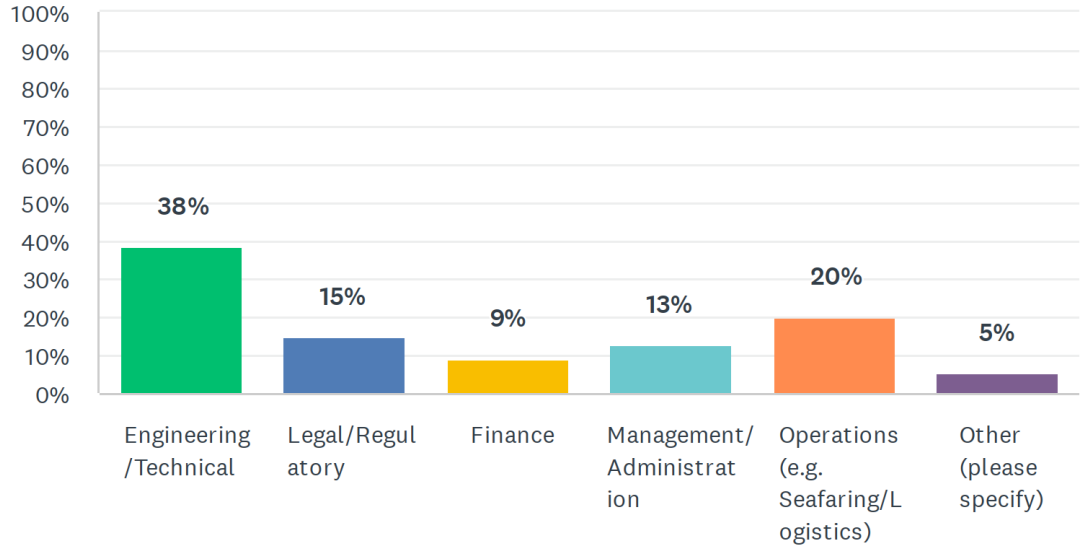

Figure 63 General population Q4.

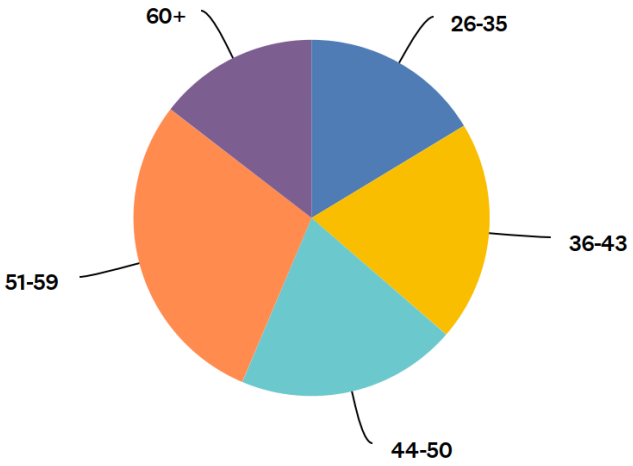

Figure 64 General population Q2.

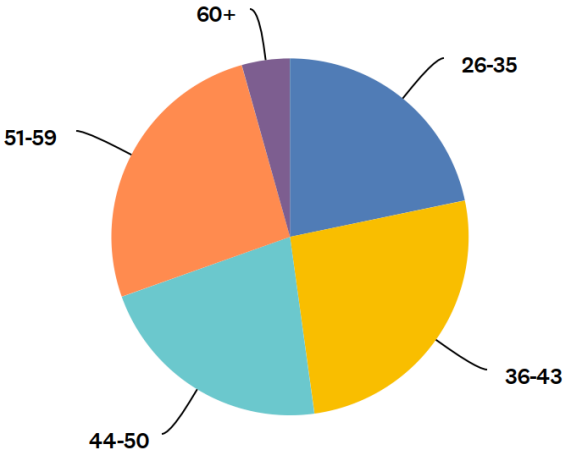

Figure 65 Participants from insurance companies Q2.

From our survey data, we reviewed if there is any noticeable differences in age groups. Insurers are presented in Figure 64 and from this we can see a difference with participants in the 60+ cathegory, and otherwise closely correlating with the general survey population, shown in Figure 65.

We further analysed the general demographical data between insurers and the general population and could not find anything specificcally out of the ordinance within the insurers group. This indicates that the survey insurance group is well coordinated with the general survey population.

We will next go further into attitudes and opinions on knowledge levels for insurers by analysing question 23

