ISWAN

The impact of maritime decarbonisation on wellbeing:

Findings of an ISWAN survey of seafarers and shore-based staff

SHIPOWNERS
SECURITY FOR SMALL & SPECIALIST VESSELS

Foreword

The maritime industry constantly evolves, looking at ways to address prevailing and future risks and concerns, with the aim to improve safety for both people and the operating environment.

When it comes to the environment, how technology can be leveraged as part of the decarbonisation roadmap is the prominent area of ongoing collaborations with the International Maritime Organization (IMO), service providers such as banks and insurers, industry associations, governments, maritime administrations, class societies, shipping companies, training institutions and others. However, as the industry strives to achieve zero-carbon operations, a vital stakeholder, that must not be overlooked to ensure an effective and safe implementation of any proposed measures, are the vessels' crews.

It is with this in mind that ISWAN, in collaboration with the Shipowners' Club, have conducted this survey that investigates the impact of decarbonisation, and the resulting workload, on seafarers' wellbeing and safety.

We look forward to working with ISWAN and other industry stakeholders to take forward the recommendations of this report and ensure that seafarers have the support they need to meet the challenges of the zero-carbon transition.

Louise Hall, Director –
Loss Prevention,
Corporate Responsibility & Marketing,
The Shipowners' Club
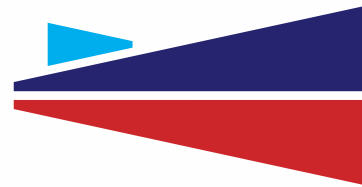
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Executive summary

Introduction

Decarbonisation is one of the key drivers of transformation in the maritime sector. To address shipping's contribution to the climate emergency, maritime companies are being required to take rapid steps to meet mandatory carbon emission regulations. At an institutional level, there is widespread acknowledgement that seafarers are central to meeting the maritime sector's decarbonisation obligations. However, through ISWAN's daily conversations with seafarers, via both our helplines and our in-person work in India and the Philippines, we became concerned that, in practice, seafarers' wellbeing is often overlooked amidst the urgent pressure to decarbonise. For this reason, in summer 2023, ISWAN ran a survey to ask seafarers and others working in the maritime sector about the impact that the rapid adoption of new technologies and regulatory regimes is having on their mental health and job satisfaction.

Overview of survey responses

The survey received 400 valid responses from seafarers, including crew from 29 different nationalities, with the majority from India (42.8% of responses) and the Philippines (15.6%). The largest number of responses were received from engineering officers (42.5%), followed by deck officers (39.4%).

The sample size was much smaller amongst shore-based staff: valid responses were received from 55 staff of 17 nationalities, with the largest number of responses from staff from India (37.7%), the United Kingdom (13.2%) and the Philippines (11.3%)

> *"I am a big supporter of decarbonisation and taking steps to reduce our negative impact on the planet and our surroundings. I just wish it was done in a much better way."*
>
> **– Seafarer respondent**

The impact of decarbonisation on maritime wellbeing: overview of key findings

- The adoption of new environmental regulations is clearly having a major impact on seafarers' working lives. Overall, just over 70% of respondents reported that environmental regulations relating to decarbonisation have a big (43.7%) or moderate (26.6%) impact on their work. The impact was higher amongst engineering officers and those respondents without a fixed trading pattern.

- The survey findings indicate a very mixed picture as regards the nature of the impact of decarbonisation on the technical aspects of seafarers' work at sea. For example, whilst for over 40% of respondents, the impact on the storage and use of different grades of fuel, fulfilling audit requirements and maintaining equipment and machinery was positive, for around a quarter of seafarers, the effect on these aspects of their work was felt to be negative. Having a fixed trading pattern appears to mitigate to some extent against negative impacts of technological change.

- There appears to be considerable support amongst seafarers for the overall direction of travel as regards decarbonisation. Overall, just over half (51.4%) of seafarers responded that decarbonisation regulations and technologies were having a positive (36.1%) or very positive (15.3%) effect on their wellbeing at sea. Just over 30% (31.1%) viewed the impact as neutral, whilst for 17.5% the impact was negative (11.9%) or very negative (5.6%). Deck officers were more likely than engineering officers to evaluate the overall impact of decarbonisation on their wellbeing positively.

- When seafarers were asked to reflect on the impact of decarbonisation on specific aspects of their wellbeing at sea, the survey findings indicate that the adoption of decarbonisation regulations and technologies is having a very substantial impact on the mental wellbeing and morale of many. Over half (53.8%) of respondents stated that the impact on their workload of adapting to new technologies and regulatory regimes had been negative. For over 40% of respondents, this was associated with an increase in levels of stress (44.0% of respondents) and fatigue (40.1%). Just under half (45.5%) of respondents reported that the introduction of decarbonisation regulations and technologies had not had a positive impact on any of the wellbeing areas included in the survey.

- The negative impact on wellbeing was more significant amongst engineers, particularly those without a fixed trading pattern. Almost 60% of these respondents (59.2%) commented on a negative impact on their workload, whilst 52.4% reported an increase in stress levels. Just over 40% (40.5%) reported increased concerns about criminalisation.

- The small sample size of shore-based staff mean that the survey findings are less robust than those of the seafaring cohort. However, the findings were broadly in line with those of seafarers, with many shore-based staff expressing their support in principle for the journey to zero carbon, but mirroring the frequently negative impact on several aspects of their health and wellbeing.

Future challenges

Survey respondents were asked to select the key challenges that decarbonisation was likely to pose for their work over the coming five years.

Amongst seafarers:

- Increased workload and fatigue was viewed as the most significant challenge, selected by almost half (46.9%).

- The practical and technical challenges of the journey to zero carbon were also apparent, with substantial numbers of seafarers also highlighting the tensions between commercial pressures and regulatory requirements (44.9%), increased maintenance requirements (41.6%), difficulties accessing the correct fuels (39.6%) and the complexity of regulatory requirements (39.0%) as key concerns.

Amongst shore-based staff:

- The complexity of different regulatory requirements was highlighted as the top challenge, selected by just under 60% of respondents.

- As was the case for seafarers, the tension between commercial pressures and regulatory requirements was the second most pressing issue, highlighted by 57.5% of shore-based staff.

- Increasingly complex logistics is also a shared concern and was selected by 44.7% of shore-based staff.

Mitigating the impacts of decarbonisation

- In terms of the actions that ship owners and managers could take to better support seafarers' wellbeing through the transition to greener shipping, over half (53.4%) of seafarers cited improved technologies, systems and processes as key. Just under 40% (37.3%) responded that focusing on a "no-blame" culture would facilitate the journey to zero-carbon, whilst 35.6% emphasised the importance of achieving greater uniformity of regulations.

- Shore-based staff, like seafarers, selected improving technologies and systems and processes as the top action that shipping companies could take, with almost 60% (59.6%) citing this as key to supporting them through the decarbonisation transition. Improved leadership and management culture and addressing the tension between commercial pressures and regulatory requirements were also seen as important by shore-based staff, with both actions selected by 57.5% of respondents.

Recommendations

ISWAN's survey suggests that many seafarers and shore-based staff understand and support the urgent need to decarbonise shipping. However, the survey findings also suggest that the potential for the rapid adoption of new technologies and regulations to have a detrimental impact on those who are tasked with implementing them is currently being overlooked.

The survey points to a number of concrete steps that maritime employers can take to better support seafarers and others working in shipping through the zero-carbon transition and to ensure that the decarbonisation does not become an additional factor that drives skilled employees away from the industry.

Rethinking wellbeing in the decarbonisation era

The survey findings indicate that the rapid changes brought about by decarbonisation are having a negative impact of many working in the maritime industry. Maritime employers can take the following steps to mitigate against these risks:

● **Acknowledge and address the impact on workloads:** The resounding feedback from ISWAN's survey is that adapting to new technologies, regulatory regimes and additional reporting is having a substantial impact on seafarers' workloads, in particular for engineers. This has knock-on effects for levels of stress, fatigue and ultimately safety. The additional workloads, particularly for engineers, should be proactively considered and factored into crew sizes.

● **Recognise the psychological impacts of rapid change and technostress:** The psychological toll that the requirement to constantly adapt to new technologies can place on seafarers, particularly in high-impact, high-risk environments, should be explicitly acknowledged. The impact of technostress and the challenges posed by rapid technological transformation should be built into mental health awareness and stress management training and resources for seafarers and other maritime employees. Focus should be placed on identifying any diversity, equity or inclusion (DEI) obstacles faced by particular demographic groups. Attention should also be given to ensuring that seafarers have appropriate time and resources for good quality social interaction to build resilience and support their wellbeing at sea.

- **Ensure both physical and psychological safety:** Feedback from some seafarers indicates that they feel that they are being asked to implement new technologies that have not been adequately tested. In order to ensure both physical and psychological safety at sea, seafarers must have the confidence that the technology that they are being asked to adopt is safe and that they and their colleagues have appropriate training and support to implement it. As part of building just, psychologically safe cultures at sea, it is vital that seafarers have the confidence to speak out about any concerns or doubts without fear of negative consequences.

- **Commit to inclusive, supportive leadership cultures:** Extensive work is underway throughout the maritime sector to reimagine seafaring's hierarchical power relationships and build cultures that are inclusive, equitable and safe. The challenges of rapid adaptation to change should be proactively built into the development of good practice as regards leadership at sea. This will be fundamental in building the type of working environments that can effectively support seafarers and other maritime employees through the wholescale transformations that the industry faces.

- **Improve terms and conditions:** Feedback from seafarers indicates that many feel that the additional efforts and work that the zero-carbon transformation demands of them is not appropriately acknowledged. In order to maintain seafarers' commitment and avoid skilled seafarers continuing to leave the industry, maritime employers must ensure that seafarers are appropriately remunerated for their work. The short-term nature of many maritime contracts can also act as a disincentive for employers to invest in providing seafarers with the training that they need to carry out increasingly complex and technical work. Offering more stable employment contracts could help to address this issue, as well as providing further stability and valorisation for seafarers.

- **Invest in seafarers:** The survey findings indicate that tensions between meeting environmental requirements and commercial pressures are creating significant stress for both seafarers and shore-based staff. Too often commercial imperatives and regulatory pressures are prioritised over the wellbeing of those working at sea. If the maritime sector is to attract and retain the technically skilled employees that it will need to achieve zero carbon, it will be necessary to invest in ensuring that the appropriate training, support and working environments are in place.

A human-centred approach to systems and processes

Both seafarers and shore-based staff stated that improving technologies, systems and processes would make the biggest difference to their wellbeing during the transition to zero carbon. The maritime industry should consider the following actions to facilitate the decarbonisation journey:

- **Protect against technostress in system design:** Maritime employers should proactively seek to ensure that new technologies, systems and processes function in cohesive, joined-up and accessible ways to reduce duplication and mitigate against the negative impacts of technostress. Employers should also proactively seek input from those tasked with implementing new technologies to better understand the impacts on their work and wellbeing.

- **Ensure strong communication channels to build collective responsibility:** It is vital that meeting the challenges of zero carbon is approached as a collective undertaking, requiring the input and commitment of all, both at sea and at shore. Fostering stronger communication channels between ship and shore and ensuring that seafarers understand the rationale for new technologies and reporting requirements will help to ensure that they feel fully engaged and involved in the decarbonisation journey. Improved understanding amongst shore-based staff about the holistic impact of new

technologies and regulatory regimes on life at sea will also help employers to factor in and mitigate against potential risks to seafarers' wellbeing. It is, furthermore, important to ensure that engineering and deck officers understand the differing impacts of decarbonisation on their work, to build a culture of safe and effective team work and shared responsibility.

- **Investigate benefits of fixed trading patterns:** ISWAN's survey findings indicate that adopting fixed trading patterns may help to mitigate against the negative effects of the adoption of decarbonisation technologies on wellbeing by enabling engineers to better prepare for frequent fuel changes in line with the relevant regulatory requirements. As the adoption of alternative fuels accelerates, maritime employers should factor in potential impacts on seafarer wellbeing when making decisions about trading patterns.

- **Consider crewing models that best meet the challenges of decarbonisation:** The proliferation of new technologies can lead to a steeper learning curve for seafarers joining a new ship. Fluid crewing models can therefore place additional burdens both on individuals joining a ship and on the already stretched teams that are required to support them to adapt to new technologies. Additional research should be carried out into the crewing models that will best support seafarers through the zero-carbon transition.

Building just and coherent regulatory regimes

In addition to the challenges at a technical level, the duplication of reporting and the requirement to conform with multiple overlapping regimes are placing additional pressure on seafarers and substantially increasing fears of errors and potential criminalisation. Regulatory bodies and maritime companies should consider the following actions to better support seafarers and other maritime employees through the decarbonisation transition:

- **Harmonise reporting regimes and requirements:** ISWAN fully supports the commitment on behalf of individual ports, nations or regions to go beyond the requirements of international legislation in tackling carbon emissions. However, regulatory and reporting requirements should be simplified and harmonised to limit the bureaucratic and administrative burden this poses.

- **Proactively build collaborative, just cultures:** Despite considerable support for decarbonisation, it has heightened fear among many seafarers and other maritime employees about making inadvertent errors and potential penalisation or even criminalisation. Particularly in light of the current complexity of reporting regimes, it is vital to build a culture that supports joined-up, collaborative action – we are all on the same side in combatting climate breakdown.

And above all:

- **Valorise seafarers and other maritime employees as partners in the decarbonisation journey:** Many working in the maritime industry understand only too well the vital importance of taking rapid action to address the climate emergency and are strongly motivated to play their part. The industry can benefit from their expertise and continue to build a sense of partnership by proactively consulting with seafarers and other employees in decision-making about the development and implementation of new technologies. ISWAN's helpline data and insights from our projects tell us that too often seafarers feel overlooked and under-valued. Having their concerns about decarbonisation acknowledged and acting on their suggestions for change would be an important step in empowering seafarers to be proponents and drivers of the journey towards zero carbon, rather than becoming another factor that risks driving many out of the industry.

