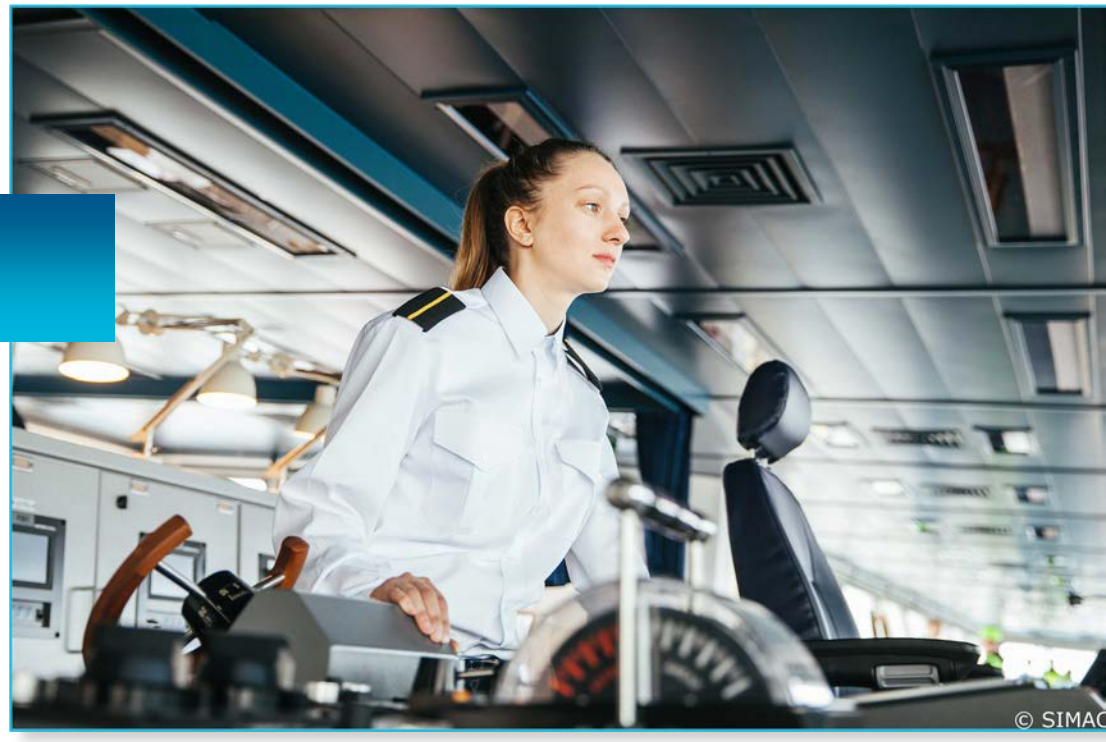
# Project SkillSea




## *WP1*

## *Skills need for the maritime transport sector*



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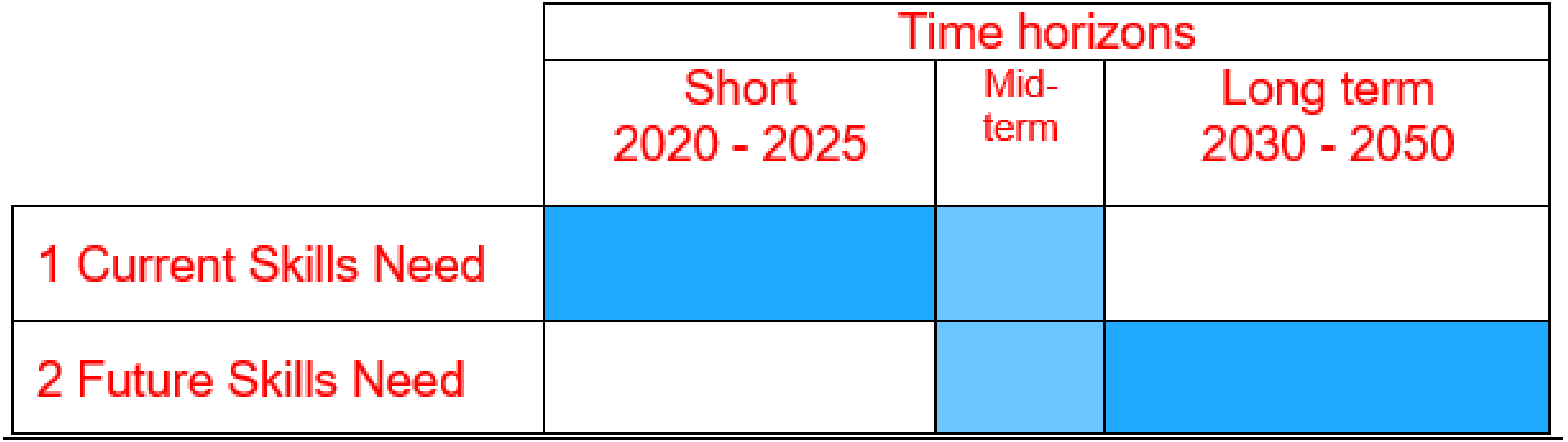
# Waves of change:
## future proofing skills and safety



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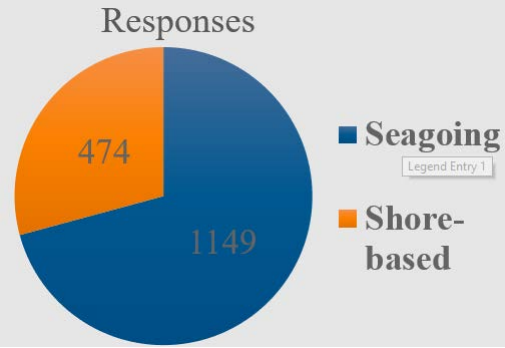
# Current Skills Need

## Survey – shipboard personnel



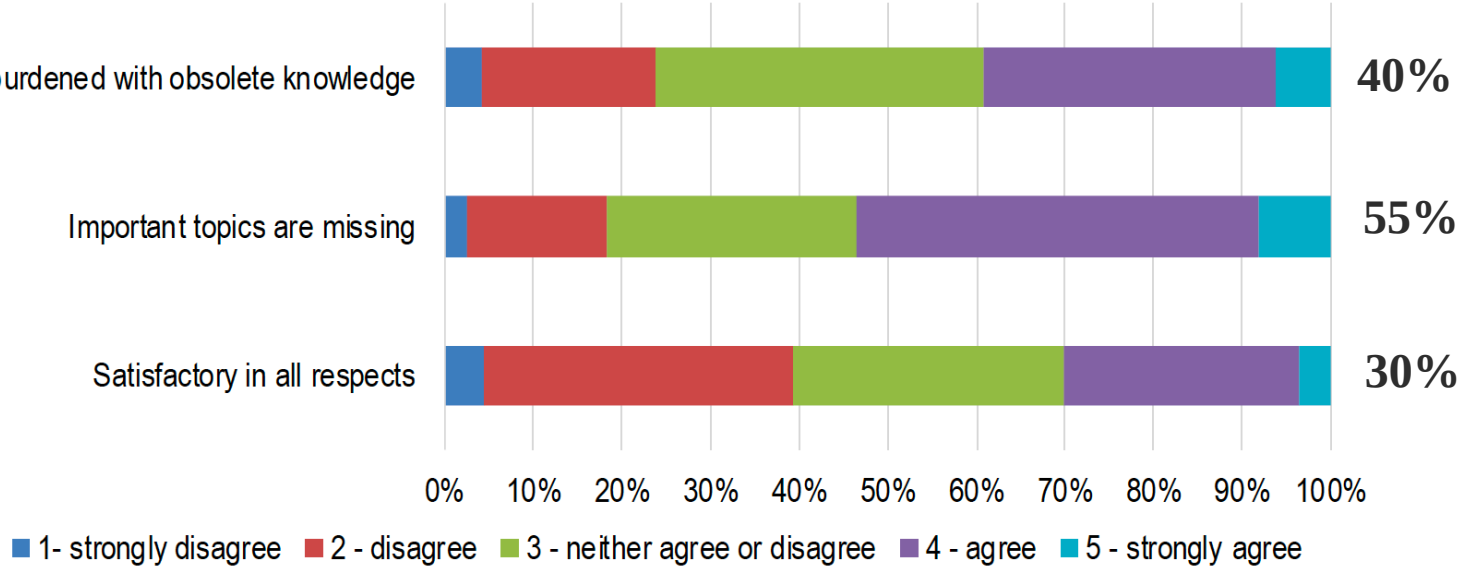




***Figure 19 Respondents' opinion on professional education and competences as outlined in the STCW Convention***

NTNU Norwegian University of Science and Technology



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# Current Skills Need

## Results and outcomes

- Maritime economy
- Maritime law
- Ships technologies
- Green skills
- Digital skills
- Transversal skills
- Measures and recommendations



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# Document D113 Future Skills Need