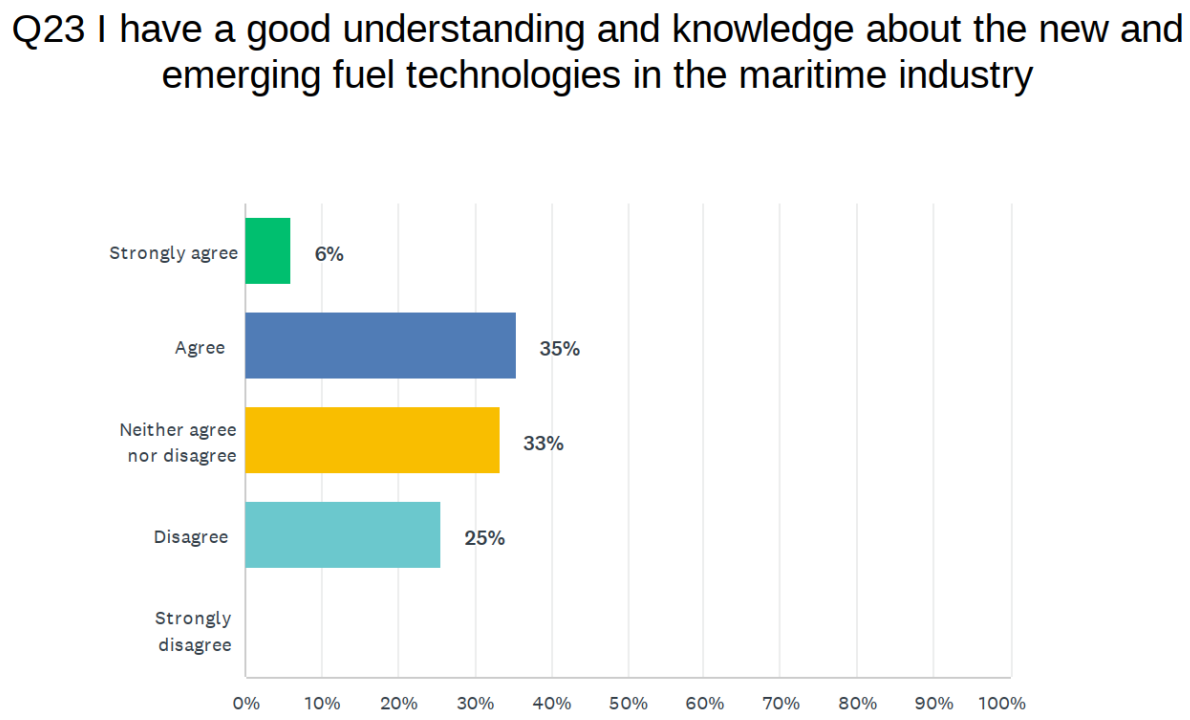

Figure 66 Self-assessment of knowledge.

In Figure 66 we can see that 41% of insurers find themselves to have a good understandng and knowledge of new fuel technologies. One third remain neutral, and one quarter find themselves to not have good knowledge.

When we filter for field of expertise and compare insurers in Figure 68 to the general population in Figure 67, we can see that insurers with technical expertise are surer about their technical knowledge (67% vs 50%) than other sectors, while insurers with legal background are less sure about their knowledge (40% vs 57%) than their legal counterparts in shipping companies and regulating bodies. No participant working in management in the insurance sector stated themselves to have a good understanding of new technologies. Operational background in insurance seems to bring the highest level of confidence, as this group had the highest amount of people answering that they strongly agree with the statement.

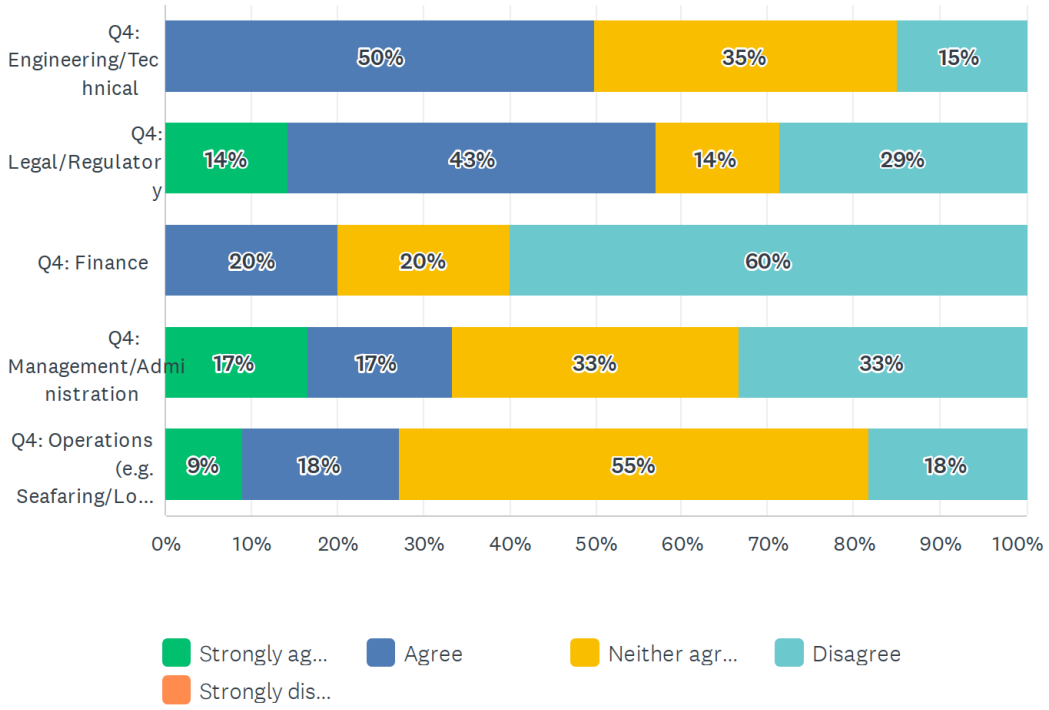

Figure 67 General population Q23.

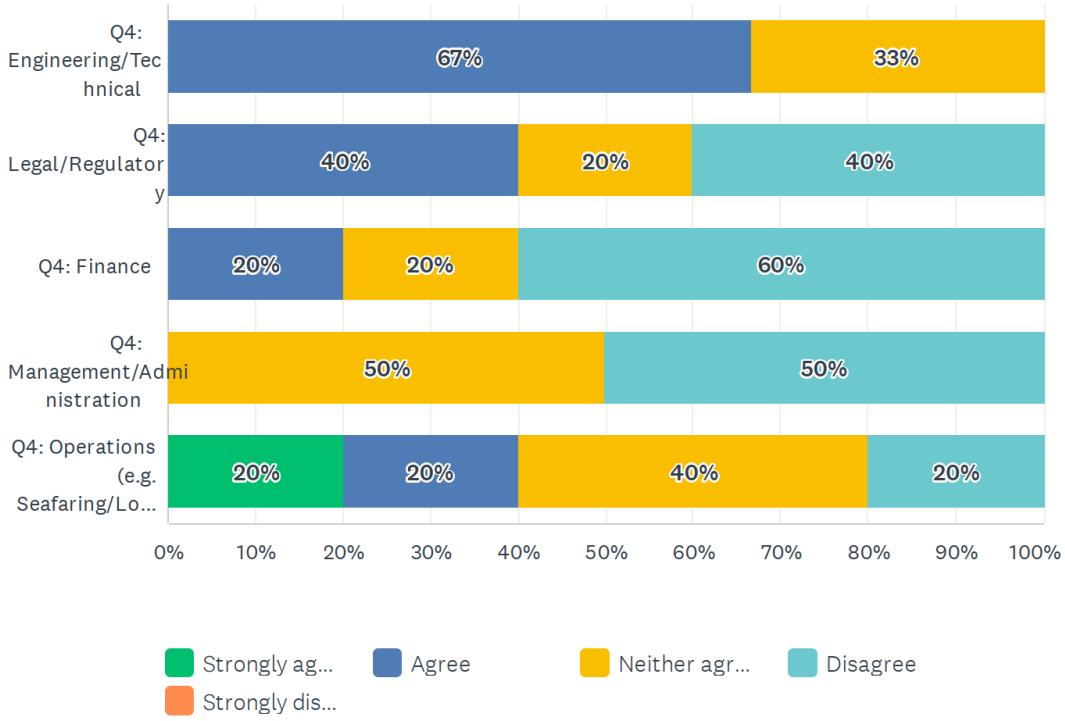

Figure 68 Participants from insurance companies Q23.