About ISWAN

The International Seafarers' Welfare and Assistance Network (ISWAN) is an international maritime charity which works to improve the lives of seafarers and their families with services, resources, strategies and advocacy. ISWAN supports seafarers and their families around the world with our free helpline services, educational resources, relief funds and humanitarian support. We also work to drive change within the maritime sector for better health and wellbeing amongst seafarers, using data from our helplines to identify areas of need and inform new projects and research.

In 2023, we assisted 6,740 seafarers and their families around the world through our helplines and delivered training to almost 6,000 seafarers, including pre-departure orientation and mental health awareness presentations. Over US$180,000 was awarded to seafarers and their families in need by the relief funds administered by ISWAN.

Introduction

Seafarer welfare: the overlooked aspect of decarbonisation?

Decarbonisation is one of the key drivers of transformation in the maritime sector.[1] To address shipping's contribution to the climate emergency, maritime companies are being required to take rapid steps to meet mandatory carbon emission regulations.[2]

At an institutional level, there is widespread acknowledgement that seafarers are central to meeting the maritime sector's decarbonisation obligations. The stated aim of the Maritime Just Transition Task Force, established following the 2021 UN Climate Change Conference in Glasgow (COP26), is to ensure that shipping's response to the climate emergency puts seafarers at the heart of the solution.[3] To date, the majority of discussions of what a "Just Transition" might look like in a maritime context focus on the pressing need to ensure that seafarers have the training and skills that they need to operate more complex technologies and handle potentially more hazardous alternative fuels.[4] In addition to considerations of physical safety, there has also been recognition of the importance of psychological safety at sea in meeting the challenges of the zero-carbon transition. For example, in its 2023 report into the role of safety culture in decarbonisation, DNV emphasises the importance of: "a robust safety culture with strong safety leadership, a culture of trust and effective processes for competence development, incentives, knowledge sharing and proactive organizational learning."[5]

The acknowledgement at an institutional level of the central importance of seafarers' safety – both physical and psychological – to the journey of decarbonisation is vital. However, through ISWAN's daily conversations with seafarers, via both our helplines and our in-person work in India and the Philippines, we became concerned that, in practice, seafarers' wellbeing is often overlooked amidst the urgent pressure to decarbonise. For this reason, in summer 2023, ISWAN ran a survey to ask seafarers and others working in the maritime sector about the impact that the rapid adoption of new technologies and regulatory regimes is having on their mental health and job satisfaction. It is hoped that the insights that respondents have shared will contribute to understanding what it will take to achieve the goal laid out by the International Maritime Organization (IMO) in its revised 2023 Greenhouse Gas (GHG) Strategy to "ensure a just transition for seafarers and other maritime workforce that leaves no one behind".

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1. DNV's report (2023), The Future of Seafarers 2030: A decade of transformation, provides in-depth analysis of the impact of the drive to decarbonisation on the sector.

2. A survey by the Global Centre for Maritime Decarbonisation (GCMD) and Boston Consulting Group (BCG) demonstrates the wide spectrum of responses of shipowners and operators to the challenges of decarbonisation. The report identifies three major decarbonisation archetypes: frontrunners who have the greatest ambitions and are willing to invest heavily; followers, who believe in decarbonising their fleets, but have tighter investment thresholds and a near-term outlook; and, conservatives who are at an early stage in their decarbonisation journey.

3. The Maritime Just Transition Task Force was founded by the International Chamber of Shipping (ICS), the International Transport Workers' Federation (ITF), the United Nations Global Compact (UNGC), the International Labour Organization (ILO) and the International Maritime Organization (IMO). Further information, including the Task Force's position paper, is available on the UN's website.

4. The Task Force's commissioned report on this issue, as well as DNV's 2023 report The Future of Seafarers 2030, both identify very substantial skills gaps that require rapid and significant investment in infrastructure.

5. DNV (2023), The crucial role of safety culture in maritime decarbonization and digitalization. DNV has produced extensive guidance about how the maritime sector can take a holistic approach to managing safety risks on the pathway to a carbon-neutral industry.

Overview of key decarbonisation regimes

At an international level, from 1 January 2023 ships have been required to calculate their attained Energy Efficiency Existing Ship Index (EEXI) and to begin collecting data to report their annual operational Carbon Intensity Indicator (CII) and CII rating, as part of the IMO's Greenhouse Gas (GHG) Strategy to halve GHG emissions by 2050.[6] In addition, individual nations and regions are increasingly developing their own environmental regulation regimes.[7] In January 2024, for example, the EU expanded its Emissions Trading System (EU ETS) to include maritime transport emissions, meaning that shipping companies will be required to restrict their emissions to comply with their ETS allowances.

6. The 2023 IMO Strategy on Reduction of GHG Emissions from Ships is available on the IMO's website.

7. An insight brief by the Global Maritime Forum (2024) examines the scope for individual nation states to make a meaningful contribution to international shipping's transition to zero carbon.

Glossary of key decarbonisation terminology

Carbon Intensity Indicator (CII): The CII determines the annual reduction factor needed to ensure continuous improvement of a ship's operational carbon intensity within a specific rating level. The actual annual operational CII achieved must be documented and verified against the required annual operational CII. This enables the operational carbon intensity rating to be determined. Based on a ship's CII, its carbon intensity is rated A, B, C, D or E (where A is the best). A ship rated D for three consecutive years, or E for one year, has to submit a corrective action plan to show how the required index of C or above will be achieved. (Source: IMO)

Energy Efficiency Existing Ship Index (EEXI): A ship's attained EEXI indicates its energy efficiency compared to a baseline. The attained EEXI will then be compared to a required Energy Efficiency Existing Ship Index based on an applicable reduction factor expressed as a percentage relative to the Energy Efficiency Design Index (EEDI) baseline. It must be calculated for ships of 400 GT and above, in accordance with the different values set for ship types and size categories. The calculated attained EEXI value for each individual ship must be below the required EEXI, to ensure the ship meets a minimum energy efficiency standard. (Source: IMO)

EU Emissions Trading System (EU ETS): The EU ETS works on the 'cap and trade' principle. A cap is a limit set on the total amount of greenhouse gases that can be emitted by the operators covered by the system. The cap is reduced annually in line with the EU's climate target, ensuring that emissions decrease over time. Within the cap, companies primarily buy allowances on the EU carbon market, but they also receive some allowances for free. Companies can also trade allowances with each other as needed. The EU ETS was extended to include the maritime sector from January 2024. (Source: European Commission)

FuelEU Maritime: The EU has adopted the FuelEU Maritime regulation to increase the share of renewable and low-carbon fuels in the fuel mix of international maritime transport in the EU.

FuelEU Maritime sets well-to-wake greenhouse gas (GHG) emission intensity requirements on energy used on board ships over 5000 GT trading in the EU and will be implemented from 1 January 2025. (Source: DNV)

RightShip GHG Rating: RightShip's GHG Rating compares a vessel's designed efficiency against peer vessels of similar size and type using a speed-corrected methodology. This approach evaluates all vessels within a peer group at a common speed and focuses on the emissions in the range of a vessel's market operating speeds, based upon a speed corrected intensity. The vessel's GHG Rating is presented using an A–E scale, with the most efficient vessels being awarded A and the least efficient awarded E. The speed corrected methodology uses EEDI, Existing Vessel Design Index (EVDI) and EEXI and allows relative comparison of a ship's CO^2 emissions to vessels of a similar size and type. (Source: RightShip)

Survey findings: the impact of decarbonisation on seafarers

Demographics

The 400 valid survey responses received from seafarers included crew from 29 different nationalities, with the majority from India (42.8% of responses) and the Philippines (15.6%). This reflects the fact that ISWAN has a physical presence and the strongest networks in these two large seafarer-supplying nations. Almost 90% of respondents were working in officer roles and 97% identified as men. The largest number of seafarer respondents were aged between 35 and 44 (34.3%), whilst just under 90% were aged between 25 and 54. The majority of respondents (83.4%) worked on oil tankers (37.9%), chemical tankers (25.3%) or cargo ships, including general or bulk carriers (20.2%). Just over half (54.8%) worked on vessels without a fixed trading pattern.

NATIONALITY OF SEAFARERS

% SEAFARER RESPONDENTS
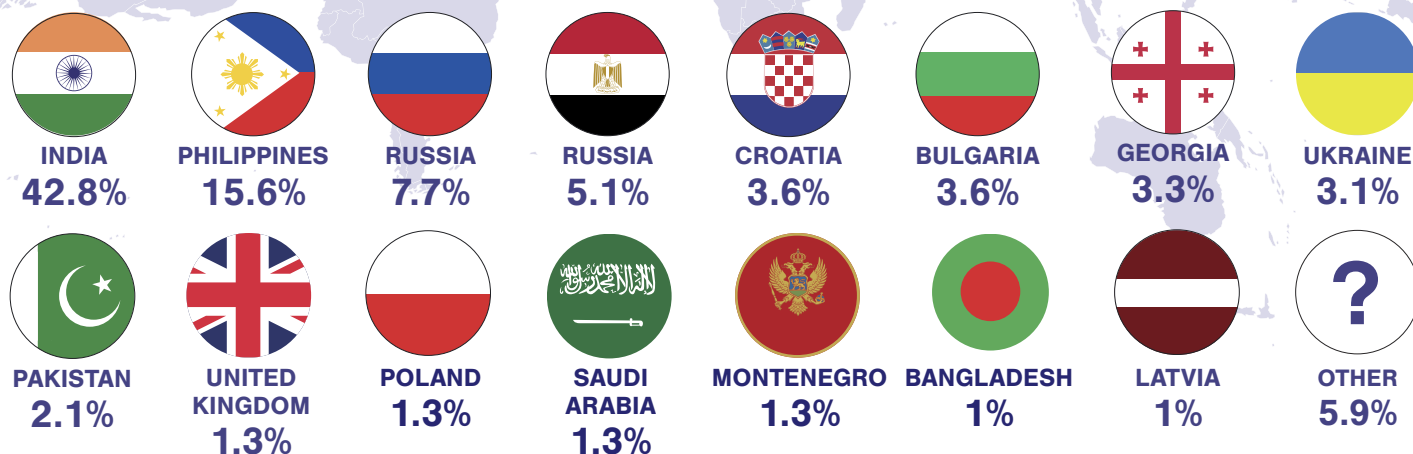
INDIA 42.8%	**PHILIPPINES** 15.6%	**RUSSIA** 7.7%	**RUSSIA** 5.1%	**CROATIA** 3.6%	**BULGARIA** 3.6%	**GEORGIA** 3.3%	**UKRAINE** 3.1%
PAKISTAN 2.1%	**UNITED KINGDOM** 1.3%	**POLAND** 1.3%	**SAUDI ARABIA** 1.3%	**MONTENEGRO** 1.3%	**BANGLADESH** 1%	**LATVIA** 1%	**OTHER** 5.9%

AGE OF SEAFARERS'
% SEAFARER RESPONDENTS

18-24	1.8%	45-54	21.8%
25-34	32.8%	55-64	8.0%
35-44	34.3%	65+	0.5%
PREFER NOT TO SAY			0.8%

Percentages in these infographics have been rounded up so may not in all cases total 100.0%.

VESSEL TYPE

% SEAFARER RESPONDENTS

CARGO TANKER 20.2%

SUPPLY SHIP 0.8%

GAS/LPG/LNG TANKER 3.8%

CRUISE SHIP 0.8%
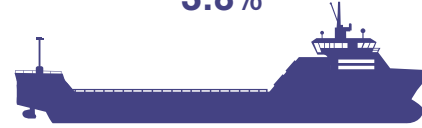
OIL TANKER 37.9%

FERRY/RO-RO FERRY 3.0%

OTHER 4.3%

TUG BOAT 0.3%

CHEMICAL TANKER 25.3%

CONTAINER SHIP 2.0%

PREFER NOT TO SAY 1.8%

ROLE
% SEAFARER RESPONDENTS

42.5%	ENGINEER/ CHIEF / SECOND / THIRD / FOURTH / JUNIOR
39.4%	MASTER / CHIEF OFFICER / SECOND OFFICER / THIRD OFFICER
7.5%	ELECTRICAL OFFICER
2.0%	DECK RATING - BOSUN / AB / OS / PUMPMAN
1.8%	DECK CADET

ENGINE ROOMRATING	**1.8%**
GALLEY: COOK /STEWARD / MESSMAN	**1.8%**
OTHER (PLEASE SPECIFY)	**1.5%**
PREFER NOT TO SAY	**1.5%**
TME /ENGINE CADET	**0.3%**

TRADING PATTERN

% SEAFARER RESPONDENTS

NO 54.8%

YES 25.1%

PARTIALLY 20.1%
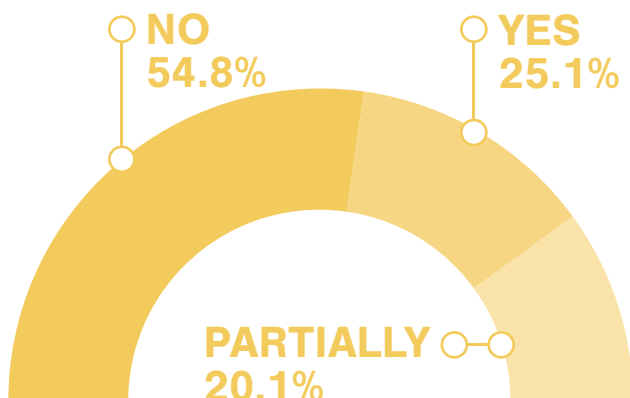
GENDER IDENTITY

% SEAFARER RESPONDENTS

MALE 97.2%

NON BINARY 0.3%

FEMALE 2.0%

PREFER NOT TO SAY 0.5%
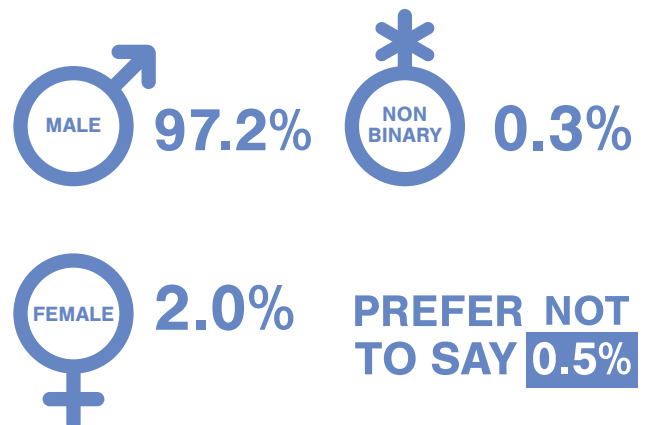
Impact of decarbonisation technologies and regulations on seafarers' work

The adoption of new environmental regulations is clearly having a major impact on seafarers' working lives. Overall, just over 70% of respondents reported that environmental regulations relating to decarbonisation have a big (43.7%) or moderate (26.6%) impact on their work.