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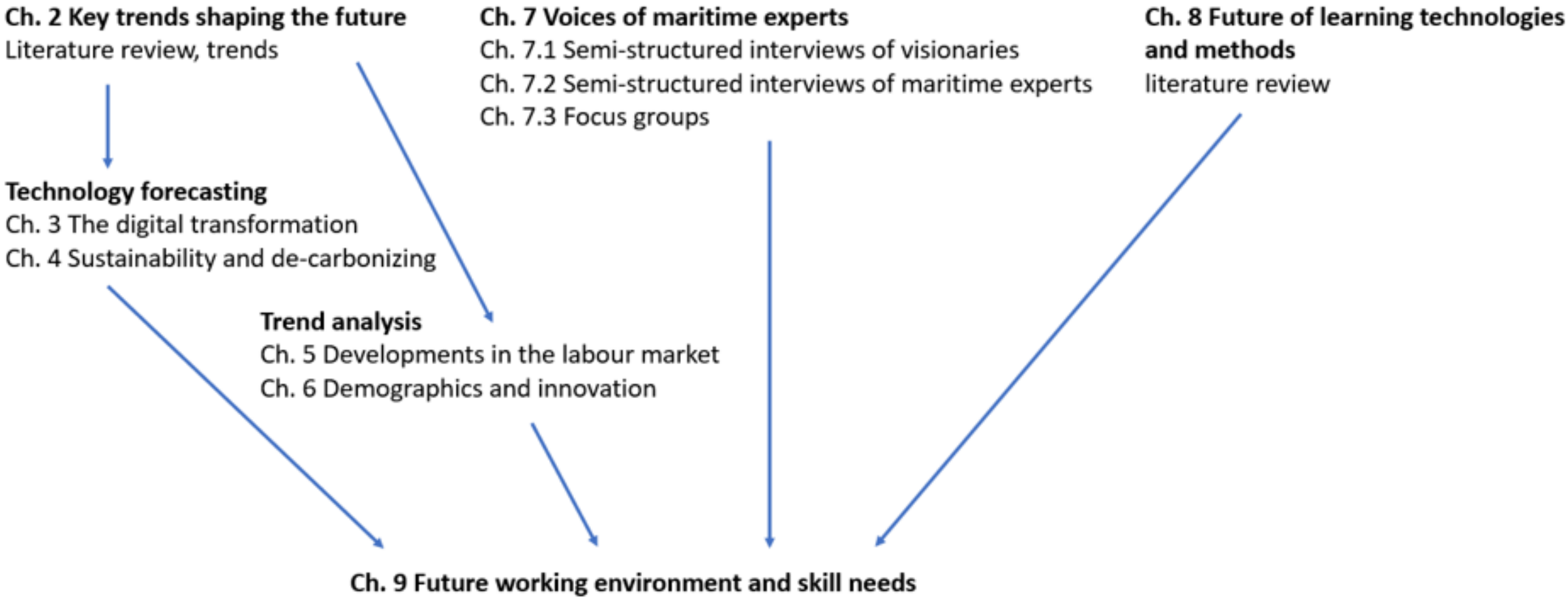
# Future Skills Need

## Structure of the report



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# Future Skills Need

## Key trends shaping the future

- United Nations, UNCTAD
- International Maritime Organisation, IMO
- European Union, EU
- European Transport Workers Federation, ETF
- European Shipowners Association, ECSA
- International Chamber of Shipping, ICS
- DNV Class Society and Maritime Advisors
- Lloyds Register
- Gartner Group

- **Shipping volume is growing**
  - **Shipping Industry is growing as an employer.**
- **UN/IMO reducing emissions by at least 50 per cent by 2050**
  - **More competence in renewable energy systems.**
  - **The IMO GHG Strategy significantly impact design and operations of all ships**
  - **Commercial pressure push all shipowners towards decarbonization**
- **More training is necessary to improve safety and operation**
  - **Training will become more digital and on-line**
  - **Automation & autonomy**
- **Port cities will compete to become leading logistics hubs.**



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# Future Skills Need

## Technology forecast
## - the digital transformation

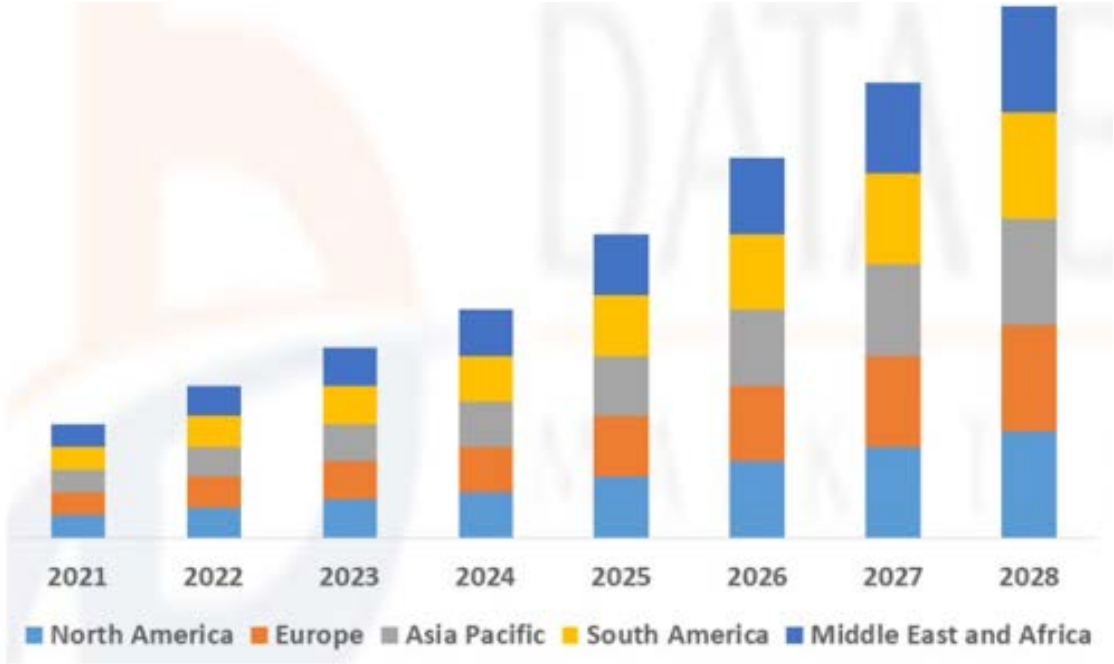


Figure 4: Expected growth of maritime satellite communication in the years

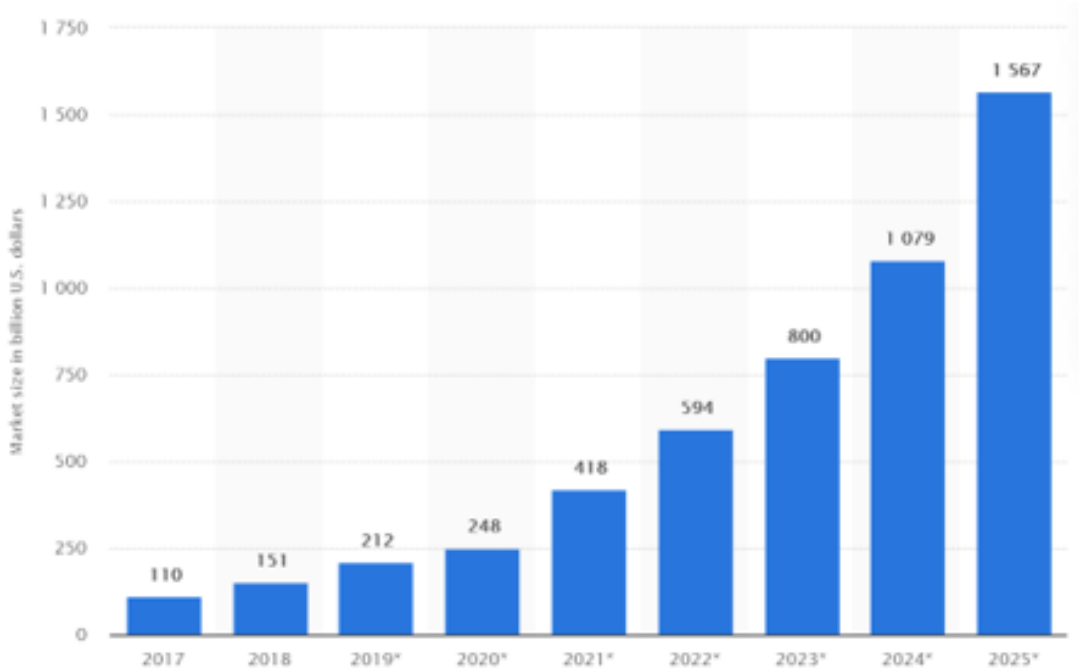


Figure 5: Expected growth of user spending on IoT solutions[11]

Data Bridge Market Research, https://www.databridgemarketresearch.com/reports/global-maritime-satellite-communication-market

Statista Business Data Platform, 2021, http://statista.com



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# Future Skills Need

## Technology forecast
## - the digital transformation

### Autonomy

IMO

- **Level one:**
  - Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.
- **Level two:**
  - Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.
- **Level three:**
  - Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.
- **Level four:**
  - Fully autonomous ship: The operating system of the ship can make decisions and determine actions by itself.