Next question to analyse is Question 24 where participants had to take an opinion with the statement*: I feel that I should know more about new fuel technologies.* We can from the data in Figure 70 below see that the insurers opinions about wanting to know more is

almost perfectly correlated with the marine sector as whole, presented as general population in Figure 69.

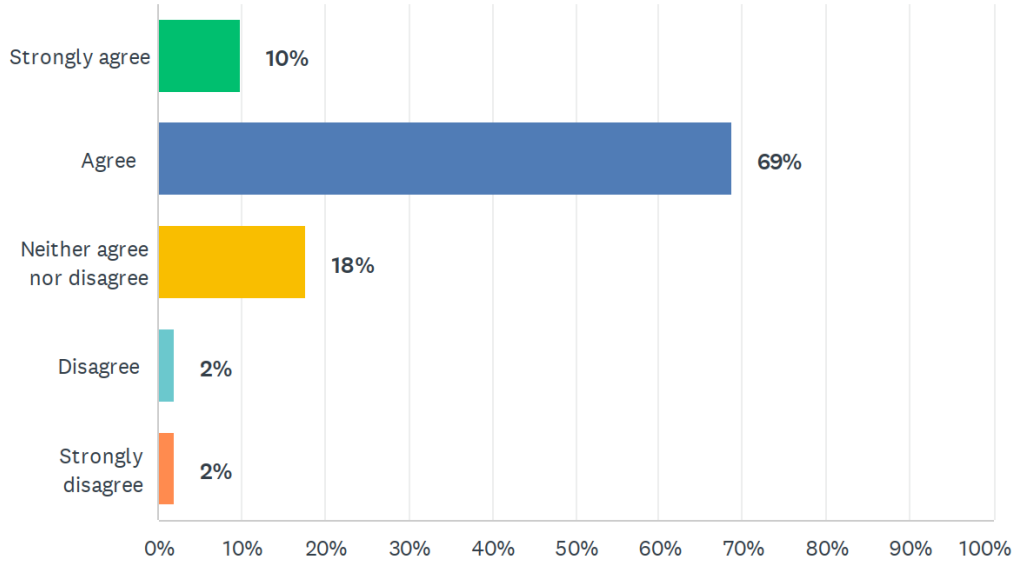

Figure 69 General population Q24.

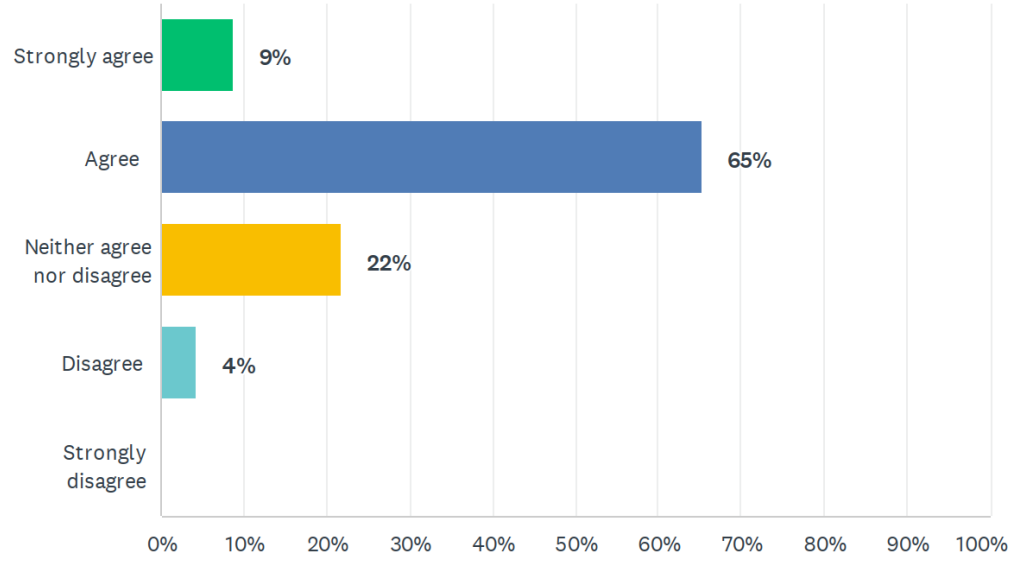

Figure 70 Participants from insurance companies Q24.

If we see further which field of expertise within the insurance companies and age group, shown in Figure 72, we can see trends emerging with a polarization in opinions for the youngest group of participants.

From the age group selection in Figure 71 , we can see that the same polarization within the group is present as we found in hypothesis 8 as well, especially within the older millennial group. When cross-referncing this with other demographics, we found that the

only group that find themselves not wanting to learn more is a minority of the legal background millennials. It must be noted that the absolute majority of this group, with 80% in agreement, find that they want to learn more. This small minority might be because some legal teams are not dealing with a lot of tehcnology in their daily working lives, and as such they feel it unnesseary to learn about new technlogies.