To what extent do environmental regulations relating to decarbonisation affect your work?

They have a big impact

43.7%

They have a moderate impact

26.6%

They do not affect my job but I am aware of them

17.8%

They have a minor impact

8.8%

I am not aware of decarbonisation regulations

3%

Seafarers, 398 responses

Engineers experienced the greatest impact on their work: just over three quarters (75.2%) reported a big (46.8%) or moderate (28.4%) impact, whilst the proportion was slightly lower amongst chief officers and deck officers, with 44.2% reporting a big impact and 25.6% responding that the impact was moderate.
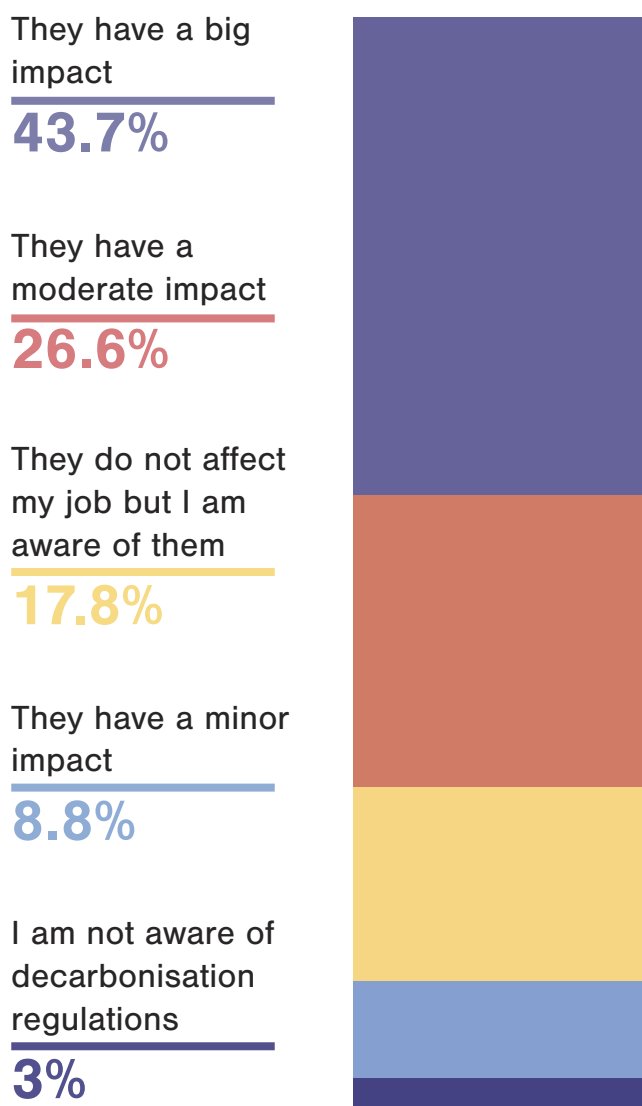
Those seafarers without a fixed trading pattern also reported a larger impact on their work: just over 72% of respondents without a fixed trading pattern reported a big (45.0%) or moderate (27.1%) impact, compared to 69.5% of seafarers with a partially fixed trading pattern and 67.7% of respondents with a fixed trading pattern. Amongst engineers, 79.6% of respondents who did not have a fixed trading pattern reported a big (49.5%) or moderate (30.1%) impact on their work, compared with 69.4% of respondents operating with a fixed trading pattern.

The survey findings indicate a very mixed picture as regards the nature of the impact on seafarers' work at sea. Whilst for over 40% of respondents, the changes brought about by decarbonisation were having a positive effect on technical aspects of their work, including the storage and use of different grades of fuel, fulfilling audit requirements and maintaining equipment and machinery, for around a quarter of seafarers, the impact on these dimensions of their work was felt to be negative.[8]

8. Based on feedback from seafarers during the testing phase of the survey, respondents were asked about broadly positive or negative impacts, rather than using a five-point scale, due to limitations in using matrix question layouts on mobile phone technology.

Impact of decarbonisation regulations and technologies on seafarers' work

Positive — % of 396 responses
Negative — % of 381 responses

Fulfilling audit or inspection requirements (SIRE-2, Rightship etc.)
- Positive: 40.9%
- Negative: 23.4%

Maintaining equipment and machinery
- Positive: 45.2%
- Negative: 25.5%

Adhering to relevant local regulations
- Positive: 36.6%
- Negative: 17.1%

Ensuring necessary local regulations
- Positive: 33.8%
- Negative: 16.3%

Maintaining up-to-date training
- Positive: 31.1%
- Negative: 17.3%

Port State Controls
- Positive: 30.6%
- Negative: 20.7%

Health & safety/accident prevention
- Positive: 40.4%
- Negative: 13.4%

Storage and use of different grades of fuel
- Positive: 40.4%
- Negative: 26.3%

None of the above
- Positive: 15.9%
- Negative: 40.7%

Axis: 0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%

In free text comments, some seafarers expressed their support for the modernisation of work at sea and their enjoyment of the challenge of learning how to implement new technologies.

"We are working on modern ships equipped with modern equipment. Thus, [the] job is much easier, convenient, efficient and safe."

"Keeping me to thrive [by] upgrading myself in line to modern tech[nology]."

One seafarer listed what they saw as the positive impacts on seafarers' work:

"1. Clean fuel and environment.

2. Learning new skills, technology, equipment [and] required training.

3. Ready to take more responsibility and challenges.

4. Feeling of satisfaction in contributing towards decarbonisation.

5. Modern ships and better shore interaction."

Other respondents, however, drew attention to the ways in which they felt changes brought about by decarbonisation were having a negative impact on their work. Perhaps unsurprisingly, there was a marked difference in responses between deck officers and engineers. Deck officers were more likely than engineers to report negative impacts in relation to reporting and crewing considerations, including fulfilling inspection requirements and maintaining up-to-date training. Amongst engineers, opinion was very divided regards the impact of decarbonisation on fuel storage and use and machine maintenance. Whilst the proportion of engineering respondents who viewed the impact on these areas of work positively was higher than amongst deck officers, there was also a much higher proportion of negative responses, with a third of engineers evaluating the impact on fuel storage and machine maintenance negatively.

Impacts of decarbonisation regulations and technologies on work – Engineering and Deck Officers

	Negative	Positive
Deck officers	151 respondents	155 respondents
Engineering officers	159 respondents	159 respondents

Storage and use of different grades of fuel
- Negative: 18.5% / 34.6%
- Positive: 39.4% / 45.8%

Health & safety/ accident prevention
- Negative: 11.3% / 15.7%
- Positive: 41.9% / 35.1%

Port State Controls
- Negative: 23.8% / 18.8%
- Positive: 28.4% / 34.5%

Maintaining up-to-date training
- Negative: 19.9% / 15.7%
- Positive: 25.8% / 36.3%

Ensuring necessary skills among crew
- Negative: 19.2% / 17.0%
- Positive: 35.5% / 33.3%

Adhering to relevant local regulations
- Negative: 15.2% / 20.1%
- Positive: 38.7% / 39.9%

Maintaining equipment and machinery
- Negative: 19.2% / 33.3%
- Positive: 43.2% / 53.6%

Fulfilling audit or inspection requirements (SIRE-2, Rightship etc.)
- Negative: 25.8% / 21.4%
- Positive: 41.3% / 43.5%

None of the above
- Negative: 40.4% / 38.4%
- Positive: 13.6% / 15.5%

A number of engineers commented on the scale of the technical challenges that they face in adapting to working with multiple fuels and adjusting maintenance regimes and safety protocols accordingly.

One engineer commented on what he saw as the difference between the scale of the impact of decarbonisation on his work to that of his deck colleagues:

"As [an] Engineer, I say this impacts us the most. Whether you install new Ballast Treatment, or scrubber system, or develop new technology engines to adhere with new regulations, you still add and change equipments which will be additional work to engineers. This will just be minor form and reports to deck crew. Just a training to be familiarize[d] to the new law and others, but for engineers, these are too much already."

Some engineers also drew attention to the challenges of adopting new fuels in existing vessels, including potential safety concerns:

"I once was onboard a ship with 3 different grades of fuel oil: ULSFO VLSFO and LSMGO.[9] The changeover procedure and its effects on all the other machineries are profound."

"After changes over to MDO [marine diesel oil], machineries start leaking because of its temperature changes and machineries age."

"They impact the safety also. Existing ships' engines are not designed to work with low sulphur fuels."

"Equipment designed for decarbonisation is creating more workload and issues and should be well tested before [being] put in use. Constraints on merchant vessels is much more than oil and other refineries ashore, thus creating [a] much more difficult work environment especially for engineering officers onboard ships."

The survey findings suggest, however, that having a fixed trading pattern may mitigate to some extent against some of the current challenges posed by the changes brought about by decarbonisation. Amongst engineers, those with fixed trading patterns were less likely to report negative impacts on their work. The greatest differential was seen in relation to the storage and use of different grades of fuel, where 23.5% of respondents with a fixed trading pattern reported a negative impact on their work, in comparison with 47.1% of those with partially fixed trading patterns and 34.1% of those with no fixed trading pattern. This suggests that having a fixed trading pattern assists engineers in managing the substantial challenges of undertaking frequent changeovers of fuel oil and carrying out the necessary maintenance work in accordance with the relevant regulatory regimes. Adhering to local regulations, ensuring the necessary skills amongst crew and fulfilling inspection requirements also appear to pose greater problems for seafarers on vessels without a fixed trading pattern.

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9. Ultra-low sulphur fuel oil (ULSFO), Very-low sulphur fuel oil (VLSFO) and low-sulphur marine gas oil (LSMGO). See Marine Insight's Guide to Marine Gas Oil and LSFO for an introductory guide to some of the fuel types used at sea.

Impact of decarbonisation regulations and technologies on engineers

% of respondents reporting negative impacts

Legend:
- Fixed trading pattern — 34 responses
- Partially fixed trading pattern — 34 responses
- No fixed trading pattern — 91 responses

Storage and use of different grades of fuel
- Fixed trading pattern: 23.5%
- Partially fixed trading pattern: 47.1%
- No fixed trading pattern: 34.1%

Health & safety/ accident prevention
- Fixed trading pattern: 11.8%
- Partially fixed trading pattern: 20.6%
- No fixed trading pattern: 15.4%

Port State Controls
- Fixed trading pattern: 14.7%
- Partially fixed trading pattern: 14.7%
- No fixed trading pattern: 22.0%

Maintaining up-to-date training
- Fixed trading pattern: 14.7%
- Partially fixed trading pattern: 14.7%
- No fixed trading pattern: 16.5%

Ensuring necessary skills among crew
- Fixed trading pattern: 11.8%
- Partially fixed trading pattern: 14.7%
- No fixed trading pattern: 19.8%

Adhering to relevant local regulations
- Fixed trading pattern: 11.8%
- Partially fixed trading pattern: 14.7%
- No fixed trading pattern: 25.3%

Maintaining equipment and machinery
- Fixed trading pattern: 32.4%
- Partially fixed trading pattern: 38.2%
- No fixed trading pattern: 31.9%

Fulfilling audit or inspection requirements (SIRE-2, Rightship etc.)
- Fixed trading pattern: 14.7%
- Partially fixed trading pattern: 20.6%
- No fixed trading pattern: 24.2%

None of the above
- Fixed trading pattern: 41.2%
- Partially fixed trading pattern: 32.4%
- No fixed trading pattern: 39.6%

Amongst deck officers, the most significant negative impact on their work was felt in relation to fulfilling audit or inspection requirements. Here too, having a fixed trading pattern appears to reduce the negative impact of meeting more complex reporting requirements. Overall, 25.8% of deck officers reported a negative impact on their work in this area; however, this ranged from 16.2% of respondents with a fixed trading pattern, to 31.0% of respondents with no trading pattern. Similarly, the proportion of deck officers reporting a negative impact on port state control surveys ranged from 18.9% of respondents with a fixed trading pattern, to 27.4% without a fixed trading pattern.

Impact of decarbonisation on seafarers' wellbeing

Throughout the survey findings, there are indications of significant support from seafarers as regards the direction of travel for decarbonisation and technological change. Overall, just over half (51.4%) of seafarers responded that decarbonisation regulations and technologies were having a positive (36.1%) or very positive (15.3%) effect on their wellbeing at sea. Whilst deck officers were slightly more likely to appraise the overall impact of decarbonisation positively or very positively (53.1%), amongst engineering officers, who are tasked with the complexities of adopting multiple fuels, the proportion who reported a positive or very positive effect on their wellbeing was lower, at 45.6%.[10] Amongst all survey respondents, just over 30% viewed the impact as neutral, whilst for 17.5% the impact was negative (11.9%) or very negative (5.6%).