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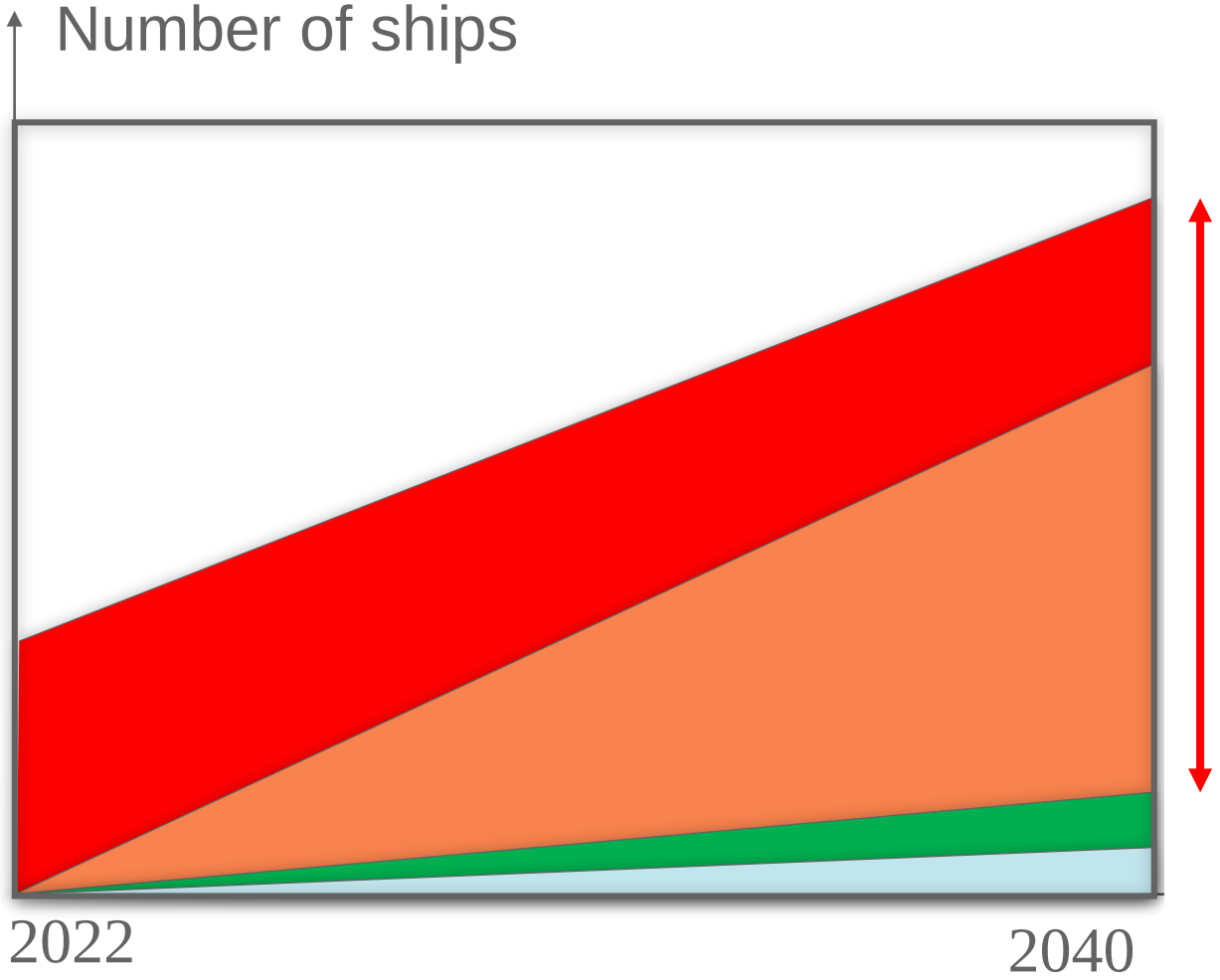
# The digital transformation (technology forecast)

## Ships with level of autonomy




**REMOTE SUPPORT/CONTROL**

- distributed maritime capabilities
- dispersed teams



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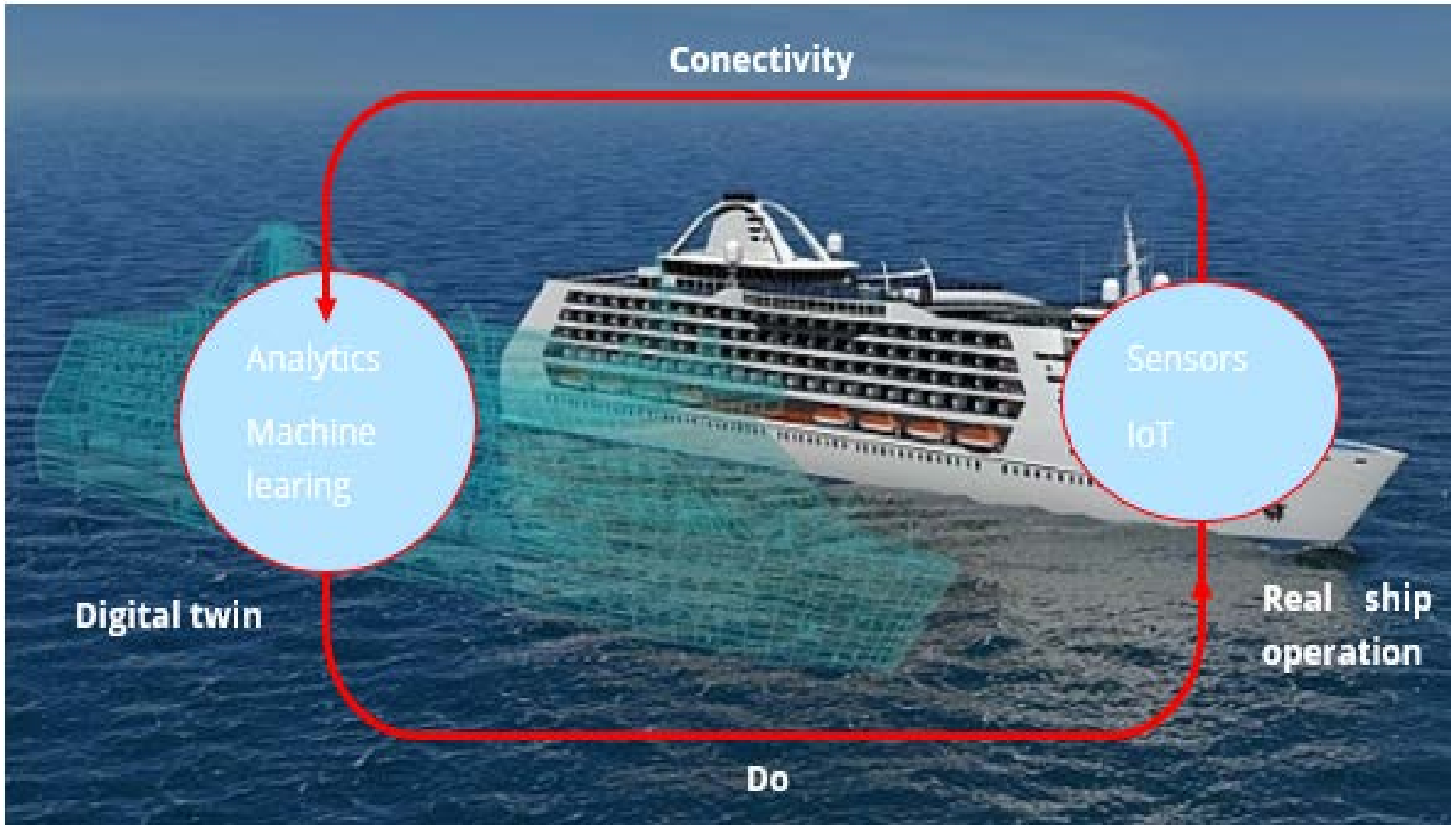
# Future Skills Need

## The digital transformation (technology forecast)

- Cyber Security
- AI
- Digital Twin



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# Future Skills Need

## The digital transformation (technology forecast)

1. **Basic digital skills** needed to operate in a increasingly digital environment. (For example Ship 4.0 / Industry 4.0, sensors, IoIT, networks, connectivity and cyber security)
2. **Deep understanding of the complex systems** onboard to be able to serve the needed redundancy of all systems)
3. **Transversal skills** needed to encourage work positions on-board, ship owner office or shore based control centre or other organisation in the value chain
4. **Work in dispersed teams.** Teams with both seagoing and shore based team members
5. **Understanding of business development taking advantage of digital technology** (for example: cargo tracking, cargo and machinery condition monitoring, logistics in digital connected value chains, smart port operation, fleet management, e-brokerage, smart commerce with blockchain)

Figure 7: Need for new digital skills



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# Yara Birkeland


MAIN PARTICULARS
•Length o.a.: 79,5 m
•Length p.p.: 72,4 m
•Width mld.: 14,8 m
•Depth shelter deck: 10,8 m
•Draught (full): 6 m
•Draught (ballast): 3 m
•Service speed: 6 knots
•Max speed: 13 knots

CAPACITY
•Cargo capacity: 120 TEU
•Deadweight: 3 200 mt
PROPULSION
•Propulsion system: Electric
•Propellers: 2 Azimuth pods
•Thrusters: 2 Tunnel thruster
•Battery pack: 7 – 9 MWh

PROXIMITY SENSORS
•Radar
•Lidar
•AIS
•Camera
•IR camera

CONNECTIVITY & COMMUNICATION
•Maritime Broadband Radio
•Satellite Communications
•GSM



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# Yara Birkeland

*Maritime officers are necessary in shore side roles when ships become remote controlled or autonomous*