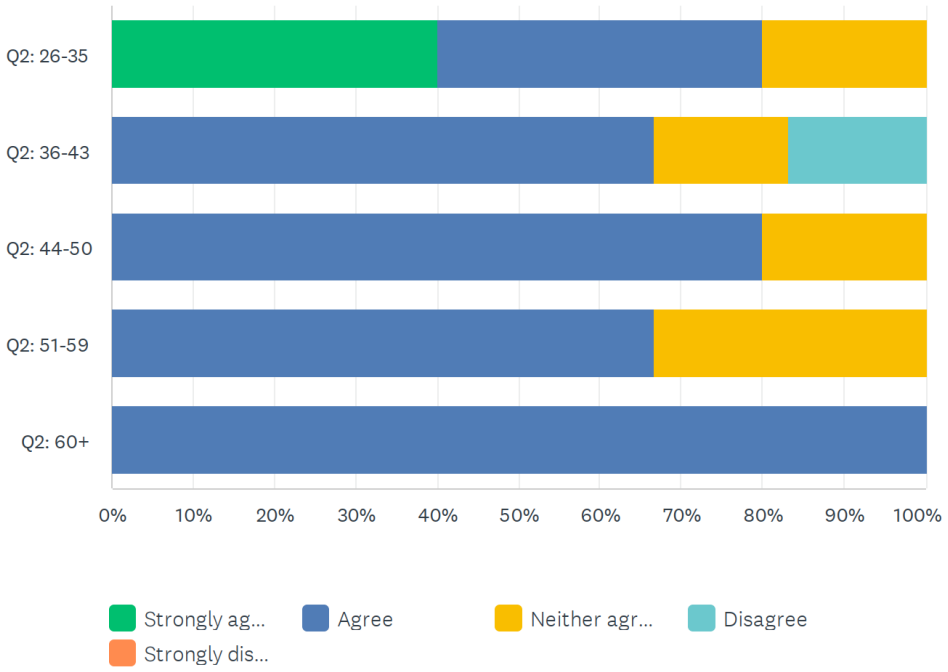

Figure 71 Age groups Q24.

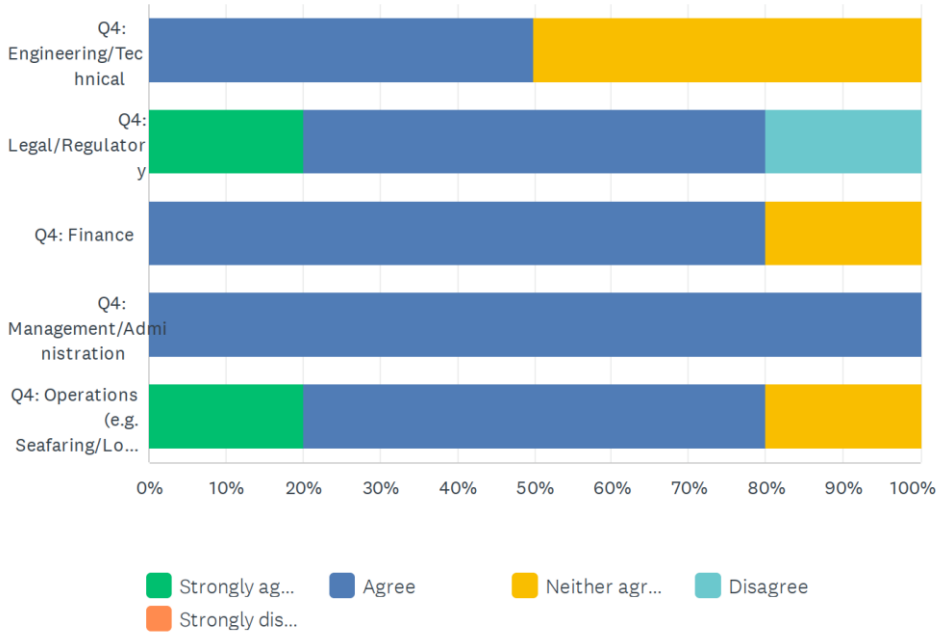

Figure 72 Field of expertise Q24.

We can also see that younger millennial group is the group that strongest want to learn more about new fuel technologies, with 40% strongly wanting to know more. The group that seems overall most wanting to know more are the 60+ group, and the management group. Both groups are showing no neutral or disagreements with the statement.

Q39 How frequently does your company offer training on emerging fuel technologies.

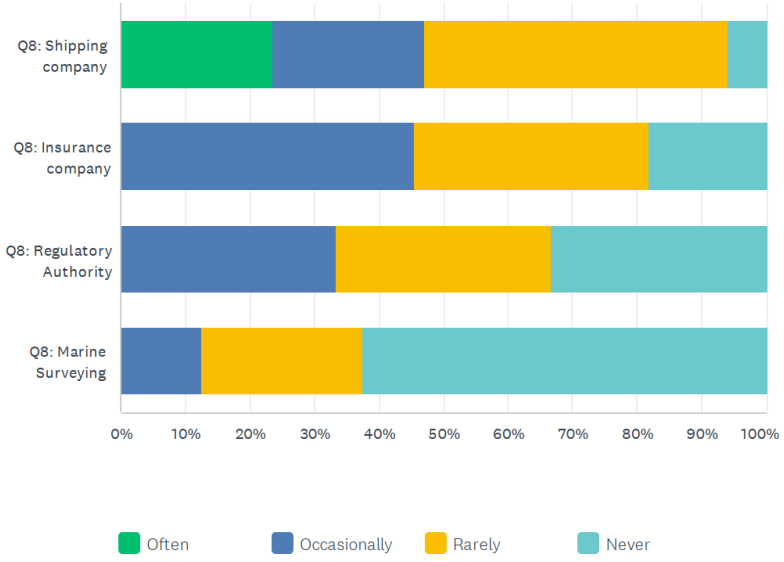

Figure 73 Training opportunities per marine sector.

We compared if insurance companies differ in the frequency that they offer training and education for their employees. As we can see in Figure 73, the sector providing most frequent training are the shipping companies, which is not too surprising, as they are in the forefront of implementing these technologies in their fleet and it directly affects their expenses and balance sheets. This can explain the finding in an earlier chapter that shipping companies feel themselves to hold superior knowledge compared to other marine sectors.

The second most frequent provide of training are the insurance companies, with 45% stating that they occasionally receive training opportunities. The main group which provides least amount of training opportunities are the regulatory bodies and marine surveying, with marine surveying being the least generous, with 63% stating that they never receive any offer for training opportunities.