Overall impact on adoption of decarbonisation regulations and technologies on seafarers' wellbeing

Very positive
15.3%

Positive
36.1%

Neutral
31.1%

Negative
11.9%

Very negative
5.6%
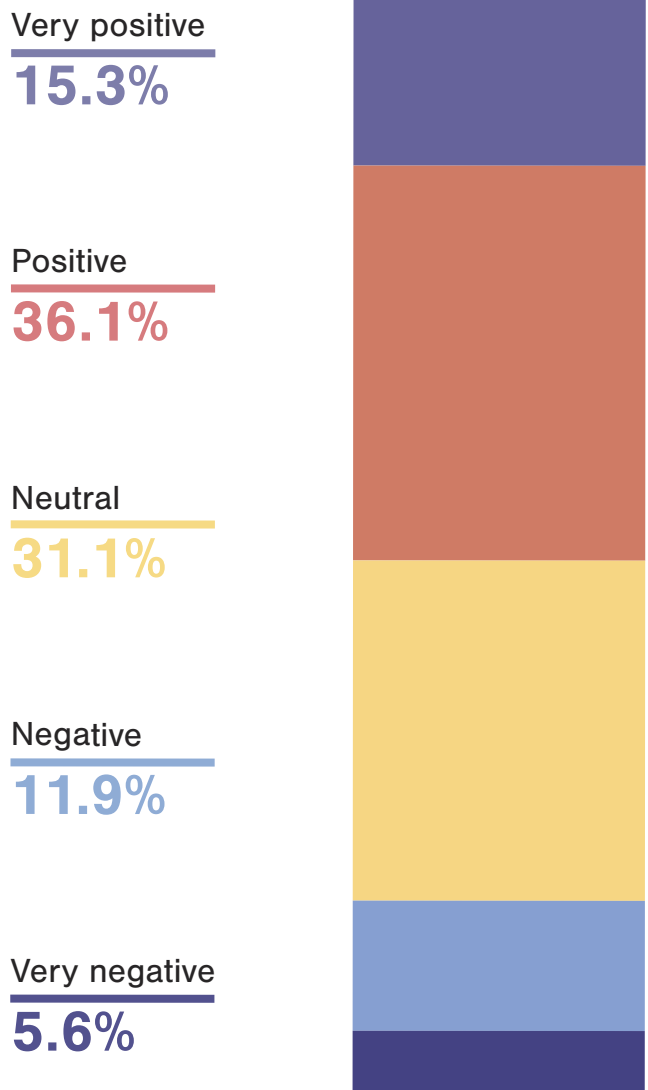
Seafarers, 360 responses

For some seafarers, concern about the climate emergency was part of their motivation to support the transition to zero carbon.

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10. The survey response rate for Ratings was not high enough to comment on the impact of decarbonisation on their work and wellbeing.

"I like to know that we, as humans, are taking the necessary steps to lower the negative impact we have on our planet. This is somewhat vital for me, as I have always had an interest in ecology and green energy tech."

"Embracing the change slow and steady. Accepting the responsibility for [a] sustainable world."

"I get more motivated knowing that the reason for all these carbon regulations is for the planet".

Throughout the survey findings, however, there is evident ambivalence about the challenges of seafaring during the transition to zero carbon. Whilst there is substantial support in principle for decarbonisation and technological modernisation, for many seafarers, this is countered by the impact of rapid change on their psychological wellbeing. One seafarer clearly articulated this mixed picture, explaining that they evaluated the impact of decarbonisation on their wellbeing at sea as neutral because the:

"Modern ship is safe and reliable, however new rules and regulations set by the shipping committee [are] getting complicated and stressful to the crew on board."

Indeed, the survey findings indicate that the adoption of decarbonisation regulations and technologies is having a very substantial impact on the mental wellbeing and morale of many seafarers. The most significant impact related to the increase in workload associated with adapting to new technologies and reporting requirements: over half (53.8%) of respondents stated that the impact on their workload had been negative. For over 40% of respondents, this was associated with an increase in levels of stress (44.0% of respondents) and fatigue (40.1%). A quarter (24.9%) of respondents felt that the additional pressures of decarbonisation were negatively impacting on the time available for social activities,[11] whilst just under a fifth (18.2%) believed that the impact on crew morale was detrimental. Just under 30% of survey respondents (28.3%) felt that change associated with decarbonisation was negatively affecting their mental health. Almost half (45.5%) of respondents reported that the introduction of decarbonisation regulations and technologies had not had a positive impact on any of the wellbeing areas included in the survey.
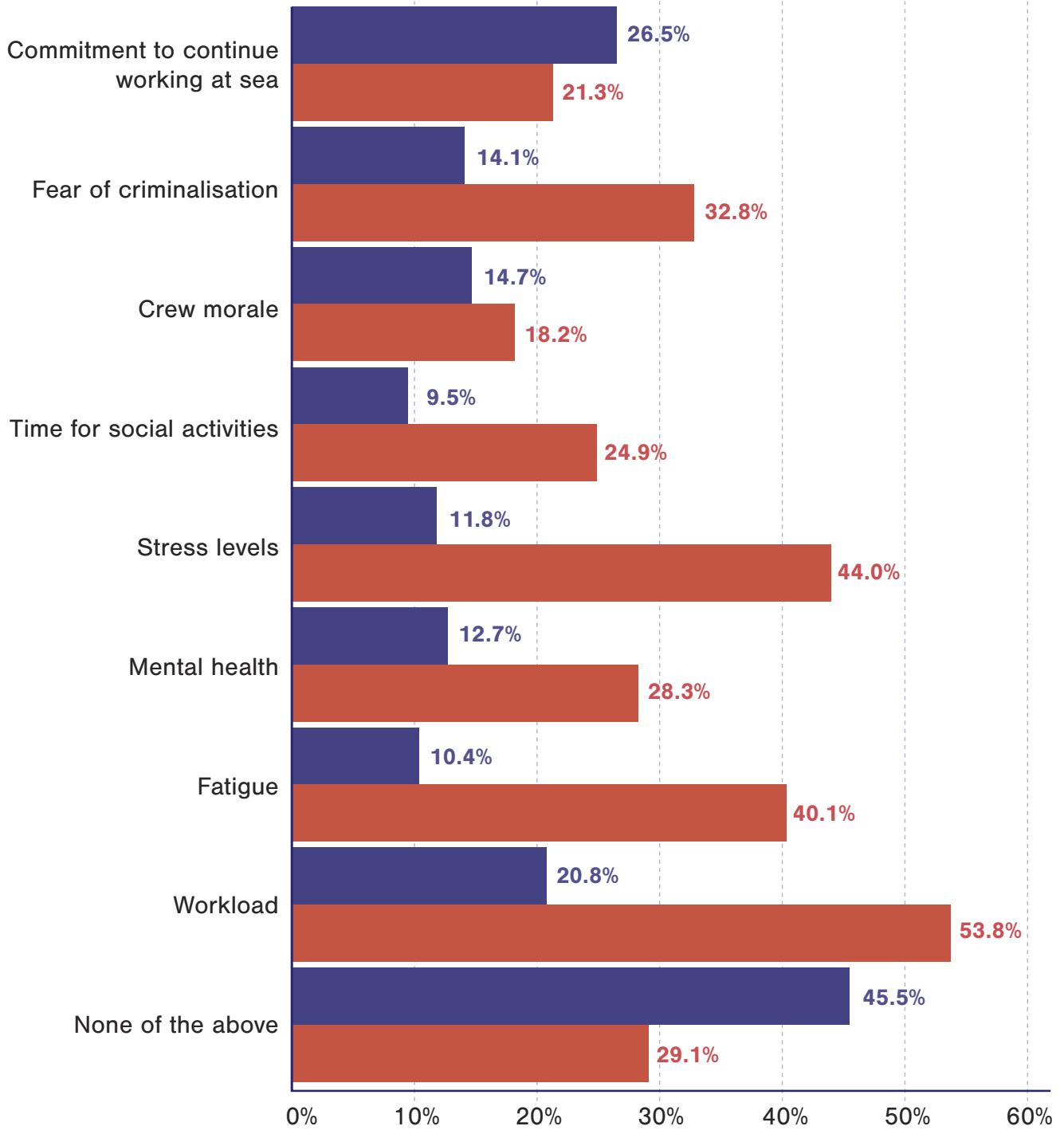
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11. ISWAN's social interaction matters (SIM) project explores the crucial importance to seafarers' health and wellbeing of having quality social interaction and rest time.

Impact of decarbonisation regulations and technologies on seafarers' wellbeing at sea

Positive — % of 347 responses

Negative — % of 357 responses

Category	Positive	Negative
Commitment to continue working at sea	26.5%	21.3%
Fear of criminalisation	14.1%	32.8%
Crew morale	14.7%	18.2%
Time for social activities	9.5%	24.9%
Stress levels	11.8%	44.0%
Mental health	12.7%	28.3%
Fatigue	10.4%	40.1%
Workload	20.8%	53.8%
None of the above	45.5%	29.1%

Technostress at sea — insights from a World Maritime University case study

ISWAN's survey results support the findings of a case study carried out as part of a report by the World Maritime University (WMU) entitled Transport 2040: Impact of Technology on Seafarers – The Future of Work. In its exploration of the impact of technostress on board a Danish-flagged vessel, the report finds that: "with the pace that technology is being integrated into shipping, seafarers are increasingly experiencing pressure to rapidly acquire new skills and competences, leading to serious consequences for their mental health and wellbeing" (WMU, 2023, p136). The study cautions that, although the shipping industry is embracing rapid change, "seafarers need to keep up with the fast-growing pace in the development of new technologies, which is known to cause work-related stress, a concept known as technostress." (ibid).

In its exploration of the impact of rapid technological change on seafarers, the report examines the multidimensional technostress creators that can lead to increased "anxiety, mental fatigue, scepticism, and a sense of ineffectiveness" (Salanova et al., cited in ibid, p123). These include techno-overload, techno-complexity, techno-invasion and techno-uncertainty.

The report also examines the technostress inhibitors that can help to mitigate against the impacts of rapidly evolving technologies, including training, new skills acquisition, culture change and raising awareness (ibid, pp136-138).

Types of Technostress

Techno-overload: pressure to work more due to technology and excessive information

Techno-invasion: the inability to escape work

Techno-complexity: time lost to efforts to understand technology

Techno-insecurity: when your job or status is threatened

Techno-uncertainty: inconvenience due to changes and computer bugs

(Dunaetz, cited in ibid, p153)

The survey indicates that for a substantial number of seafarers, the lack of standardisation and cohesion in environmental legislation and reporting requirements is leading to an increased fear of being held legally responsible for making a mistake. Almost a third (32.8%) stated that the raft of change brought about by decarbonisation was leading to an increased fear of criminalisation as a result of administrative errors or inadvertently contravening one of the overlapping environmental regulatory regimes.

"One is always scared of getting into trouble with the authorities or company due to an oversight or mistake by self or staff. This is mainly due to varying rules and limits in different parts of the world. Also interpretations are also different in different countries and the seafarer is always wrong!"

"Due to different rules each local authorities impose. It has a big risk of making mistakes due to improper publication of rules and various regulations imposed."

"With failure of new machines, compliance is at stake and there is no leeway for this. Eventually, crew will be put to fault if any finding crops up."

The only area of wellbeing in which respondents deemed the positive impacts of decarbonisation to outweigh the negative related to their commitment to continue working at sea. Just over a quarter (26.5%) responded that decarbonisation was having a positive impact on their commitment to remaining in the maritime sector, whilst for just over a fifth (21.3%) the impact was negative. Again, this perhaps reflects the two sides of seafarers' experiences of the journey to zero carbon: many find it motivating to feel that they are part of finding solutions to the climate emergency; however, for a significant minority, the day-to-day impact on their workload and stress levels are so substantial that they are undermining their commitment to working at sea.

Some seafarers commented on what they see as the knock-on effects of rapid technological change combined with insufficient human resources, on wellbeing and onboard safety. One respondent stated that: "extra paper work and adherence to varying rules leads to fatigue and increases [the] probability of accidents and poor health due to fatigue." Another seafarer expressed concerns that the safety and wellbeing of seafarers is being overlooked in the rush to adopt new technologies that may not, in the seafarers' view, have been sufficiently tested:

"The ships are brand new, but nobody knows what they're dealing with. Even the manufacturers have themselves designed it for the first time. So, it's like a pilot project with testing being done on live sailing ships. The crew is having [an] extreme[ly] hard time with no shore assistance."

Another respondent commented that the contributions that seafarers make to the transition to zero carbon are not being sufficiently acknowledged or taken into account, with potentially severe consequences for the industry's safety and sustainability: "No crew will stick with this troublesome thing for long despite the environmental aspects. In the end, more incompetent crew will join which will further degrade the quality, and safety will go for a toss."

For some respondents, the pressure of decarbonisation is one of several factors that are contributing to the shipping industry's growing recruitment and retention crisis:

"The industry is under pressure in many areas, and it is not just decarbonization. The profession becomes more complex, less attractive and operations are more difficult especially with reduced standards of training. Shipping operators don't give much attention to improvement of onboard operations."

"Seafaring is a long lost industry now. Only those will remain who have nowhere else to work. The smart people will always find better alternatives to sailing at sea."

In free text comments, some respondents emphasised that it is the complexity of the regulatory environment that is having the greatest impact on their stress levels and workloads, as requirements frequently vary from port to port and in different parts of the world. Some respondents commented that the additional workload associated with the requirement to adhere to multiple reporting regimes is not being reflected in crew size, hence the impact on stress and fatigue.

"Every port had [a] dif[ferent] set of rules in terms of fuel usage."

"A lot of complicated rules and regulations set by the shipping committee resulting [in] an extra load, thus extra stress and fatigue to the crew onboard."