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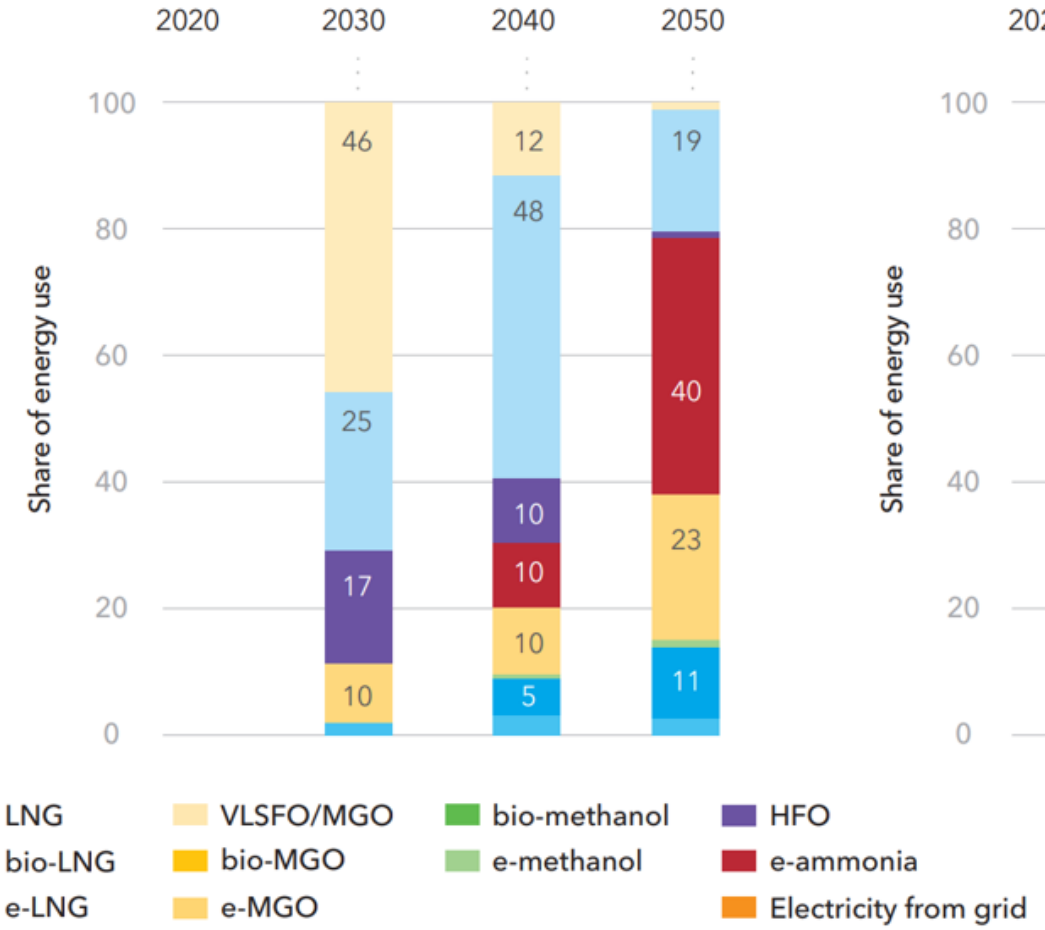
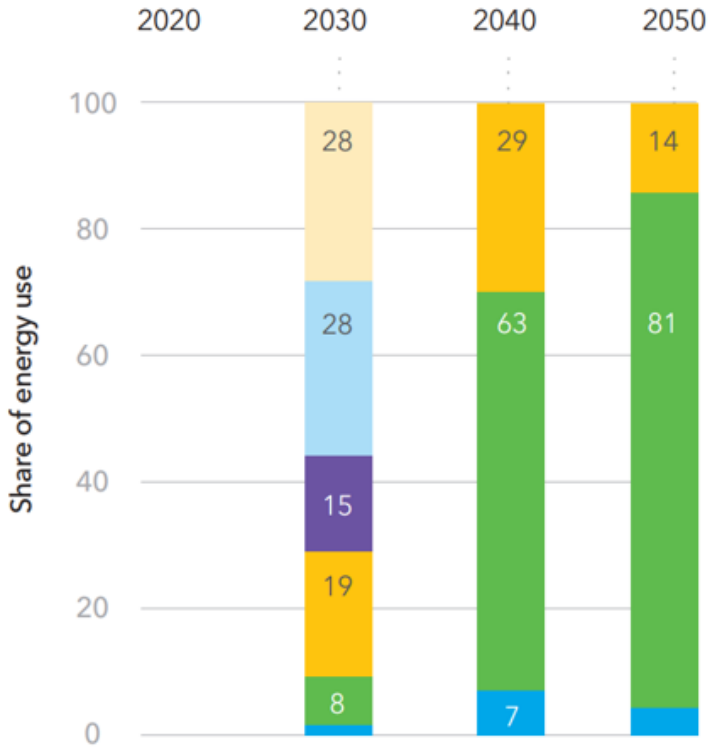
# Future Skills Need

## Technology forecast
## - Sustainability and de-carbonizing

- Rules, regulations, and agreements
- Outlook and development trends
- Need for new sustainability skills




DNV: MARITIME FORECAST TO 2050 Energy Transition Outlook 2020



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# Future Skills Need

## Sustainability and de-carbonizing (technology forecast)

*Table 1: Use and order book of ships with alternative fuel*

| Alternative fuel | Fleet | % Fleet | Order Book, # | Order Book, % |
|---|---|---|---|---|
| LNG | 609 | 0,6 | 365 | 10,7 |
| LPG | 1 | 0 | 37 | 1,1 |
| Biofuel | 23 | 0 | 7 | 0,2 |
| Methanol | 12 | 0 | 11 | 0,3 |
| Ethan | 7 | 0 | 13 | 0,4 |
| Hydrogen | 0 | 0 | 3 | 0,1 |
| Ammonia | 0 | 0 | 0 | 0,0 |
| Battery | 141 | 0,1 | 109 | 3,2 |
| Total (Number) | 776 | 0,8 % | 520 | 15,2 % |



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# Future Skills Need

## Sustainability and de-carbonizing (technology forecast)

| | |
|---|---|
| 1 | •**Understanding of risk related to differnt fuels and energy sources** |
| 2 | • **Operation** of complex hybrid, low and zero emission machineries |
| 3 | •**Documentation of emissions,** EU and international legislation ($CO_2$, NOx, SOx) |
| 4 | • **Environmental economics, performance management systems** |
| 5 | • **Logistics** and optimisation method to achiceve hig vessel utilisation |
| 6 | • **Advanced routeing,** considering factors such as wind, current, and waves |

*Figure 9: Need for new sustainability skills*



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# Future Skills Need

## Trend analyses
## - developments in the labour market

The EU fleet accounts for 685.000 seafarers

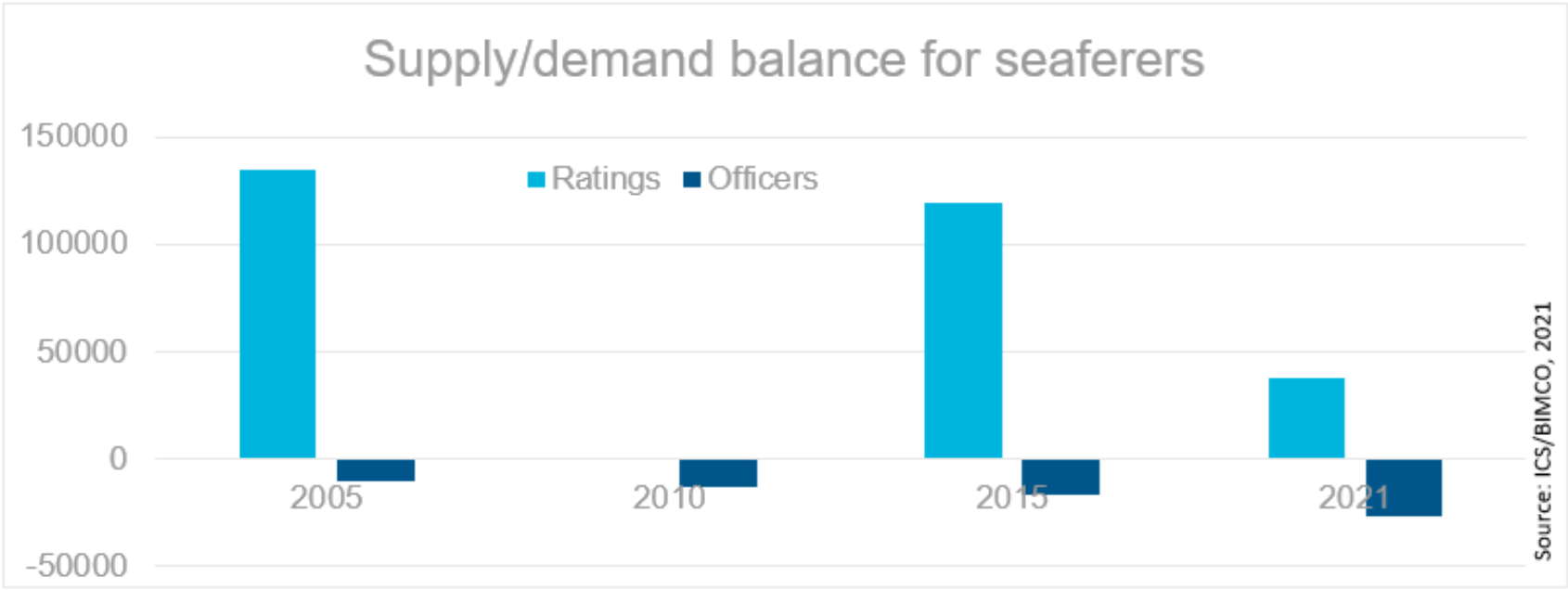


Figure 11: Increasing demand for officers

ICS BIMCO. 2021. "Seafarer Workforce Report." London/Copenhagen, 108 pages.