This will directly be compared to how participants feel about the prospect about learning more about new fuel technologies. In the general survey population, 88% of participants wants to learn more about new technologies, with 20% being in strong favour of wanting to learn more. In Figure 74 and 75, this is compared across the marine sectors.

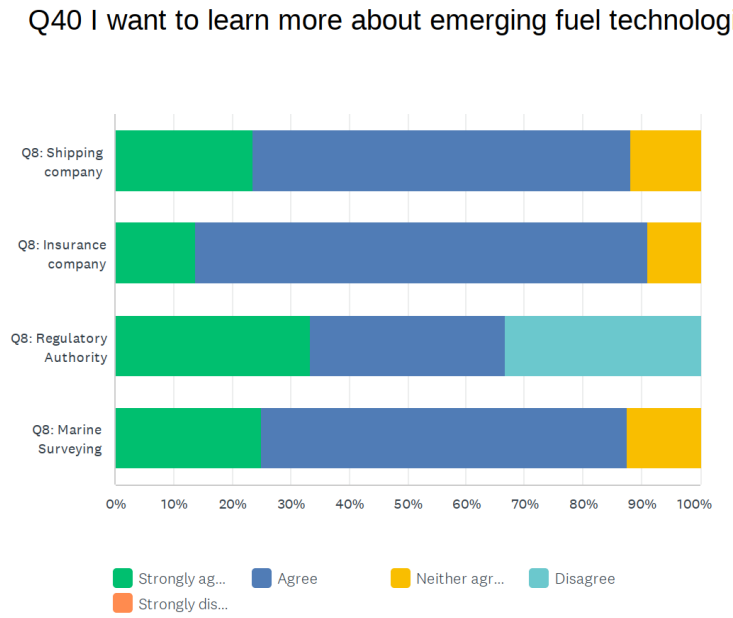

Figure 74 Willingness to learn more.

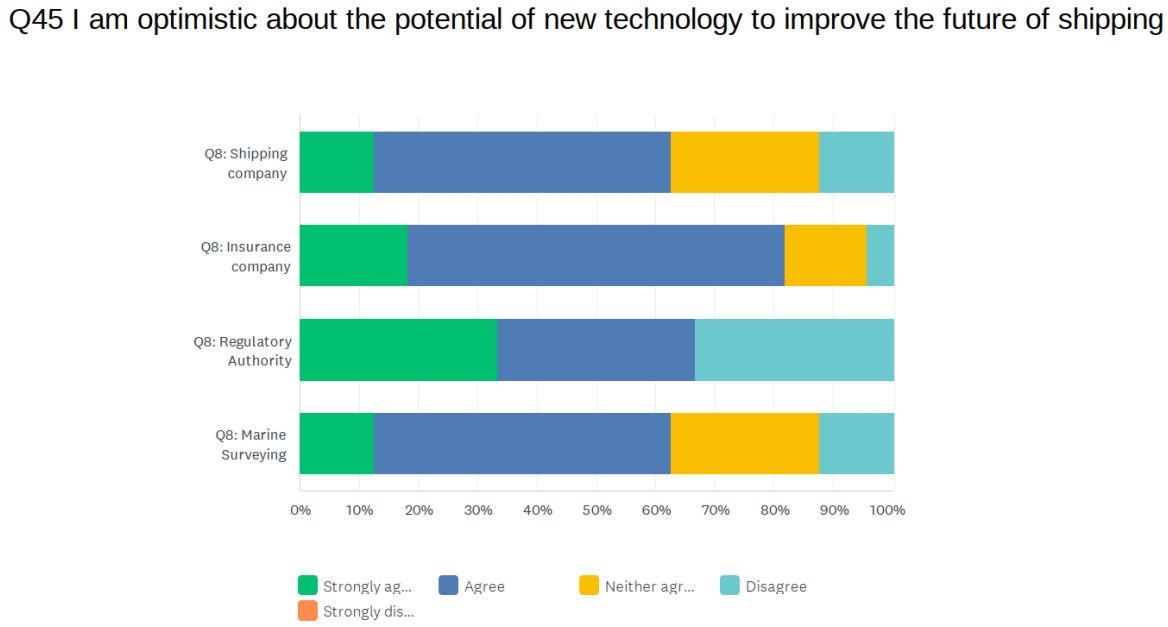

Figure 75 Optimism towards new fuel technologies.

As we can see in this Figure 74, the wish to learn is almost identical between all sectors except for the regulatory authorities, where a third do not want to learn more about new fuel technologies. In the other sectors, no one disagree, and everyone wants to learn more or have a neutral stance. The regulatory sector is polarized and contains the most positive (strongly agree) and most negative (disagree) within the same group.

This same trend can be seen when asking for the feeling of optimism towards new fuel technologies. Here we can again see the regulatory authorities have 33% not being optimistic about new fuels being introduced, whilst they also have the most respondents feeling strong optimism about it (33%).

When answering the question if the respondents often collaborate with other sectors, here shown in Figure 76, we can find out that the group most often collaborating are the regulatory bodies. This is interesting in comparison with the marine surveying companies, where a majority (63%) report that they do not often collaborate with other sectors. Marine insurers have almost half (48%) reporting that they do not often collaborate with other sectors, and 22% being neutral.