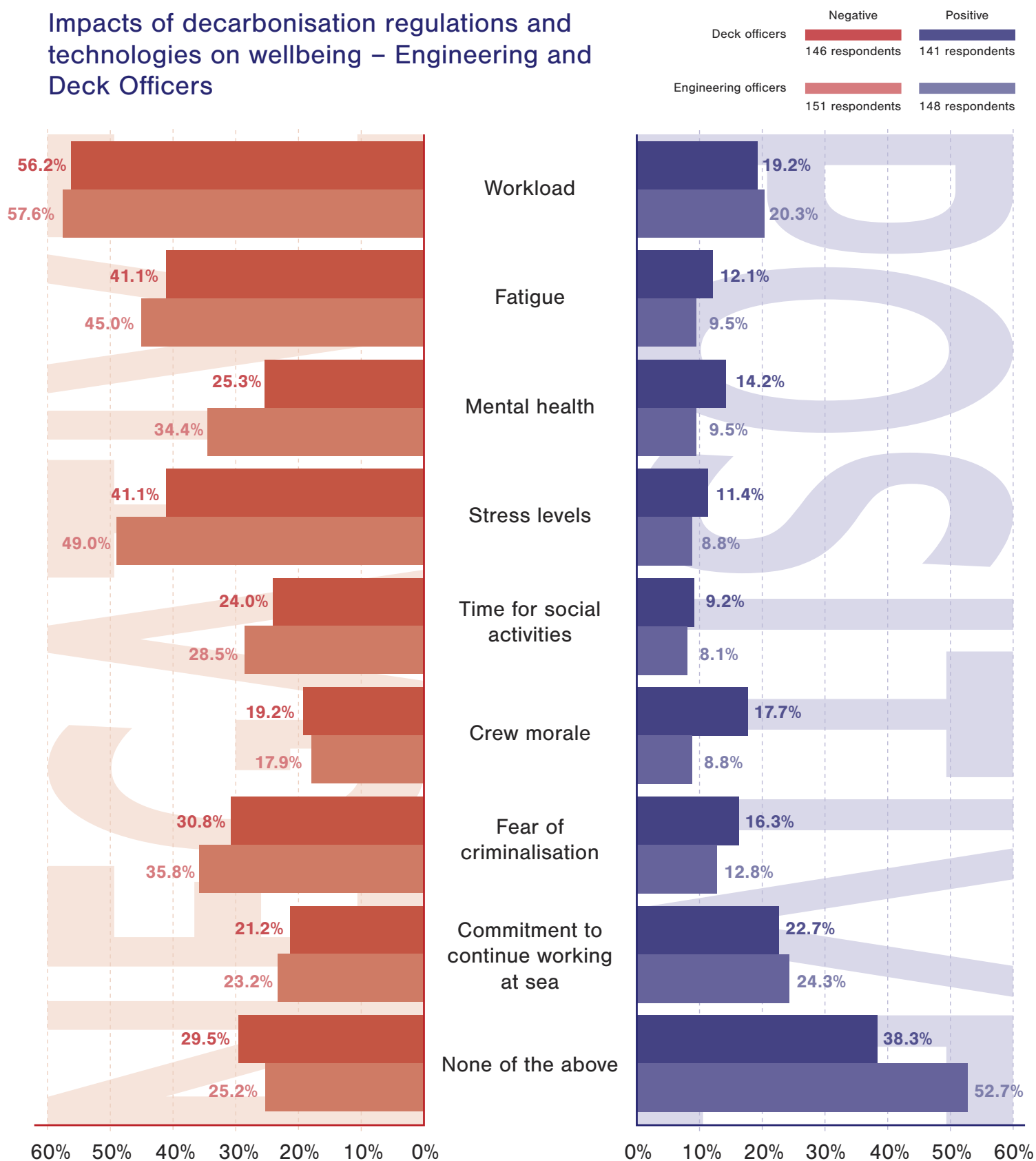*"To[o] much pressure for compliance and reporting with no increase of manpower."*

"Mentally one is under immense pressure with so much or regular checks."

As with the impacts on technical aspects of work, there was substantial variation between deck officers and engineering officers in terms of the impact of the decarbonisation transition on their wellbeing. The proportion of engineers that evaluated the impact on their wellbeing as negative was higher across all wellbeing categories than for deck officers, with the exception of crew morale. Indeed, over half of engineers (52.7%) responded that there had not been a positive impact on any of the wellbeing areas surveyed, in comparison with 38.3% of deck officers. The differential was most striking in terms of impacts on mental health, with 34.4% of engineers stating that decarbonisation was having a negative impact on their mental health, in comparison with 25.3% of deck officers.

"Complying to the new local and international regulation (e.g. CII) is additional work. The company is closely monitoring the consumption and small shortcomings means repeating of work."

Impacts of decarbonisation regulations and technologies on wellbeing – Engineering and Deck Officers

	Negative	Positive
Deck officers	146 respondents	141 respondents
Engineering officers	151 respondents	148 respondents

	Negative		Positive	
	Deck officers	Engineering officers	Deck officers	Engineering officers
Workload	56.2%	57.6%	19.2%	20.3%
Fatigue	41.1%	45.0%	12.1%	9.5%
Mental health	25.3%	34.4%	14.2%	9.5%
Stress levels	41.1%	49.0%	11.4%	8.8%
Time for social activities	24.0%	28.5%	9.2%	8.1%
Crew morale	19.2%	17.9%	17.7%	8.8%
Fear of criminalisation	30.8%	35.8%	16.3%	12.8%
Commitment to continue working at sea	21.2%	23.2%	22.7%	24.3%
None of the above	29.5%	25.2%	38.3%	52.7%

Amongst engineers with no fixed trading pattern, the impact of decarbonisation on wellbeing at sea appears to be even more stark: 59.2% commented on a negative impact on their workload, whilst 52.4% reported an increase in stress levels. Just over 40% (40.5%) reported increased concerns about criminalisation.

Engineers who took part in the survey commented on the strain that the requirement to undertake additional tasks with the same, or fewer, crew was placing on their health and wellbeing. One engineer emphasised the profound, multifaceted impacts on themselves and their colleagues:

"Negative effects are both physical and mental. Understanding the scope of change was a challenge because shore staff were also not clear how the change was going to take shape. Then cleaning and preparing the bunker tanks were a physical challenge. Use of different fuels required a lot of training and understanding. Maintaining machinery has added burden to already stressed crew. [The] final blow is ongoing with compliance checks from Port and Flag states plus Third-parties."

Other engineers commented on the major effects that frequent fuel changes are having on their daily routines:

"Again stress levels are agitating due to demands... a simple fuel switch on every port calls will give a big impact on a wellbeing of a person, especially if the port calls are every day."

"Some ports have regulations, some don't have. So we have to change over to different grades of fuel frequently which is not good for the machinery and of course it affects our rest hours."

"Extra work, with [the] same man power; frequent changeover affects the routines and frequency of overhauling of purifier, fuel pumps and injectors."
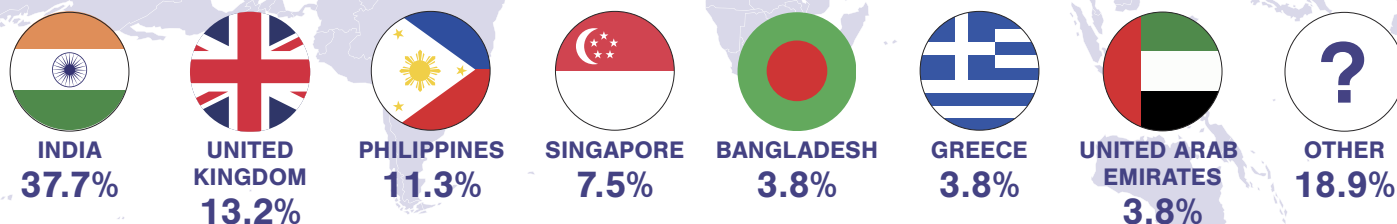
The impact of decarbonisation on shore-based staff

The sample size was much smaller amongst shore-based staff than was the case for seafarers: valid responses were received from 55 staff of 17 nationalities, with the largest number of responses from staff from India (37.7%), the United Kingdom (13.2%) and the Philippines (11.3%). Just under 90% identified as men and, as with seafarers, the largest number of respondents were from the 35-44 age group (30.9%). Responses were received from shore-based staff working in a wide range of roles, with the largest number coming from technical management (16.4%), crewing management (14.5%) or training/teaching (12.7%). The small sample size and very broad range of roles mean that the survey findings are less robust than those of the seafaring cohort and should be taken as providing only an initial insight into the potential impacts on shore-based staff of decarbonisation.
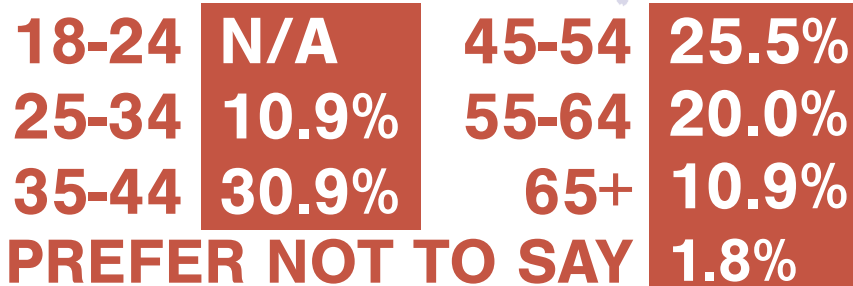
NATIONALITY
% SHORE-BASED RESPONDENTS

INDIA	UNITED KINGDOM	PHILIPPINES	SINGAPORE	BANGLADESH	GREECE	UNITED ARAB EMIRATES	OTHER
37.7%	13.2%	11.3%	7.5%	3.8%	3.8%	3.8%	18.9%

AGE
OF SEAFARERS'
% SHORE BASED RESPONDENTS

18-24	N/A	45-54	25.5%
25-34	10.9%	55-64	20.0%
35-44	30.9%	65+	10.9%

PREFER NOT TO SAY 1.8%

34.6% OTHER (PLEASE SPECIFY)*	PREFER NOT TO SAY **7.3%**
16.4% TECHNICAL SUPERINTENDENT / FLEET TECHNICAL MANAGER / DIRECTOR TECHNICAL	MARITIME ADMINISTRATION **7.3%**
14.5% CREWING MANAGER / DIRECTOR CREWING	MARINE INSURANCE OR CHARTERING **5.5%**
12.7% TRAINING/TEACHING	CLASSIFICATION SOCIETY **1.8%**

ROLE
% SHORE BASED RESPONDENTS

Percentages in these infographics have been rounded up so may not in all cases total 100.0%.

TRADING PATTERN

% SHORE BASED RESPONDENTS

NO
42.3%

YES
38.5%

PARTIALLY
19.2%
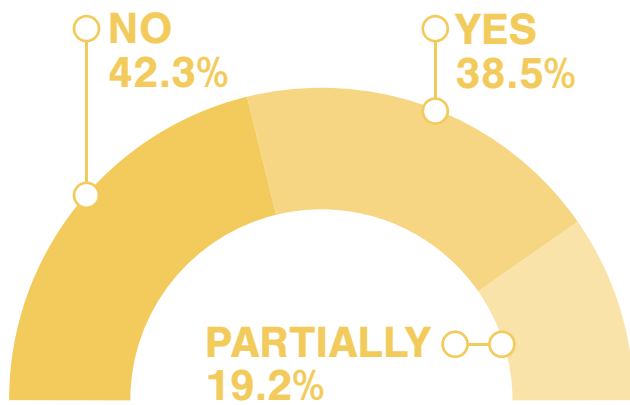
The impact of decarbonisation on shore-based staff's work

The extent of the impact that shore-based staff felt that environmental regulations were having on their work was slightly lower than that of seafarers: 67.9% of shore-based respondents evaluated the impact as either big or moderate, in comparison with 70.3% of seafarers. The broad range of roles carried out by shore-staff respondents should, however, be borne in mind.

GENDER IDENTITY

% SHORE BASED RESPONDENTS
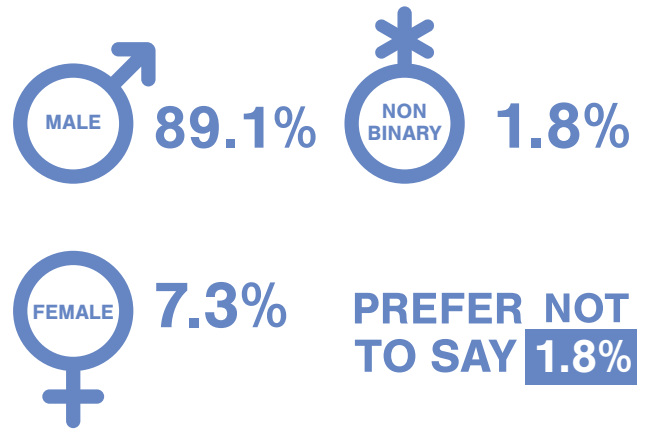
MALE **89.1%**   **NON BINARY** **1.8%**

FEMALE **7.3%**   **PREFER NOT TO SAY** **1.8%**

To what extent do environmental regulations relating to decarbonisation affect your work?