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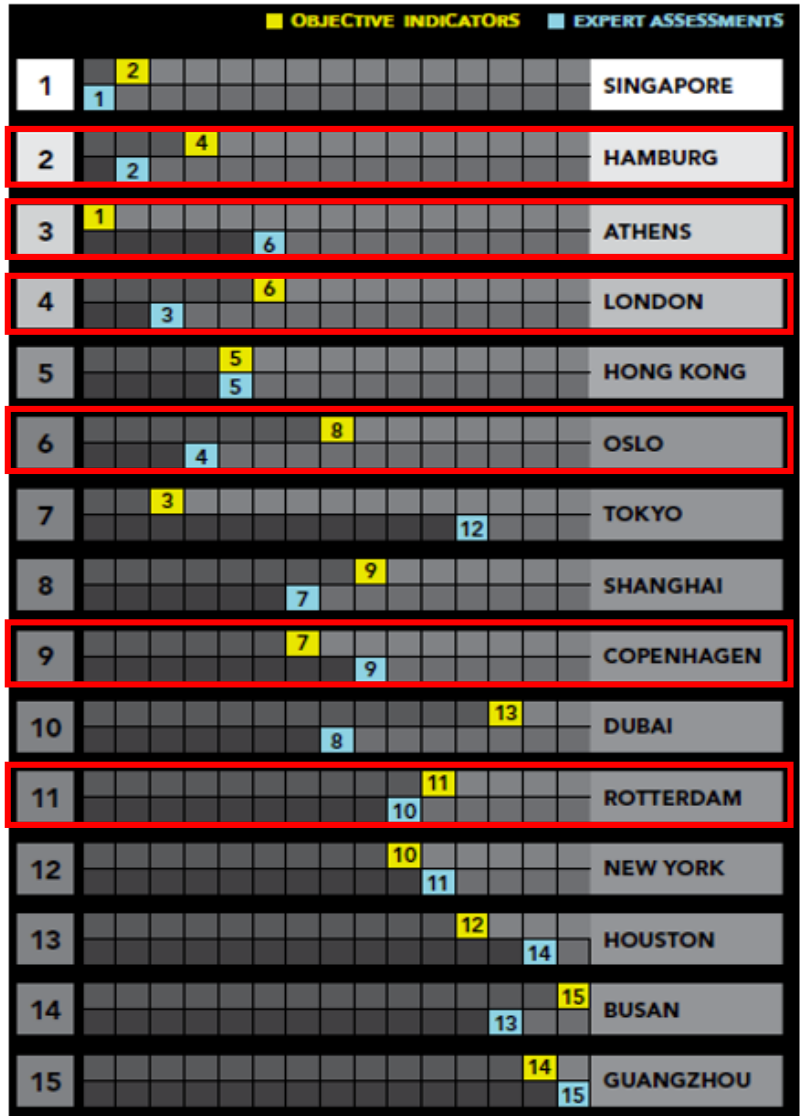
# Future Skills Need

## Trend analyses
## - demographics and innovation

how globalisation impact maritime communities and industrial clusters

1. Good maritime education and training located in strong industrial clusters will have a precondition to develop new competencies
2. Maritime clusters with a variety of job opportunities and career paths to new occupations are a key to talent attractiveness
3. Close links between educatin institutions and industrial clusters can foster innovation as knowledge creation
4. Close links between education centres, shipowner and manufacturers are critical for the strength of R&D



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# Future Skills Need

## Voices of maritime experts

1. **Semi-structured interviews of 5 visionaries in the maritime industry**
2. **Semi-structured interviews of 12 maritime experts from across the maritime industry**
3. **3 Focus Groups**

*Table 3: Overview of visionaries, interviewed experts and participants in focus groups*

| *Segment* | Company/organisation | 5 Visionares | 12 Interviews | Focus groups | | |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| *Finance:* | NORDEA | | 1 | | | |
| | DNB | | 1 | | | |
| *Insurance:* | Guard | | | | | |
| | Skuld | 1 | 1 | | | |
| | Lloyds | | | | | |
| *Brokers* | Clarksson | 1 | 1 | | | |
| | Plato | | | | | |
| | Pareto | | | | | |
| | Rystad | | 1 | | | |
| *Technology* | Kongsberg | 1 | 1 | | | |
| | Transas | | | | | |
| | Furuno | | | | | |
| | Ulstein Group | | 1 | | | |
| | Fincantieri | | | 1 | | |
| *Ship Owner* | Maersk | | 1 | | | |
| | BW Group | | 1 | | | |
| | CMB | 1 | 1 | | | |
| | Frontline | | | | | |
| | MSC | | | 1 | | |
| | Bernhard Shulte | | | | | 1 |
| | Color Line | | | 1 | 1 | |
| | Ponant | | | 1 | 1 | |
| | Hapag Lloyd | | | | | 1 |
| | MD Offen Containerships | | | | | 1 |
| | Seatrade | | | | | 1 |
| | Stena | | | 1 | 1 | |
| | Carnival | | | 1 | 1 | |
| *Class society* | DNV-GL | 1 | 1 | | | |
| | Lloyds | | | | | |
| | ABS | | | | | |
| *Trade unions* | Ships engineer union of Norway | | 1 | | | |
| *Education* | NTNU | | | | | |
| | SIMAC | | | | | |
| | UoR | | | | | |
| | UdC | | | | | |
| | LJMU | | | | | |
| | FORMARE | | | | | |
| | STC Group | | | | | |
| | EF | | | | | |
| | UofEgean | | | | | |
| | ENSM (France) | | | | | |
| | HSBA | | | | | |

# Future Skills Need

## Voices of maritime experts

### Semi-structured interviews of 5 visionaries in the maritime industry

### DNV GL

**The fleet of the future will be continually communicating with its managers and perhaps even with a 'traffic control' system that is continually monitoring vessel positions, manoeuvres and speeds. Fleet managers will be able to analyse this data, enabling them to advise the captain and crew on navigation, weather patterns, fuel consumption, and port arrival.**

**- Knut Ørbeck-Nilssen** CEO DNV GL Maritime

I see an industry bringing people together and keeping the world's economy healthy and growing. But the industry itself, the vessels, the infrastructure, and the systems that connect them could change substantially.

DNV GL is an international classification society headquartered in Høvik, Norway.
Industry Various
Founded 1864
Area served Worldwide
Revenue NOK 19,639 million

The biggest challenge for seafarers is understanding the data. For example, connectivity between ship and shore will have vastly improved and will be much more common. ***The fleet of the future will be continually communicating with its managers and perhaps even with a "traffic control" system that is continually monitoring vessel positions, manoeuvres and speeds. Fleet managers will be able to analyse this data, enabling them to advise the captain and crew on navigation, weather patterns, fuel consumption, and port arrival***. This will help to reduce the risks of human error leading to accidents, increase cost efficiency, and help to improve environmental performance. Some of this data will also be shared. Ports will use the data to help them plan and optimise loading and unloading.

Classification societies will analyse the data to check on the status of machinery and hull, letting the owners and operators know when a survey is required based on the condition of the systems, helping them to reduce downtime and avoid unnecessary maintenance. At DNV GL, we are excited to be a part of this coming transformation. We will continue to work with stakeholders across the maritime world to realise the potential of our industry and make sure that the outlook for shipping tomorrow is brighter than today.

### Kongsberg Maritime

**Seafarers should know how to interact with the computer systems to respond to challenges in the operation of autonomous ships, such as when routes are changed, or ships are in hazardous waters.**

- **Egil Haugsdal**, President Kongsberg Maritime

Kongsberg Maritime is a Norwegian technology enterprise.
**Industry** Marine systems provider for on- and offshore, merchant marine, subsea, navy, coastal marine, aquaculture, training services and more.
**Founded** 1814
**Area served** Worldwide
**Revenue** NOK 22 600 MNOK (2018 consolidated figure)

The maritime community is on the cusp of a major technological revolution, and a growing number of industries and companies are going through major changes and a digital shift. Digitalisation provides unique opportunities, which can be seen as an opportunity for new products and services. It is important that KONGSBERG's digital platforms are able to securely integrate shore- and vessel-based data within a broader context. We need seafarers who have the knowledge to translate those experiences so we can develop better products and services for them. For example, autonomous technology is developed on land. However, the users of the autonomous technology will for a large part be seafarers. ***Seafarers should know how to interact with the computer systems to respond to challenges in the operation of autonomous ships, such as when routes are changed, or ships are in hazardous waters***. Land-based ship operators will need to know how to re-gain manual control of a ship and they will also need knowledge of international and national laws and regulations, to safeguard the company's profits. Humans will always be in the centre when we are developing autonomous ships. The important thing is to understand the new roles and skills that will be required of humans in the future, such as communication abilities in different languages, information security knowledge – how to secure and safeguard ships; negotiation ability – knowing specific cultures and laws in specific areas; and data analytics ability – retrieving knowledge from different data resources, such as GPS, lidar, radar, and other systems and devices.

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# Future Skills Need

## Voices of maritime experts

**Key findings**
**Structured interviews**

- Sustainability and digitalisation are also focused by the group of “visionaries”.
- Improved connectivity open for new opportunities in shipping. Control centres will have continually access to data onboard. Fleet managers will be able to analyse and advice the crew on navigation weather patterns, fuel consumptions, port arrival, need for service, and so on.
- However, the users of the autonomous technology will for a large part be seafarers. *Seafarers should know how to interact with the computer systems to respond to challenges in the operation of autonomous ships, such as when routes are changed, or ships are in hazardous waters.*
- Despite introducing more digital technologies the human element of the business is needed. It is vital importance to maintain skilled seafarers that have their proud expertise also in a world getting more digital.

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# Future Skills Need

## Voices of maritime experts

**Key findings Focus groups**

- Competence required by STCW is not sufficient
- Soft skills to manage teams and people working remotely.
- Sea-land mobility and transferable skills to other types of jobs
- Recruitment

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# Future Skills Need

## Voices of maritime experts

1. *Seafarers are expected to be able to analyse data, enabling them to advise the captain and crew on navigation, weather patterns, fuel consumption, and port arrival.*
2. Seafarers should know how to interact with the computer systems to respond to challenges in the operation of autonomous ships, such as knowing specific cultures and laws in specific areas
3. Seafarers are expected to be able to help banks and insurance companies to prevent loss, to estimate energy use, to improve pollution and reduce fuel emissions.
4. It is important to use digital approach to enable lifelong learning programmes that enable seafarers to work across industries and services in the maritime shipping sector
5. Seafarers need a flexible, scalable training system, and it is important that maritime training institutions encourage specialisation.
6. The interface between seagoing and shore-based jobs should be improved to help seafarers building up transversal competences and skills in the maritime sectors, i.e, software development, technology-based sales and marketing.