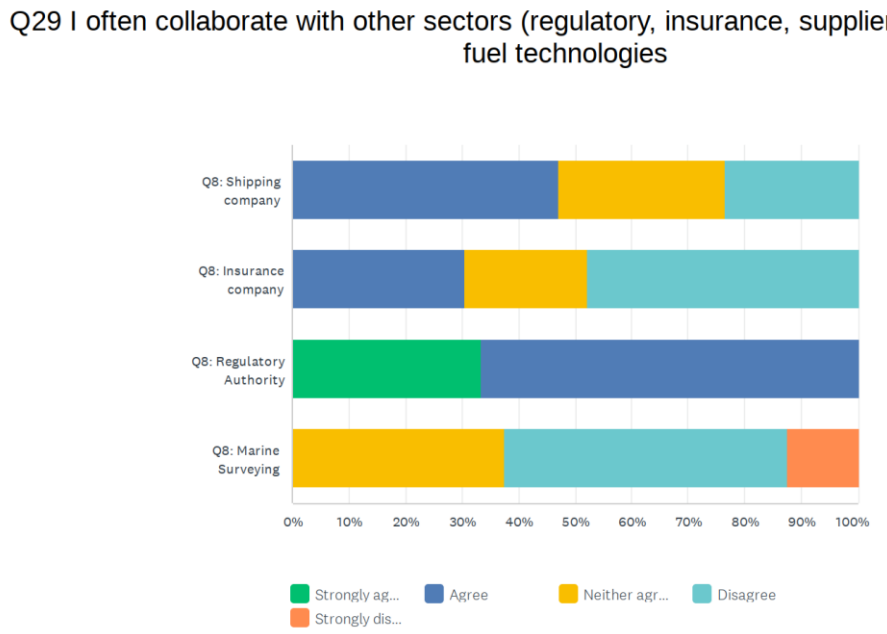

Figure 76 Collaboration rate per sector.

Researchers' disclaimer: It must be noted that the regulatory bodies are a small sample size and that the opinions expressed here might not be applicable for the sector as whole, but rather personal opinions.

7.8.1 Hypothesis summary

In this chapter we have analysed the hypothesis if employees in insurance might feel they lack sufficient knowledge about new fuel technologies. We have focused on exploring attitudes and differences and in knowledge perception, training opportunities, generational and field of expertise.

Demographical and expertise

- Insurance companies have a broader range of expertise (e.g. finance and legal) compared to other marine sectors, which seems to lean more into technical roles.
- Age distribution in the insurance sector closely aligns with the broader survey population, through there are slightly fewer respondents in the 60+ category.

Knowledge self-assessment Q23

- For insurers, 41% feel knowledgeable about new fuel technologies while 33% remain neutral and 26% disagree.
- Confidence in knowledge correlates strongly with technical expertise 67% of technical respondents in insurance rate their knowledge positively compared to 50% in the general population.
- Legal professionals in insurance feel less confident, 40% agree versus 57% in other sectors and no insurance managers expressed confidence in their knowledge level.

Desire to learn more Q 24.

- Insurers desire to learn mirrors the general marine sector with 88% wanting to know more about new fuel technologies.
- Younger millennials and the age group over sixty plus show the strongest interest in learning more.
- The minority not interested in learning comes mainly from legal background, likely due to limited exposure to technical details in daily work tasks.

Training frequency Q39

- Insurance companies ranked second in training provision, with 45% offering occasional training opportunities.
- Shipping companies lead in training opportunities reflecting their direct involvement in new fuel technology implementation.
- Marine surveyors received at least training opportunities with 63% reporting no opportunities given by the employer.

Collaboration and optimism Q45.

- Regulatory bodies are the most collaborative sector while nearly half of insurance respondents (48%) rarely collaborate with other marine sectors.
- Optimism about new fuel technology is generally consistent across sectors. However regulatory bodies exhibit polarization with a third being strongly optimistic and another third not being optimistic.

Insights

- A broader range in the fields of expertise in insurance companies reflects their need to support a diverse business model but may impact confidence in technical areas.
- Training opportunities and technical backgrounds are key drivers of confidence and enthusiasm for new fuel technologies.
- Regulatory bodies show polarized attitudes but collaborate the most, while insurers and marine surveyors report limited interaction with other sectors. It must be noted that the small sample size from regulatory authorities should be interpreted cautiously as their opinion might not represent the entire sector.

7.9 Hypothesis 10

In this chapter, we will analyse how prepared participants feel their sector is regarding the impact of new fuel technologies. We have touched the subject in previous chapters, and in this chapter, we will concentrate on direct feeling of oneself and one's company. We will begin with analysing question 41, that is directly related to the hypothesis. In this question, the participants were asked if they feel concerned about their company not being prepared for the adoption of new fuel technologies.

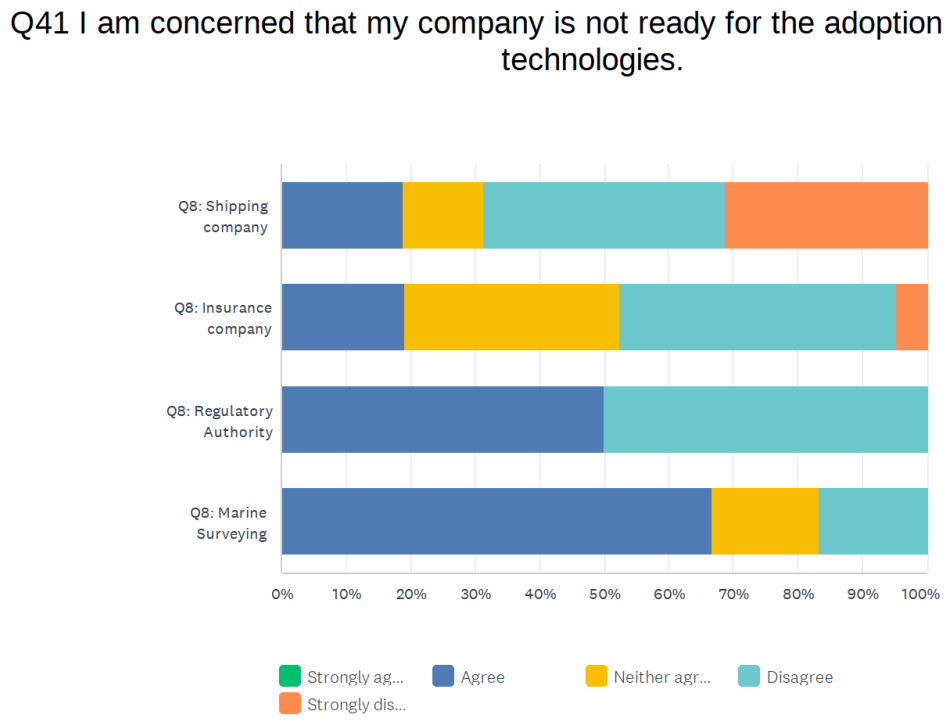

Figure 77 Level of concern per marine sector.