They have a big impact
43.4%

They have a moderate impact
24.5%

They do not affect my job but I am aware of them
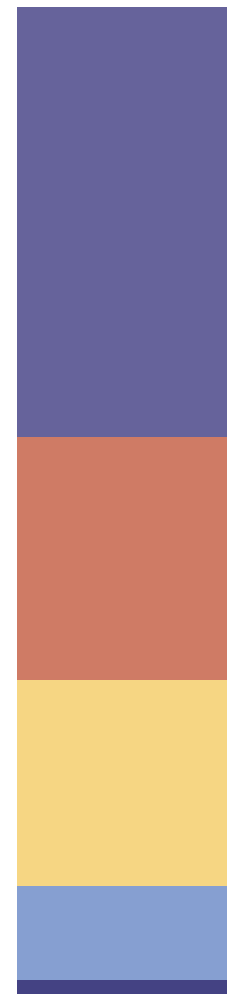**20.8%**

They have a minor impact
9.4%

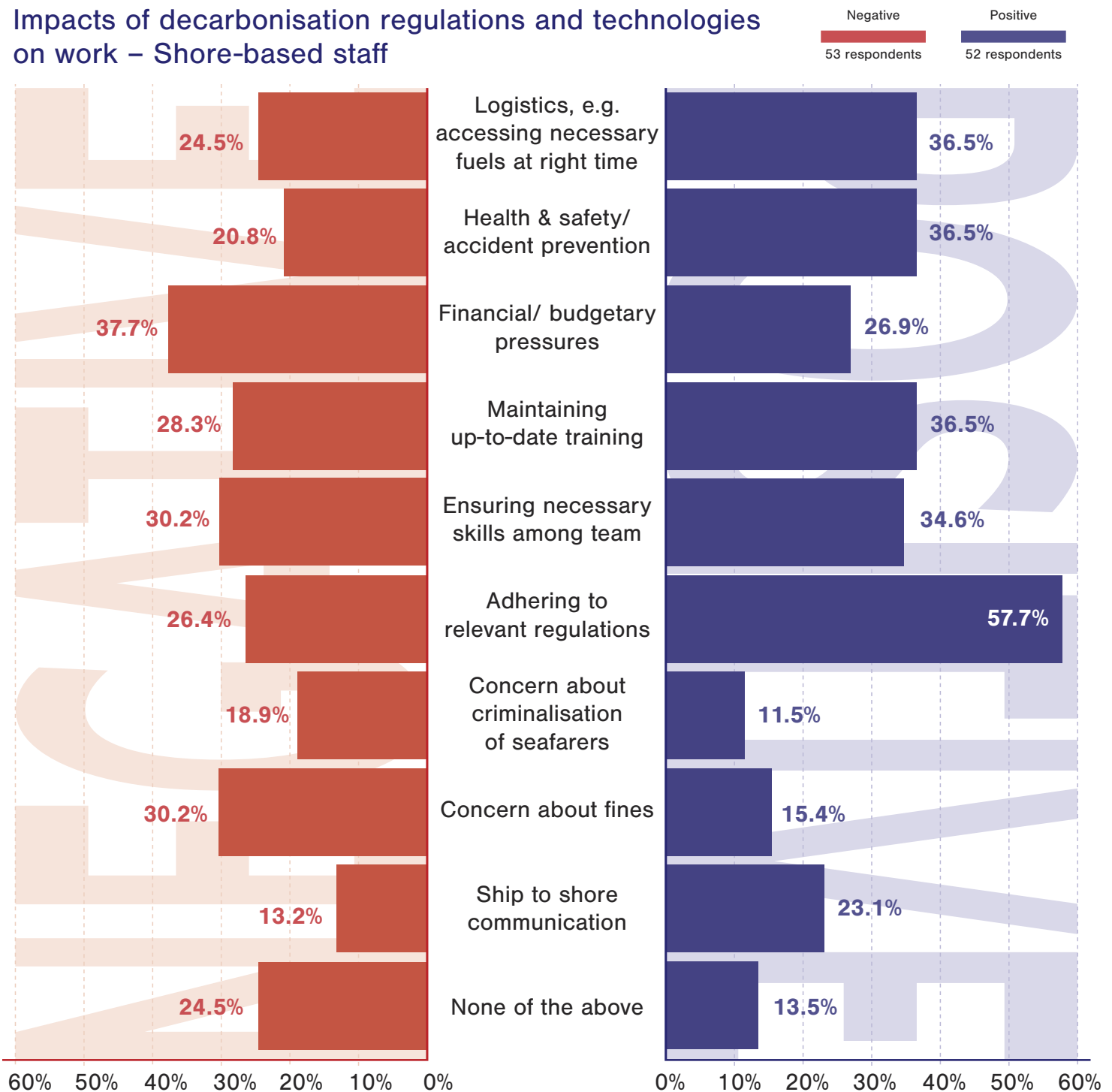I am not aware of decarbonisation regulations
1.9%

Shore-based staff, 53 respondents

In terms of the impact on their work responsibilities, the responses of shore-based staff were more ambivalent than those of seafarers. Throughout their survey responses, shore-based staff reflect tensions between the need to meet the requirements of environmental regulations and financial pressures. The proportion of respondents who deemed that decarbonisation regulations and technologies were having a negative impact on financial and budgetary pressures outweighed those who viewed the impact positively. The proportion of respondents who felt that changes relating to decarbonisation had increased concerns about receiving fines and about the potential criminalisation of seafarers was also higher than those who viewed these changes positively. This indicates that seafarers' anxieties about the adoption of decarbonisation regulations leading to higher risks of errors and potentially criminalisation are shared by their shore-based colleagues.

Impacts of decarbonisation regulations and technologies on work – Shore-based staff

Negative — 53 respondents
Positive — 52 respondents

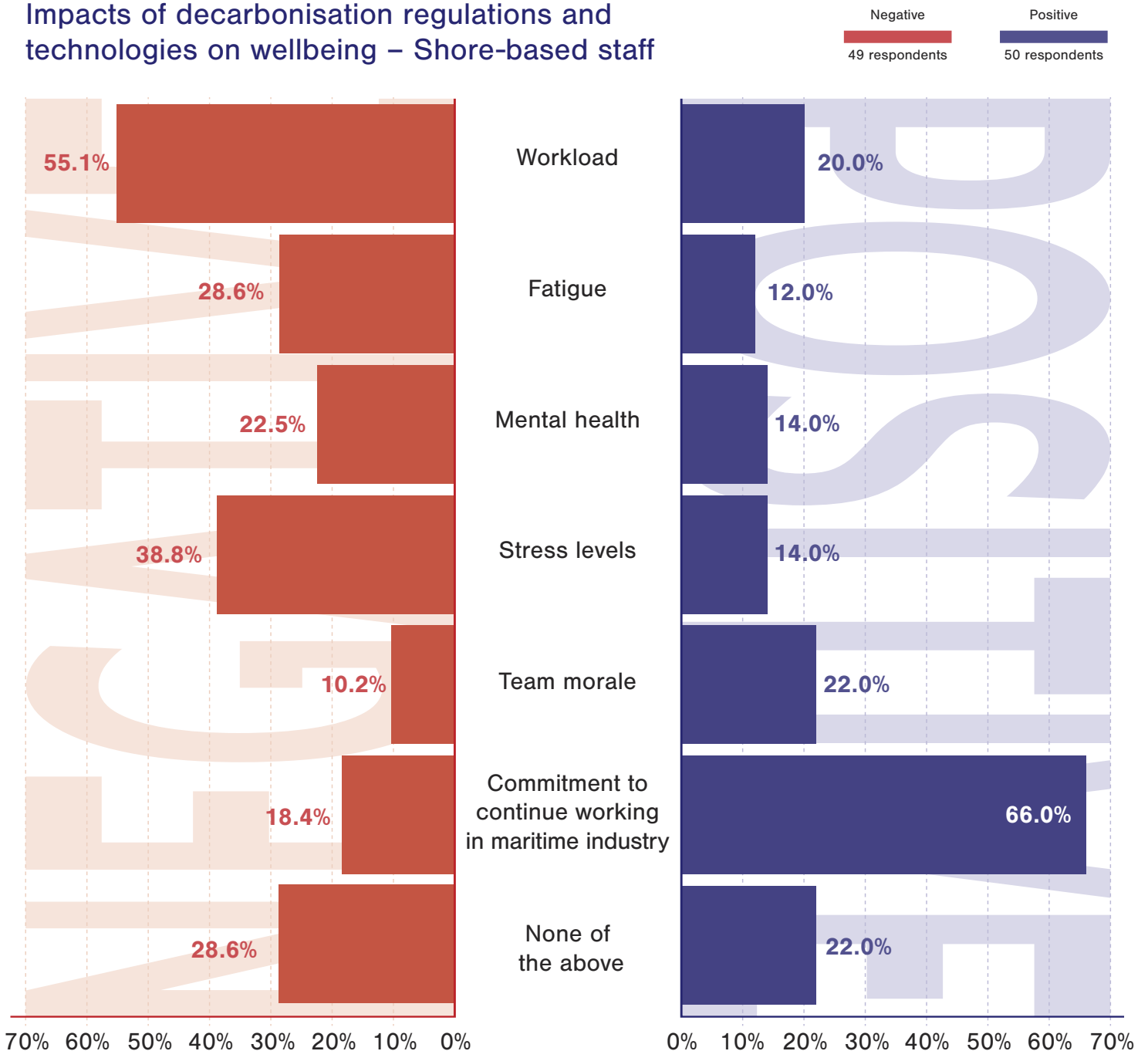| Category	Negative	Positive
Logistics, e.g. accessing necessary fuels at right time	24.5%	36.5%
Health & safety/ accident prevention	20.8%	36.5%
Financial/ budgetary pressures	37.7%	26.9%
Maintaining up-to-date training	28.3%	36.5%
Ensuring necessary skills among team	30.2%	34.6%
Adhering to relevant regulations	26.4%	57.7%
Concern about criminalisation of seafarers	18.9%	11.5%
Concern about fines	30.2%	15.4%
Ship to shore communication	13.2%	23.1%
None of the above	24.5%	13.5%

Impact of decarbonisation on shore-based staff's wellbeing

Shore-based staff reported that the introduction of decarbonisation regulations and technologies was having very similar impacts on their workload to that of seafarer respondents: 55.1% of respondents evaluated the impact as negative, in comparison with 20.0% who viewed it positively. Almost 40% of respondents (38.8%) also reported a negative impact on their stress levels. In comparison, almost two thirds (66.0%) of respondents reported that the journey to decarbonisation was having a positive impact on their commitment to working in the maritime industry, whilst the proportion of respondents who viewed the impact on team morale positively (22.0%) was more than double that who experienced it as negative (10.2%). This suggests that contributing to making the maritime industry more environmentally sustainable is a strong motivating factor for many shore-based staff, despite the additional stresses that it may bring.

Impacts of decarbonisation regulations and technologies on wellbeing – Shore-based staff

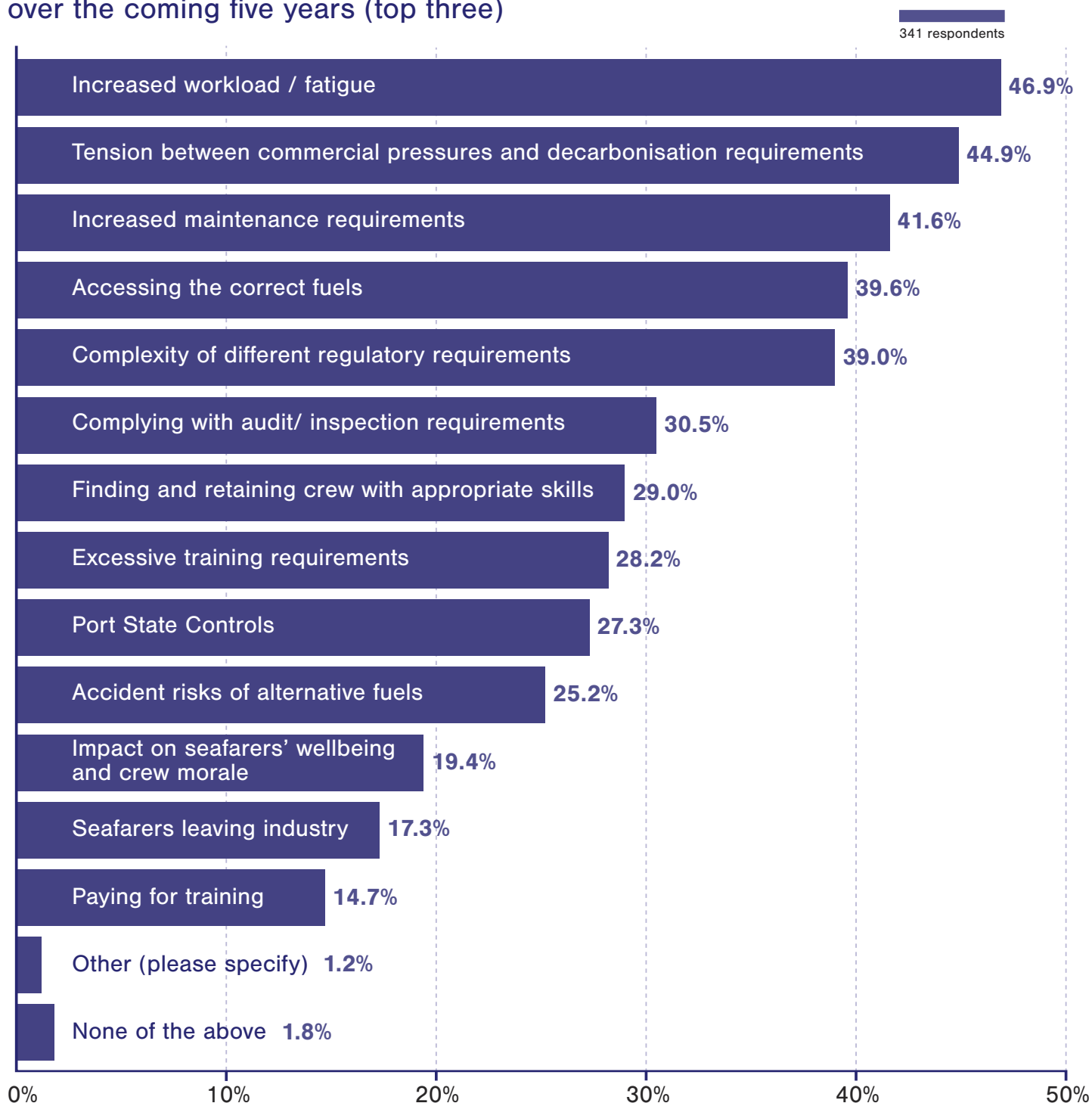|	Negative	Positive
	49 respondents	50 respondents
Workload	55.1%	20.0%
Fatigue	28.6%	12.0%
Mental health	22.5%	14.0%
Stress levels	38.8%	14.0%
Team morale	10.2%	22.0%
Commitment to continue working in maritime industry	18.4%	66.0%
None of the above	28.6%	22.0%