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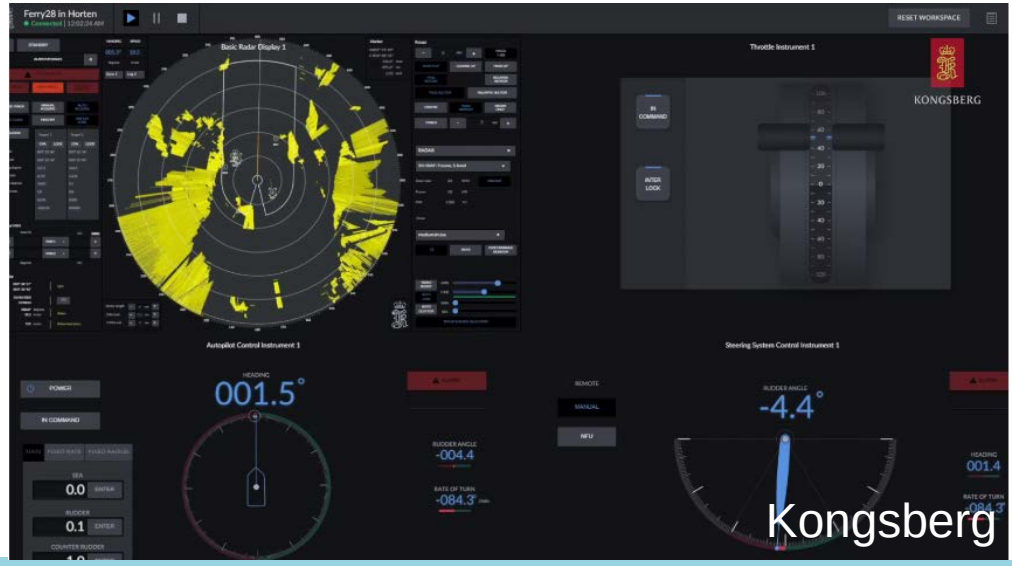
# Future Skills Need

## Future learning technology and methods

Connectivity drive new learning technologies

- e-learnig
- Cloud computing (simulators)
- VR
- On-the-job-training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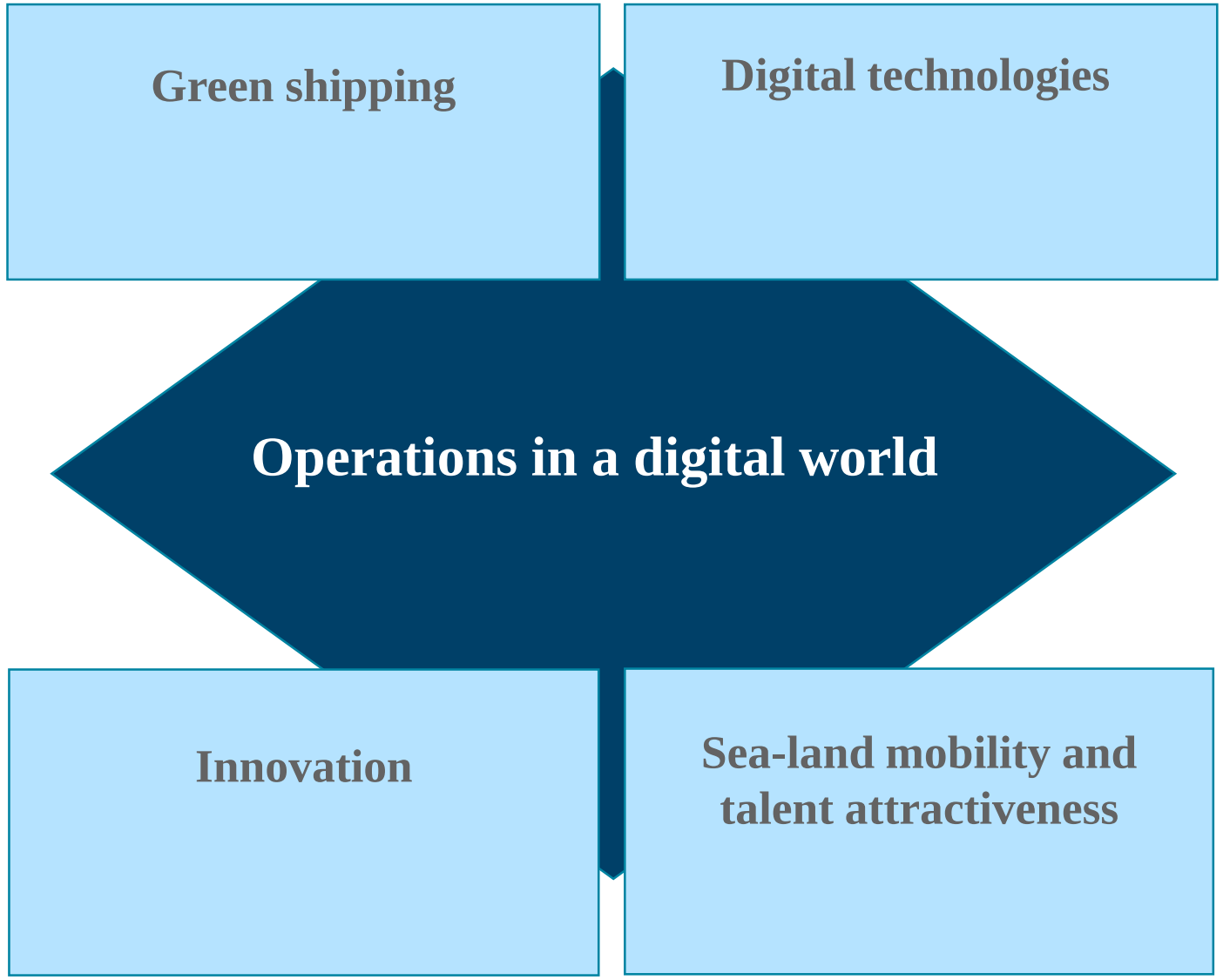
# Future Skills Need

**Recommendations for future education and training**

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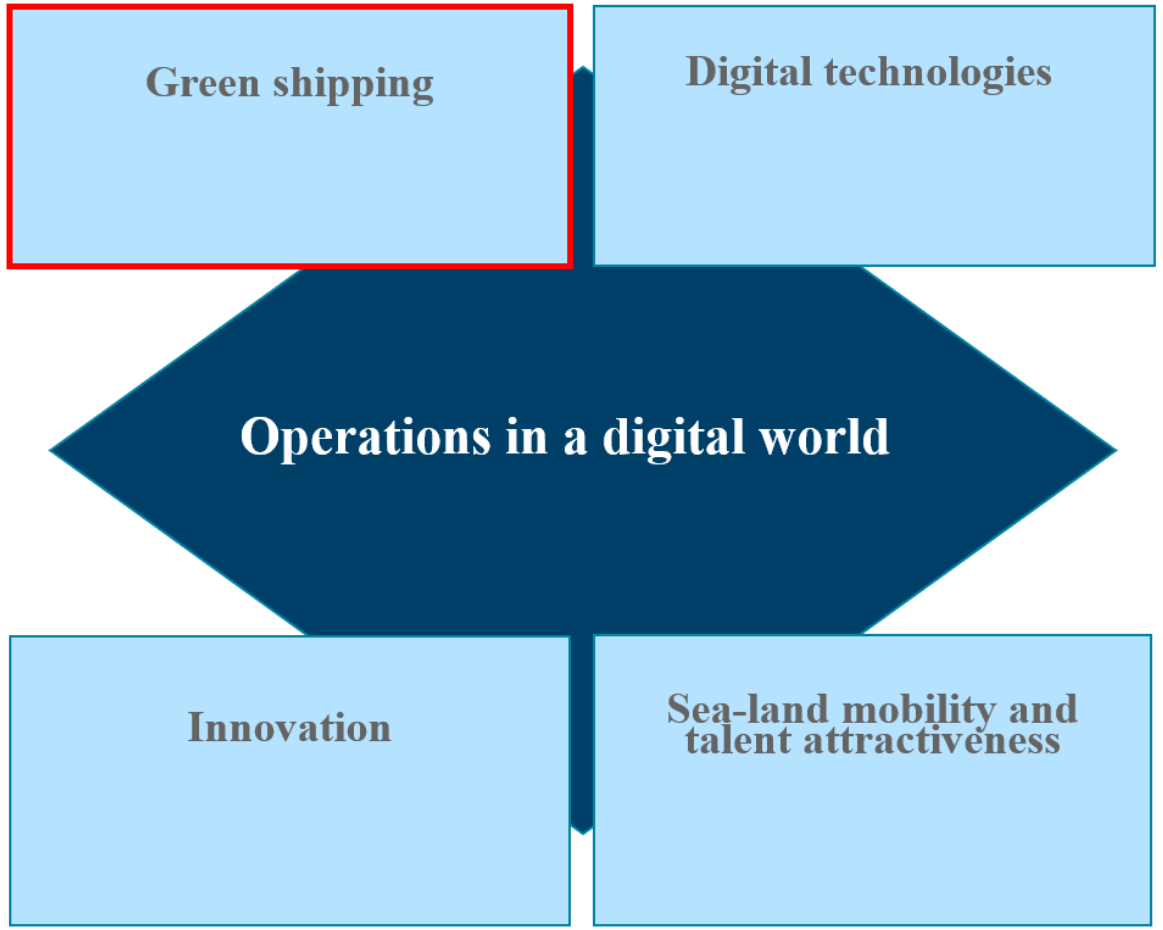
# Future Skills Need

## Recommendations for future education and training

**Green shipping**

- Measurement, calculation and documentation of emissions, EU and international legislation
- Operation of complex hybrid and zero emission machineries
- Environmental economics, performance management systems
- logistics and optimisation methods to achieve high vessel utilisation
- Advanced routeing, considering factors such as wind, current, and waves
- How to handle a variety of fuels (toxic content, explosion etc.)