We can see from the data in Figure 77 that shipowners are least amount of concerned about the transition, with 69% not being concerned. 19% of respondents from shipping companies and insurance companies are concerned about their companies not being ready for the adoption of emerging fuel technologies. The insurance company respondents are three times more neutral in their answers than the shipping companies, showing that either insurance companies generally are more conservative in their opinions, or that they do not feel the same level of confidence as the shipping companies.

Regulatory authorities are showing the same kind of polarization we have seen in earlier chapters. As we have noted before, this can be partially because of a small sample size. Two-thirds of marine surveyors feel concerned about the readiness of their employer. If we cross-analyse this with hypothesis 9, question 39 about training frequency, we see that the percentages of people feeling concerned are closely correlated to the frequency of training opportunities provided. We can see from these that the amount of people in marine surveying that feel concerned are 67% and people saying that they never receive any training are 63%. This is overall concerning, as marine surveyor are involved in surveying, approving and validating installations and safety for ship owners, insurers, government bodies and more. It seems to be a confirmed trend that marine surveyors

want to learn more, are not given sufficient opportunity to do that and they feel concerned about it for their company's future.

Q30 I am well prepared for the industry adoption of emerging fuel technologies

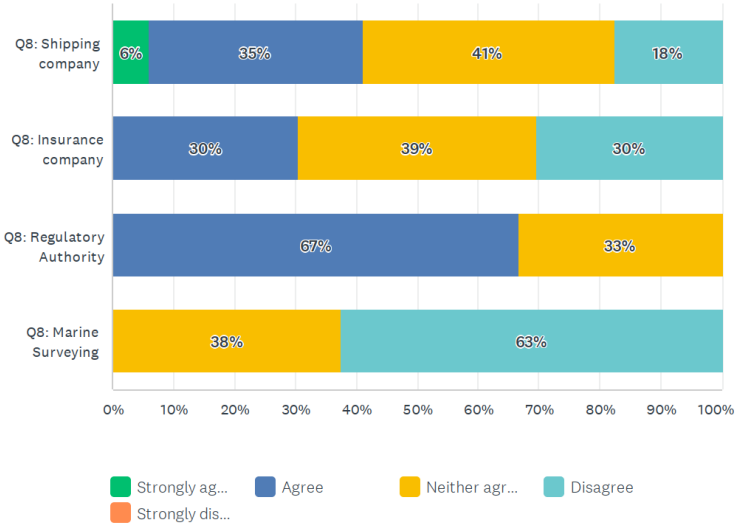

Figure 78 Feeling of preparedness.

We can as further confirm this statement with the analysis from question 30, Figure 78. We can see that marine surveyors are the most negative towards their own preparedness for fuel transition. 63% stated that they disagree with feeling well prepared for the transition and 38% remained neutral. No one stated that they feel well prepared.

7.9.1 Hypothesis summary

In this hypothesis we have examined the level of preparedness perceived by different sectors for the adoption of new fuel technologies. The analysis focused on survey questions addressing company concern (Q41), and self-preparedness (Q30).

Key findings include:

- Ship owners demonstrated the highest level of confidence with 69% indicating no concern about their company's preparedness or readiness. Only 19% of respondents from shipping companies and insurance companies expressed concern with insurance companies showing higher neutrality in their responses. This suggests either a conservative outlook or less confidence in readiness compared to shipping companies.

- Marine surveyors were the most concerned group with 67% expressing concern about their company's preparedness. These concerns strongly correlated with limited training opportunities given as 63% of marine surveyors reported receiving no training. This trend is significant given the surveyor's critical role in validating installations and safety.
- Cross reference data, for example Q39 on training frequency, further supports this finding. Lack of training opportunities contributes to the sense of unpreparedness among marine surveyors.

Conclusion. This analysis highlights considerable variation in preparedness perceptions across marine sectors. While ship owners and some industry groups exhibit confidence marine surveyors stand out as a group expressing significant concern. These disparities underlined the importance of investment in training and readiness initiatives to address sexual specific challenges in adopting new fuel technologies.

8 Further research

This chapter gives suggestions for ways or topics for future research to continue from our research.

8.1.1 Longitudinal studies

Long-term research into trends and changes in attitudes and adoption rates of new fuel technologies. For example, researchers could evaluate changes in perceptions after significant regulatory updates or technological advancements. Long-term studies could help identify key indicators driving or blocking adoptions within different sectors. This could also include following the same participants over a longer period, to study how opinions and attitudes change over time with the development and diffusion of innovations into the routine work life.

8.1.2 Broader demographics

Expanding the demographic distribution into larger survey sample size or wider geographical area could provide a broader perspective into the marine sectors and specifically marine insurance sectors readiness for new fuel technologies. This could include participation from regions with different regulatory landscapes, economic conditions, or levels of technological advancement.

8.1.3 Implementation impact analysis

Further studies could be implemented to assess operation and financial impacts for companies' adoption for emerging new fuel technologies and compare them within sectors. For instance, studies could evaluate changes in claims patterns, policy structures or risk profiles directly related to customers that are adopting new fuel technologies.

8.1.4 Collaboration

Future studies could investigate how to create effective frameworks for collaboration amongst shipowners, insurers, regulators, and technology developers. Case studies could focus on creating collaboration partnerships and evaluating how they affect the comfort within sectors and with external partners. The effectiveness of training could be reviewed,

and to see if training both gives a tangible lift in knowledge and in self-confidence, or if they would be disproportionate.

8.1.5 Sector-specific studies

Future studies can dive into deeper detailed studies into one specific sector and trying to find underlaying and unique challenges in this sector and try to develop tailored solutions to overcome these challenges. In this field, the insurers' view could be further analysed, to see if there are insurability differences between different fuel or propulsion types. Further studies could include to create insurance models based on the differences and to suggest revisional changes to marine insurance plans.

8.1.6 Interviews and case studies

Interviews would assist in bringing deeper insights into the specific topics. Businesses can experience changed in different ways, and in-depth analysis and interviews could be paired with the quantitative data from a survey. This could uncover deeper motivations and reasoning behind decisions and opinions.