Future impacts of decarbonisation

Survey respondents were asked to select the top three challenges that decarbonisation was likely to pose for their work over the coming five years. Increased workload and fatigue was viewed as the most significant challenge, selected by almost half (46.9%) of seafarer respondents. The practical and technical challenges of the journey to zero carbon were also apparent, with substantial numbers of seafarers also highlighting the tensions between commercial pressures and regulatory requirements (44.9%), increased maintenance requirements (41.6%), difficulties accessing the correct fuels (39.6%) and the complexity of regulatory requirements (39.0%) as key concerns.
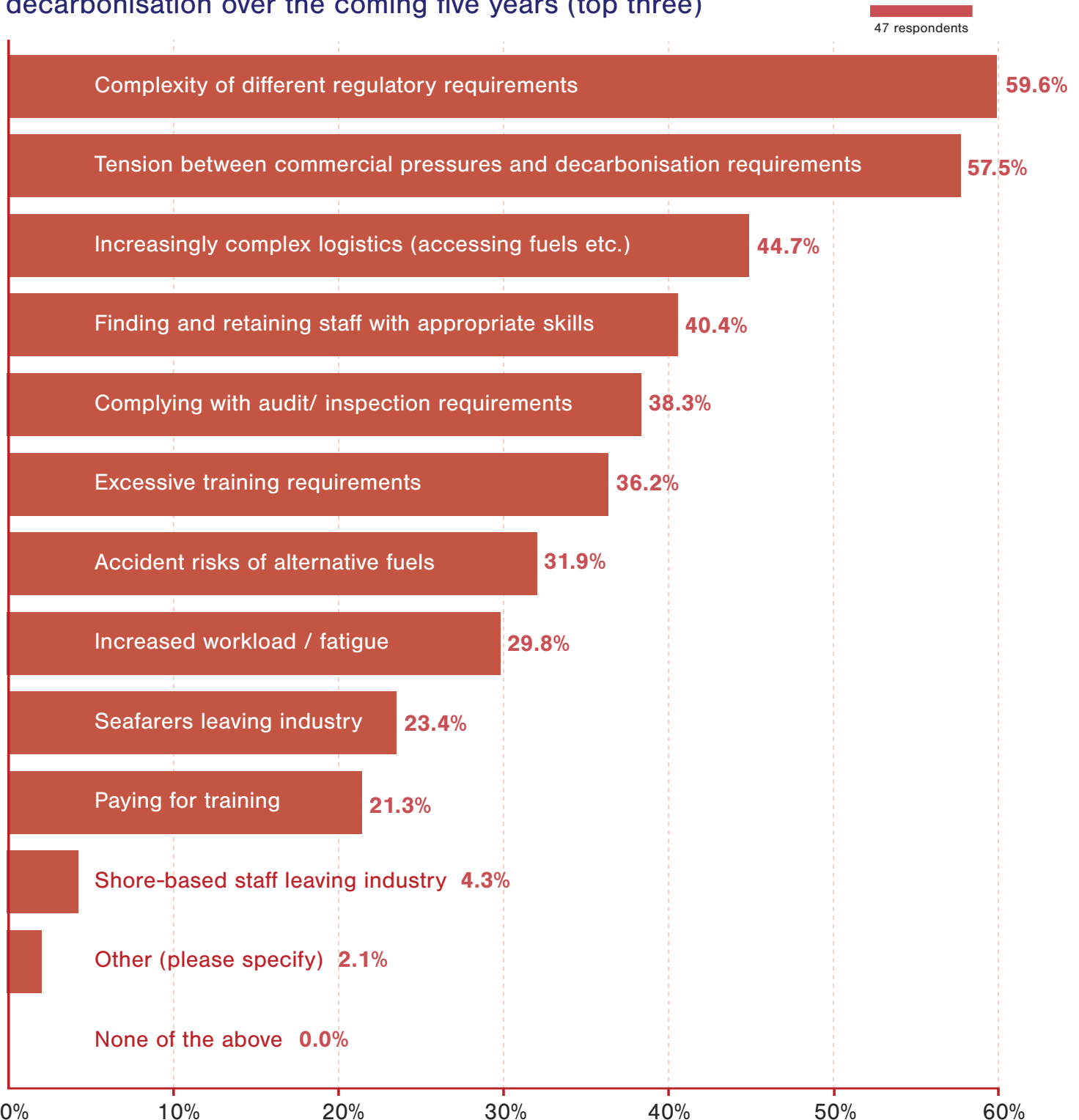
Key challenges for seafarers posed by decarbonisation over the coming five years (top three)

341 respondents

Challenge	Percentage
Increased workload / fatigue	46.9%
Tension between commercial pressures and decarbonisation requirements	44.9%
Increased maintenance requirements	41.6%
Accessing the correct fuels	39.6%
Complexity of different regulatory requirements	39.0%
Complying with audit/ inspection requirements	30.5%
Finding and retaining crew with appropriate skills	29.0%
Excessive training requirements	28.2%
Port State Controls	27.3%
Accident risks of alternative fuels	25.2%
Impact on seafarers' wellbeing and crew morale	19.4%
Seafarers leaving industry	17.3%
Paying for training	14.7%
Other (please specify)	1.2%
None of the above	1.8%

For shore-based staff, the complexity of different regulatory requirements was highlighted as the top challenge, selected by just under 60% of respondents. As was the case for seafarers, the tension between commercial pressures and regulatory requirements was the second most pressing issue, highlighted by 57.5% of shore-based staff. Increasingly complex logistics is also a shared concern and was selected by 44.7% of shore-based staff. The likely future challenges of finding and retaining staff with the appropriate skills featured more prominently in the concerns of shore-based staff and was selected by just over 40% of respondents. Whilst increased workload and fatigue was lower down the list for shore-based staff than for seafarers, it was nonetheless cited as a key concern for almost 30% of respondents (29.8%).

Key challenges for shore-based staff posed by decarbonisation over the coming five years (top three)

47 respondents

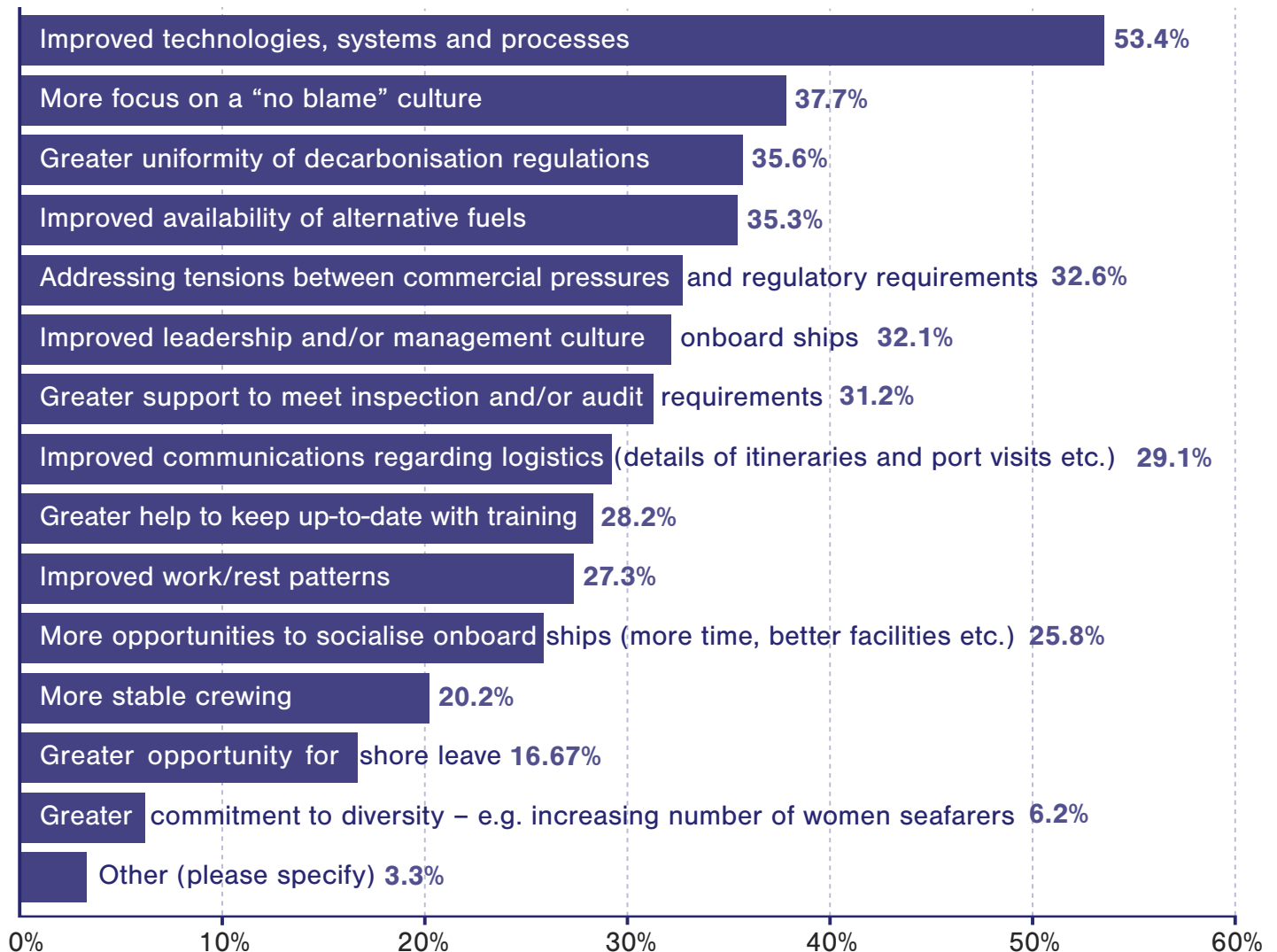| Challenge	%
Complexity of different regulatory requirements	59.6%
Tension between commercial pressures and decarbonisation requirements	57.5%
Increasingly complex logistics (accessing fuels etc.)	44.7%
Finding and retaining staff with appropriate skills	40.4%
Complying with audit/ inspection requirements	38.3%
Excessive training requirements	36.2%
Accident risks of alternative fuels	31.9%
Increased workload / fatigue	29.8%
Seafarers leaving industry	23.4%
Paying for training	21.3%
Shore-based staff leaving industry	4.3%
Other (please specify)	2.1%
None of the above	0.0%

Supporting maritime employees through the zero-carbon transition

Respondents were asked to share their views about the most important steps that maritime employers could take to support them through the zero-carbon transition. Both seafarers (53.4%) and shore based staff (59.6%) selected improving technologies, systems and processes as the most crucial action. This potentially indicates a current lack of coordination, consistency and joined-up planning in the rush to adapt new technologies to conform with the requirements of new regulatory regimes. Fo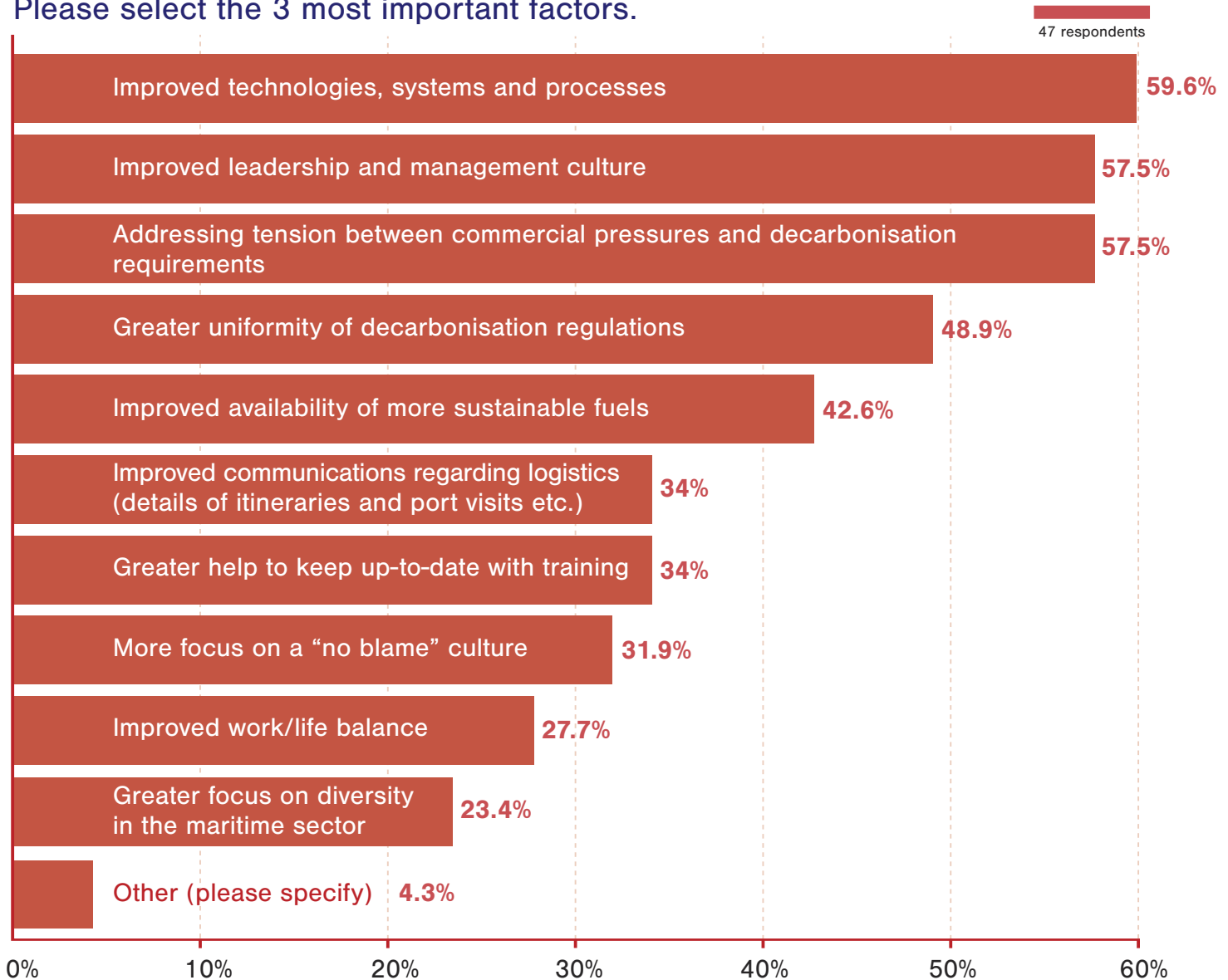r almost 40% of seafarers (37.7%), strengthening focus on a "no blame" culture was deemed a key priority, reflecting the increased anxieties that the decarbonisation transition has brought as regards making mistakes and potential criminalisation. Improving leadership and management culture more broadly was rated as important for both seafarers (32.1%) and, in particular, for shore-based staff (57.5%). Both groups also rated addressing the tensions between commercial pressures and regulatory requirements as key to supporting employees through the challenges of decarbonisation.