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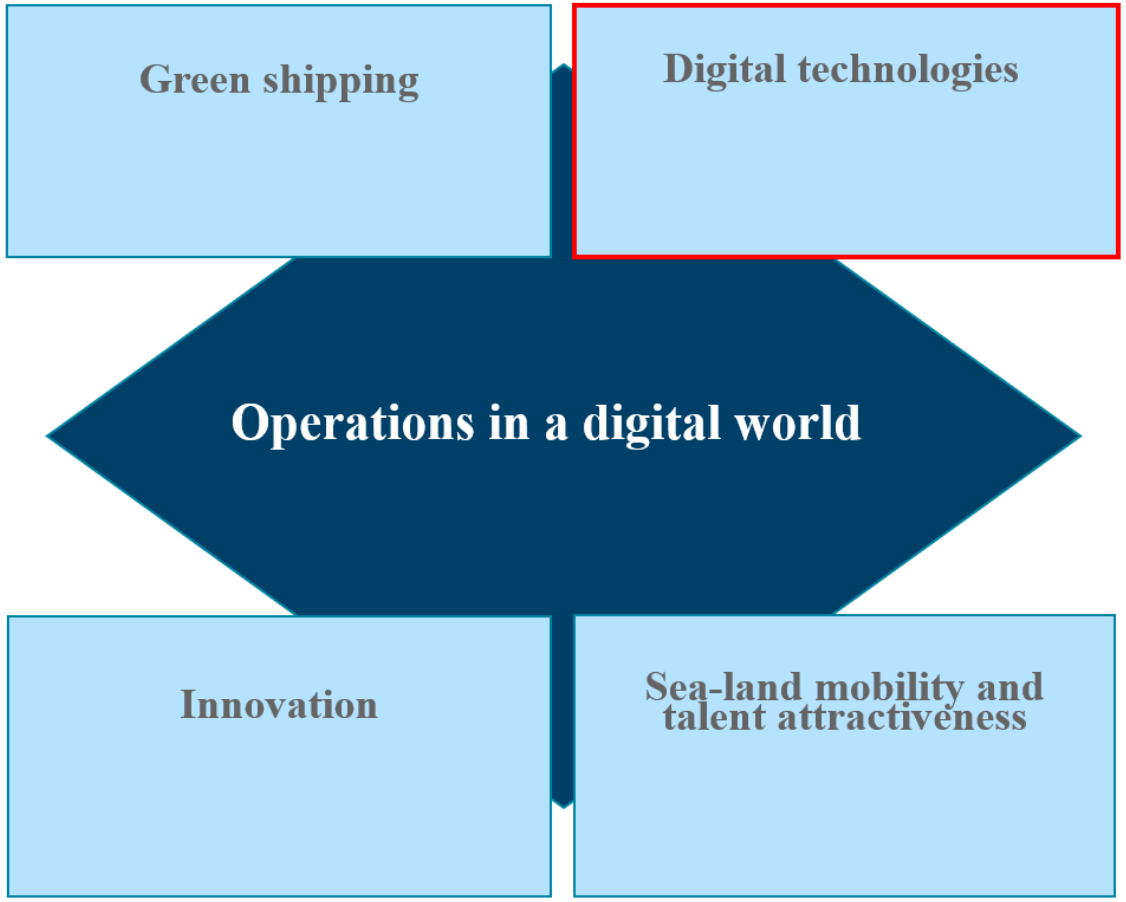
# Future Skills Need

## Recommendations for future education and training

**Digital technologies**

- Basic digital technology skills as for example
  - Sensors
  - IoIT
  - Networks
  - Connectivity and
  - Cyber security
  - Ship 4.0/ Industry 4.0
- Advanced analytics and use of data in optimisation of the fleet
- Deep understanding of the complex systems onboard and systems connected to the ship to be able to serve the needed redundancy of all systems
- To update, service and repair digital systems



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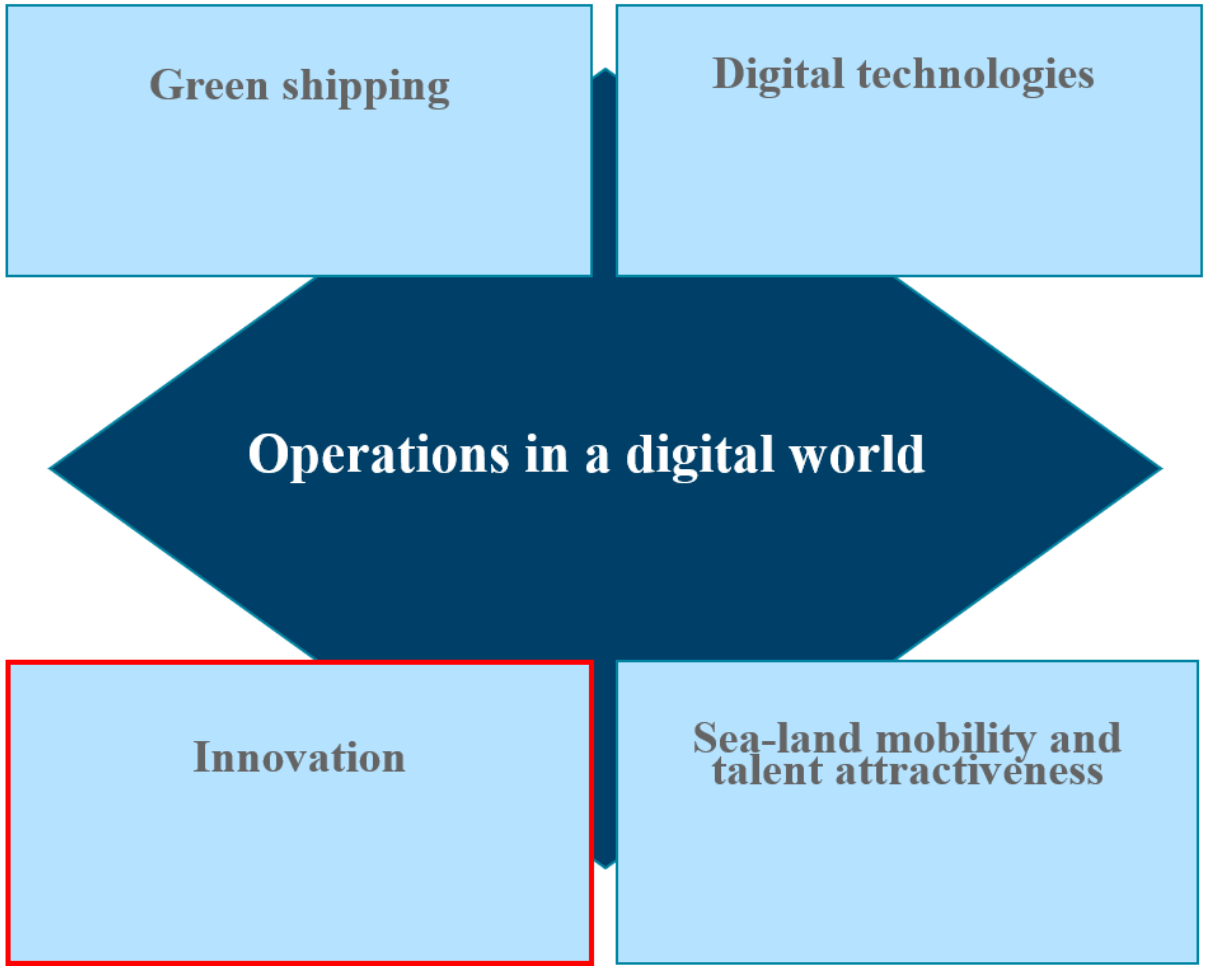
# Future Skills Need

## Recommendations for future education and training

**Innovation**

- Understanding of business development taking advantage of digital technology (for example: cargo tracking, cargo and machinery condition monitoring, logistics in digital connected value chains, smart port operation, fleet management, e-brokerage, smart commerce with blockchain)
- Good maritime education and training located in strong industrial clusters will have a precondition to develop new competencies
- Close links between education institutions and industrial clusters can foster innovation as knowledge creation and strength of R&D

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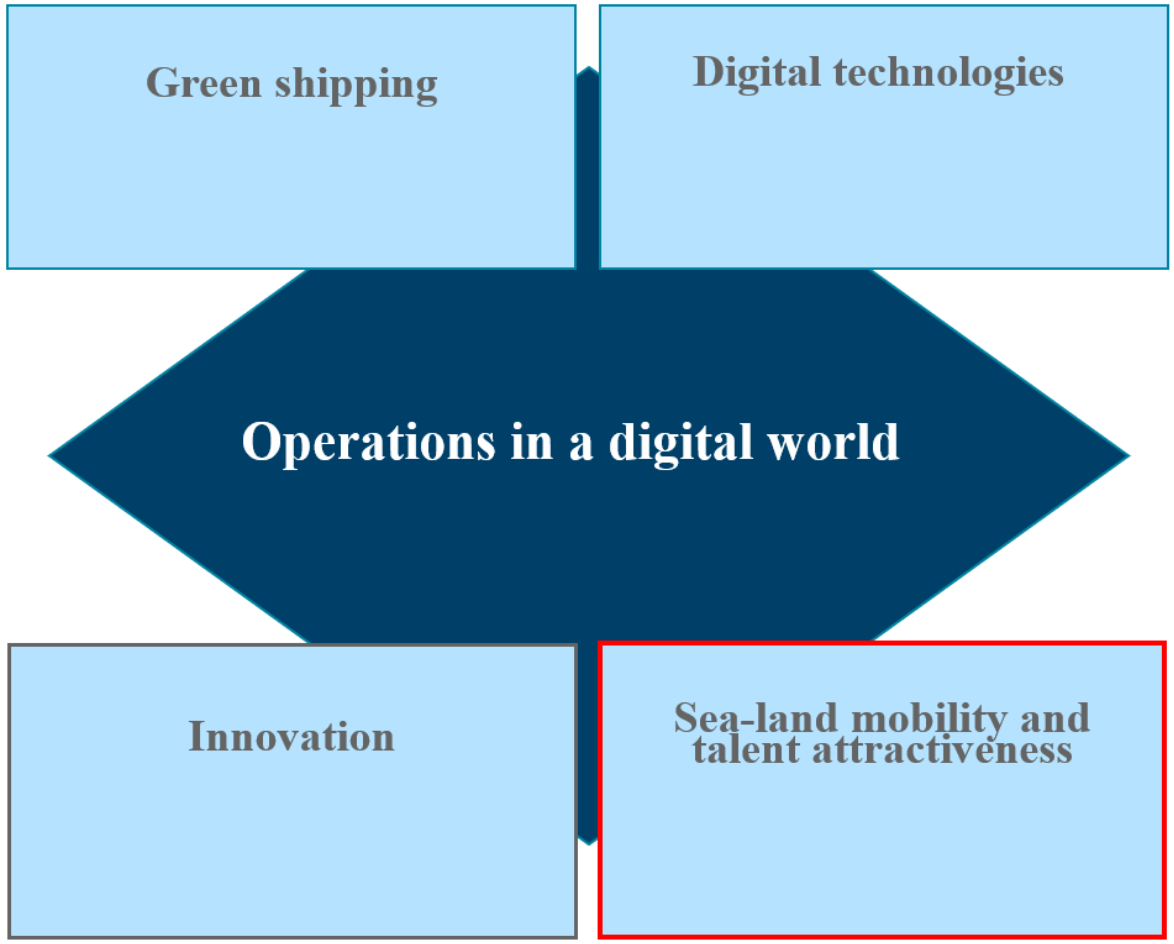
# Future Skills Need