Case studies could be investigated to find how the study finding play out in real cases. For example, how an insurance claim is being handled and received by ship owners, marine surveyors and the insurer. Will differences in expectations come from differences in knowledge or from organizational expectations. The insurance claim could be studied in detail, motivation and reasonings analysed, and later cross-examined against survey answers to explore trends or new insights.

9 Discussion

This research provides valuable insights into the preparedness and attitudes of the marine insurance sectors regarding the adoption of new fuel technologies. While optimism prevails, the thesis highlights several areas that requiring to be addressed.

The identified knowledge gap between ship owners and insurers highlights the need for sectors-specific actions. Insurers must deepen their understanding their understanding of technical advancements to keep up with their client's knowledge and improve their risk

assessment and claims handling processes. Collaboration with other sectors and learning opportunities can be a way to bridge this gap efficiently.

The views on regulatory barriers vary significantly across sectors. Shipping companies often see regulations as an obstacle, while insurers and authorities see them less restrictive. This difference in views calls for improved dialogue and collaboration to balance regulatory goals with industry feasibility.

Collaboration between sectors is paramount to improve the transition and create stronger partnerships to overcome challenges between ship owners, insurers and regulatory bodies. Shared knowledge platforms can be a feasible way to develop better practices and streamline adoption.

Findings support the need for continuous learning throughout the career, to build confidence and competence in new fuel technologies. Cross-sector workshops and training programs can help to lift confidence and empower marine professionals across the whole marine industry.

Overall, marine professionals view the transition towards new fuel technologies in a positive light, showing optimism for a more sustainable future. The study underlines the need for a coordinated, informed and adaptive approach to integrate the new technologies into the broader marine sector. By addressing identified challenges, the industry can drive collaboration and find new possibilities to progress towards a greener and more sustainable future together.

10 Critical review and limitations

The following can be considered limitations for this study and should be considered when reading and using the data from this study.

10.1.1 Sample size

The samples had 56 responses, and though the participation percentage was relatively high, this can still be considered a small sample size due to it being spread over several sectors in the marine industry. This may limit generalizability of the findings to a broader context and for the survey to be mainly seen as exploratory into a field that has seen little research. For example, the regulatory authorities' responses to the survey are limited, with

only four participants from this marine sector answering the survey. This can shift bias within this group´s answers to be more of personal opinions and attitudes than that of the whole sector. To elevate this, more participants would be required to be surveyed, with preset data and amount criteria to be fulfilled for an accurate statistical analysis. This would ensure that the individual bias could be mitigated better, as criteria would need to take culture, age, sector and other demographical data and limits into account.

10.1.2 Selection of participants

The selection of participants was done by the researchers, from a predetermined database of potential participants, based on their employer. Even if this was done to be as impartial as possible, there might be selection bias from the researchers to include more commonly known company names than less commonly known companies.

10.1.3 Regional focus

The study primarily targeted the Nordic countries, with a heavy participation from one specific country (Finland). This imbalance in responses might skew due to specific cultural differences within the Nordic countries and show larger differences than in actual existence. The narrow regional selection might not fully capture the perspectives of professionals in other regions with differing regulatory and business practices.

10.1.4 Self-reported data

Responses were based on self-assessment, which can introduce biases such as over- or underestimating oneself, which can also be affected by cultural differences. For example, a culture with more humble expectations of one’s self-worth might impact self-confidence, which in turn gives a lower self-assessment on knowledge. To move further deep into this subject, an independently verifiable scale would be a tool to consider. This would most likely require a thesis to be developed, so this would require further and deepened studies to be included.

11 Conclusion

This thesis provides valuable insights into challenges and opportunities associated with the transition towards new fuel technologies within the marine sector. A recurring theme throughout this study is the disparity in knowledge, attitudes and preparedness across different sectors, roles, regions, and other demographic groupings.

We have seen that there is a significant knowledge gap existing between ship owners and marine insurers while ship owners tend to perceive themselves as more knowledgeable and better informed about new fuel technologies. Insurers often lack confidence in their technical expertise. However, insurers show a strong will to learn, indicating their openness to adaptation. Addressing this gap is essential to foster mutual understanding and good collaboration between these sectors. Despite this gap, most ship owners feel adequately supported by insurers and regulatory bodies though a third still expressed concerns about the sufficiency of support and transition to new fuel technologies.

Professionals from all sectors show optimism towards the adoption of new fuel technologies. Participants with technical backgrounds are generally supportive but display a more cautious attitude in their answers. This is most likely due to their deeper understanding of technical challenges involved in adopting new technology. Professionals with legal background view regulations in a more positive light, with few seeing them as significant obstacles. In contrast, ship owners and marine surveyors view regulatory barriers as a challenge which reflect the various impacts of regulations across roles in the marine sectors.

Younger professionals exhibited polarized attitudes; some are supportive of new fuel technologies while others remain skeptical. Factors such as organizational support, training opportunities and exposure to technology play a bigger role in attitudes than age alone.

When it comes to valuing technical expertise, large majority of shipping companies consider it important for insurers to possess strong technical knowledge. However, less than one-third of shipping companies are willing to pay higher premiums for this expertise, showing a disconnect between perceived value and financial commitment.

Regarding organizational preparedness, the confidence levels vary significantly. Ship owners report the least amount of concern about their preparedness, while marine

surveyors express the greatest concern, citing limited training opportunities as a major factor. This highlights the need for targeted investments in training, especially for critical roles that ensure safety and compliance.

In conclusion, the study emphasizes the need for tailoring strategies to address sectoral differences. Investing in training, fostering collaboration, and addressing the needs of younger professionals are essential steps to ensure a smoother and easier transition to new fuel technologies. By aligning technical expertise, regulatory support, and organizational readiness, the marine sector will be better prepared for the challenges and opportunities presented by emerging fuel technologies.

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Appendices

- Appendix A, Complete Survey
- Appendix B, All data from survey, unfiltered
- Appendix C, Filtered datasets and charts for Hypotheses 1-10