What actions could ship owners and managers take to support seafarers' wellbeing through the transition to greener shipping? Please select the 3 most important factors.

337 respondents

Action	%
Improved technologies, systems and processes	53.4%
More focus on a "no blame" culture	37.7%
Greater uniformity of decarbonisation regulations	35.6%
Improved availability of alternative fuels	35.3%
Addressing tensions between commercial pressures and regulatory requirements	32.6%
Improved leadership and/or management culture onboard ships	32.1%
Greater support to meet inspection and/or audit requirements	31.2%
Improved communications regarding logistics (details of itineraries and port visits etc.)	29.1%
Greater help to keep up-to-date with training	28.2%
Improved work/rest patterns	27.3%
More opportunities to socialise onboard ships (more time, better facilities etc.)	25.8%
More stable crewing	20.2%
Greater opportunity for shore leave	16.67%
Greater commitment to diversity – e.g. increasing number of women seafarers	6.2%
Other (please specify)	3.3%

What actions could shipping companies take to support shore-based staff through the transition to greener shipping? Please select the 3 most important factors.

47 respondents

Factor	Percentage
Improved technologies, systems and processes	59.6%
Improved leadership and management culture	57.5%
Addressing tension between commercial pressures and decarbonisation requirements	57.5%
Greater uniformity of decarbonisation regulations	48.9%
Improved availability of more sustainable fuels	42.6%
Improved communications regarding logistics (details of itineraries and port visits etc.)	34%
Greater help to keep up-to-date with training	34%
More focus on a "no blame" culture	31.9%
Improved work/life balance	27.7%
Greater focus on diversity in the maritime sector	23.4%
Other (please specify)	4.3%

In free text comments, several seafarer respondents expressed the opinion that ensuring appropriate crewing levels to meet the challenges of new technologies and increased regulatory requirements should be a priority for maritime employers. For example, one respondent commented that: "the major downfall in all these is increased maintenance but then companies are more focused in reducing the no. of engineers and crew onboard. This is leading to excessive pressure on maintenance." Others called for increased regulation of crew size, with one respondent suggesting that the Electro-Technical Officer (ETO) role should be mandatory and another stressing that: "the number of engine crew were [sic] always compromise[d]. There should be regulation on this. Not only the crewing should decide. Crew welfare [is] always in compromise over business matter[s]." A further respondent stressed what they saw as the undervaluing of seafarers even more forcefully:

"Seafarers are the weakest link in the safety chain of commercial shipping. The most-important factor is the undermanned, over-worked seafarer. Humanizing the seafarer to the management is the most critical task, ISWAN can undertake. Workload vs life-balance studies can be undertaken to rationalize the compliance requirement of a ship, and revise the manning levels onboard."

A number of seafarer respondents also reflected on the crucial importance of ensuring that seafarers' contributions to implementing rapid technological change are appropriately valorised.

Some commented that salaries should be increased to reflect the additional pressures and responsibilities that seafarers are being asked to assume. For example, one stated that there are:

"So many new things to implement, but wages and care from company is still the same. Why would the crew sacrifice their mental peace for someone else's experiments. Either increase remuneration or increase manpower."

Other seafarers stressed the need for effective information flows to help to ease information overload and to make transitions between different regulatory requirements as smooth as possible. One seafarer called for companies to: "prepare your ships well in advance and don't burden [seafarers] with information and queries at the last minute." More bluntly, one respondent called for employers to provide clear, step-by-step instructions: "avoid producing big manuals, nobody read[s] it."

Although improved access to training was not one of the top actions highlighted by seafarers, several respondents commented on the crucial importance of appropriate training opportunities. One respondent commented that: "training is the key, no training is being provided for the new technologies coming in". Another stressed the need for opportunities to gain practical,

as well as theoretical, knowledge: "New regulations are more stringent and [employers] need to keep seafarer[s] up to date with [...] development in shipping industries. Seafarers need to [be] provide[d with] proper training and open opportunities to get actual experience onboard and adopt new upcoming technology." A further suggestion was to provide online training courses before joining a new ship: "that would definitely help inform the crew and reduce the stress of trying to figure out a new requirement or circular while also trying to do all other jobs and activities you have on a daily basis on board, especially if all of that is coupled with inspections, PSC [Port State Control] and some stressful port operations." The lack of adequate training for seafarers was also highlighted by one member of shore-based staff, who commented on the additional stress and workload this caused:

"Decarbonisation has led to many changes in the industry. Some crew onboard vessels that used alternative fuels were not trained prior to their embarkation. There are also some shipping companies that tried to make use of technological advancements such as new machines and equipment. These are well and good, if not for the fact that some seafarers were not given prior training before using them – resulting to exhaustive efforts and prolonged time to understand the machinery."

Towards sustainable shipping: conclusions and recommendations

> *"I am a big supporter of decarbonisation and taking steps to reduce our negative impact on the planet and our surroundings. I just wish it was done in a much better way."*
> **– Seafarer respondent**

ISWAN's survey suggests that many seafarers and shore-based staff understand and support the urgent need to decarbonise shipping. However, the survey findings also suggest that the potential for the rapid adoption of new technologies and regulations to have a detrimental impact on those who are tasked with implementing them is currently being overlooked.

> *"Decarbonisation is a great attempt by the maritime industry to go green. However, the industry has to counterbalance these changes through a more human-centric perspective, as some, probably even most, of these transitions lead to job displacement, possible retrenchment, heavy workload, fatigue, and high stress levels."*

The survey points to a number of concrete steps that maritime employers can take to better support seafarers and others working in shipping through the zero-carbon transition and to ensure that the decarbonisation does not become an additional factor that drives skilled employees away from the industry.

Rethinking wellbeing in the decarbonisation era

The survey findings indicate that the rapid changes brought about by decarbonisation are having a negative impact of many working in the maritime industry. Maritime employers can take the following steps to mitigate against these risks:

- **Acknowledge and address the impact on workloads:** The resounding feedback from ISWAN's survey is that adapting to new technologies, regulatory regimes and additional reporting is having a substantial impact on seafarers' workloads, in particular for engineers. This has knock-on effects for levels of stress, fatigue and ultimately safety. The additional workloads, particularly for engineers, should be proactively considered and factored into crew sizes.

● **Recognise the psychological impacts of rapid change and technostress:** The psychological toll that the requirement to constantly adapt to new technologies can place on seafarers, particularly in high-impact, high-risk environments, should be explicitly acknowledged. The impact of technostress and the challenges posed by rapid technological transformation should be built into mental health awareness and stress management training and resources for seafarers and other maritime employees. Focus should be placed on identifying any diversity, equity or inclusion (DEI) obstacles faced by particular demographic groups. Attention should also be given to ensuring that seafarers have appropriate time and resources for good quality social interaction to build resilience and support their wellbeing at sea.

● **Ensure both physical and psychological safety:** Feedback from some seafarers indicates that they feel that they are being asked to implement new technologies that have not been adequately tested. In order to ensure both physical and psychological safety at sea, seafarers must have the confidence that the technology that they are being asked to adopt is safe and that they and their colleagues have appropriate training and support to implement it. As part of building just, psychologically safe cultures at sea, it is vital that seafarers have the confidence to speak out about any concerns or doubts without fear of negative consequences.

● **Commit to inclusive, supportive leadership cultures:** Extensive work is underway throughout the maritime sector to reimagine seafaring's hierarchical power relationships and build cultures that are inclusive, equitable and safe. The challenges of rapid adaptation to change should be proactively built into the development of good practice as regards leadership at sea. This will be fundamental in building the type of working environments that can effectively support seafarers and other maritime employees through the wholescale transformations that the industry faces.

> *"Decarbonisation helps to reduce harmful emissions. But seafarers are the backbone of the maritime industry, so [it is important to] to create company cultures that not only support meaningful and rewarding careers but also provide a sense of overall mental and physical wellbeing."*
> **– Seafarer respondent**

- **Improve terms and conditions:** Feedback from seafarers indicates that many feel that the additional efforts and work that the zero-carbon transformation demands of them is not appropriately acknowledged. In order to maintain seafarers' commitment and avoid skilled seafarers continuing to leave the industry, maritime employers must ensure that seafarers are appropriately remunerated for their work. The short-term nature of many maritime contracts can also act as a disincentive for employers to invest in providing seafarers with the training that they need to carry out increasingly complex and technical work. Offering more stable employment contracts could help to address this issue, as well as providing further stability and valorisation for seafarers.

> *"[Decarbonisation is] positive for environment aspects as a seafarer we should take care of environment and sea. Just increase the morale by increasing man power wages and providing good systems to adopt the technologies."*
>
> **– Seafarer respondent**

- **Invest in seafarers:** The survey findings indicate that tensions between meeting environmental requirements and commercial pressures are creating significant stress for both seafarers and shore-based staff. Too often commercial imperatives and regulatory pressures are prioritised over the wellbeing of those working at sea. If the maritime sector is to attract and retain the technically skilled employees that it will need to achieve zero carbon, it will be necessary to invest in ensuring that the appropriate training, support and working environments are in place.

A human-centred approach to systems and processes

Both seafarers and shore-based staff stated that improving technologies, systems and processes would make the biggest difference to their wellbeing during the transition to zero carbon. The maritime industry should consider the following actions to facilitate the decarbonisation journey:

- **Protect against technostress in system design:** Maritime employers should proactively seek to ensure that new technologies, systems and processes function in cohesive, joined-up and accessible ways to reduce duplication and mitigate against the negative impacts of technostress. Employers should also proactively seek input from those tasked with implementing new technologies to better understand the impacts on their work and wellbeing.

- **Ensure strong communication channels to build collective responsibility:** It is vital that meeting the challenges of zero carbon is approached as a collective undertaking, requiring the input and commitment of all, both at sea and at shore. Fostering stronger communication channels between ship and shore and ensuring that seafarers understand the rationale for new technologies and reporting requirements will help to ensure that they feel fully engaged and involved in the decarbonisation journey. Improved understanding amongst shore-based staff about the holistic impact of new technologies and regulatory regimes on life at sea will also help employers to factor in and mitigate against potential risks to seafarers' wellbeing. It is, furthermore, important to ensure that engineering and deck officers understand the differing impacts of decarbonisation on their work, to build a culture of safe and effective team work and shared responsibility.

> *"How to communicate these requirements in a positive way and not as a threat?"*
> **– Shore-based respondent**

- **Investigate benefits of fixed trading patterns:** ISWAN's survey findings indicate that adopting fixed trading patterns may help to mitigate against the negative effects of the adoption of decarbonisation technologies on wellbeing by enabling engineers to better prepare for frequent fuel changes in line with the relevant regulatory requirements. As the adoption of alternative fuels accelerates, maritime employers should factor in potential impacts on seafarer wellbeing when making decisions about trading patterns.

- **Consider crewing models that best meet the challenges of decarbonisation:** The proliferation of new technologies can lead to a steeper learning curve for seafarers joining a new ship. Fluid crewing models can therefore place additional burdens both on individuals joining a ship and on the already stretched teams that are required to support them to adapt to new technologies.[12] Additional research should be carried out into the crewing models that will best support seafarers through the zero-carbon transition.

Building just and coherent regulatory regimes

In addition to the challenges at a technical level, the duplication of reporting and the requirement to conform with multiple overlapping regimes are placing additional pressure on seafarers and substantially increasing fears of errors and potential criminalisation. Regulatory bodies and maritime companies should consider the following actions to better support seafarers and other maritime employees through the decarbonisation transition:

12. This issue is reflected in WMU's case study of technostress at sea: "[One interviewee] stated that stress can affect everyone and not only the person dealing with the technology. New crew members need to be trained by others, which creates a feeling of stress for everybody. There are always new crew members on board who are unaccustomed to technology, which is stressful. Interviewees also believed that the company has no desire to spend money on training the crew because once trained, they tend to leave. This places responsibility on other crew members who gain an additional workload. When asked why there was a staff shortage, the interviewee answered that the company is trying to fill the gap" (WMU, 2023, p145).

- **Harmonise reporting regimes and requirements:** ISWAN fully supports the commitment on behalf of individual ports, nations or regions to go beyond the requirements of international legislation in tackling carbon emissions. However, regulatory and reporting requirements should be simplified and harmonised to limit the bureaucratic and administrative burden this poses.

- **Proactively build collaborative, just cultures:** Despite considerable support for decarbonisation, it has heightened fear among many seafarers and other maritime employees about making inadvertent errors and potential penalisation or even criminalisation. Particularly in light of the current complexity of reporting regimes, it is vital to build a culture that supports joined-up, collaborative action – we are all on the same side in combatting climate breakdown.

"Seafarers are committed to their work and work ethics. In this present situation seafarers are already stretched with respect to maintenance, work onboard. If ship staff, port state, local authorities and shore team work in a positive way rather than resorting to [a] blame game, I believe it is very easy to implement decarbonisation which is very much the need of the hour considering the global deterioration of the environment."
– **Seafarer respondent**

And above all:

- **Valorise seafarers and other maritime employees as partners in the decarbonisation journey:** Many working in the maritime industry understand only too well the vital importance of taking rapid action to address the climate emergency and are strongly motivated to play their part. The industry can benefit from their expertise and continue to build a sense of partnership by proactively consulting with seafarers and other employees in decision-making about the development and implementation of new technologies. ISWAN's helpline data and insights from our projects tell us that too often seafarers feel overlooked and under-valued. Having their concerns about decarbonisation acknowledged and acting on their suggestions for change would be an important step in empowering seafarers to be proponents and drivers of the journey towards zero carbon, rather than becoming another factor that risks driving many out of the industry.