## Recommendations for future education and training

**Sea-land mobility and talent attractiveness**

- Tranversal skills needed to to enable them to move from one value chain to another and thereby
- It is a need to establish suitable lifelong learning programmes that enable seafarers to work across industries and services in the maritime shipping sector
- Maritime clusters with a variety of job opportunities and career paths are a key to talent attractiveness
- Improved interface between seagoing and shore-based jobs can help with building up transversal competences and skills in the maritime sectors.

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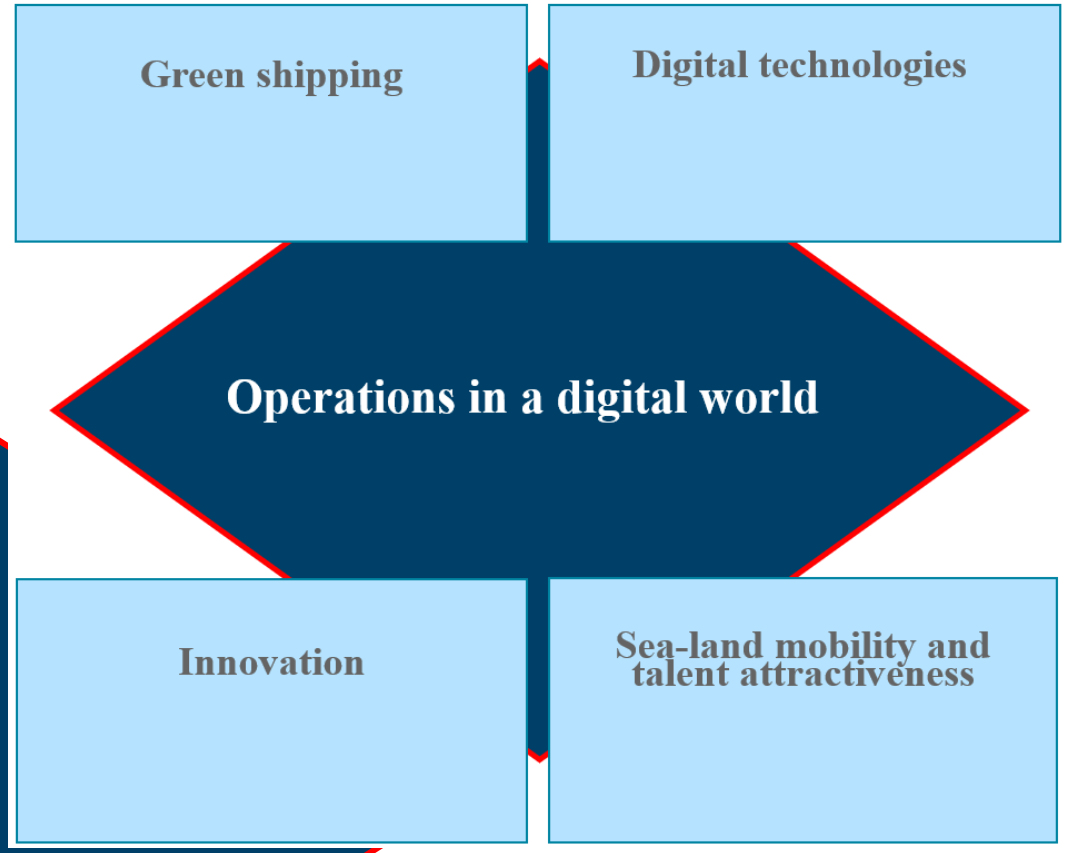
# Future Skills Need

## Recommendations for future education and training




**Operations in a digital world**

- The fleet of the future will be continually communicating with its managers that is continually monitoring vessel positions, manoeuvres and speeds. Fleet managers will be able to analyse this data, enabling them to advise the captain and crew on navigation, weather patterns, fuel consumption, and port arrival.
- Seafarers should know how to interact with the computer systems to respond to challenges in the operation of autonomous ships, such as when routes are changed, or ships are in hazardous waters.
- Operation by dispersed crew and digital connected teams
- New roles due to shore-based control centres supporting ships with optimisation services, remote control and autonomy

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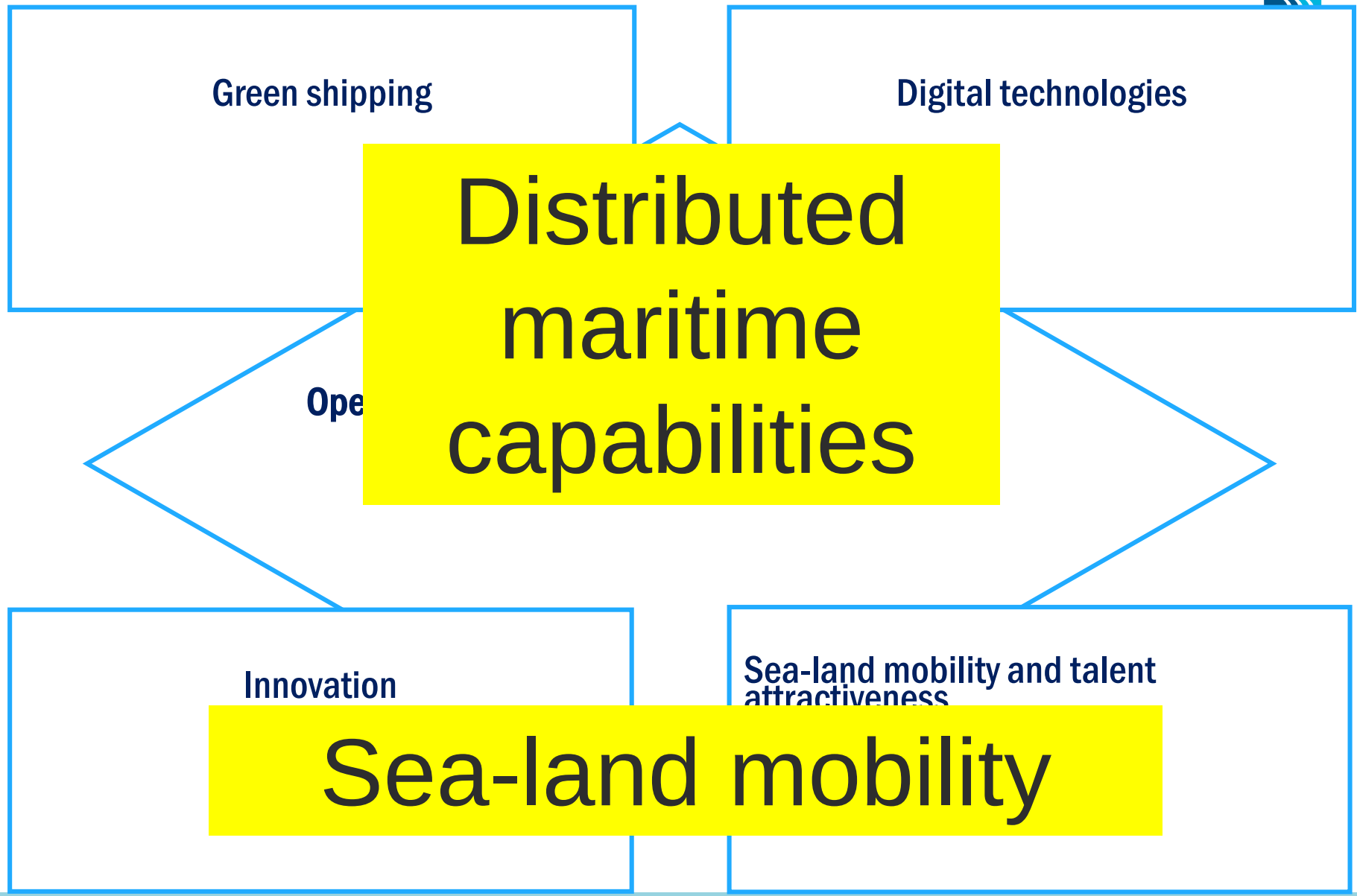
# Future Skills Need

## Take away



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# Future Skills Need

## Recommendations for future education and training

*Thank you*

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