

Maritime Research and Innovation UK (MarRI-UK) Response - Invest 2025: The UK's Modern Industrial Strategy

1) How should the UK government identify the most important subsectors for delivering our objectives?

To effectively identify the most important subsectors for delivering our objectives, the government should adopt a comprehensive and inclusive approach:

1. Holistic Evaluation of the UK's Industrial Landscape

The UK government must take a broad, cross-sector view, recognising that excluding critical sectors early in strategic planning risks losing out on significant long-term growth and economic resilience. For example, while the maritime sector is not explicitly recognised within the Industrial Strategy's eight "growth-driving" sectors, its vital contributions to the economy and national infrastructure necessitate inclusion.

- **Fact:** According to Maritime UK State of the Maritime Nation report published in 2019, Maritime sector alone directly supported over **£47 billion in business turnover, £17 billion in GVA, and 220,100 jobs**. These roles span shipbuilding, ports, logistics, and maritime services, many of which are high-skilled and high-paying jobs. The UK aerospace sector, often highlighted in the Industrial Strategy, contributes **£10.9 billion GVA** and employs **104,000 people** according to ADS' Aerospace Sector Outlook, showcasing comparable economic weight. Given Maritime's broader role in trade, supply chains, and decarbonisation, the sector contribution warrants similar recognition and support.
- **Opportunity:** Incorporating maritime industries into growth strategies can maximise untapped potential, particularly in areas such as port modernisation, vessel retrofitting, and clean propulsion technologies. With strategic investments and recognition, maritime industries could deliver transformative growth for the UK, rivalling sectors like aerospace in both impact and innovation potential.

2. Prioritise Sectors Based on Unique Strategic Importance and align with Strategic Goals

As an island nation, the UK's economy heavily relies on maritime infrastructure and logistics, with **95% of goods entering and exiting the UK by sea**, as stated in the UK Port Freight Statistics report published in 2022. UK government should prioritise subsectors that align with key national strategies, such as the UK's Net Zero by 2050 plan, Maritime 2050, and international decarbonisation objectives. Neglecting maritime advancements risks losing competitive advantages in global trade and creating dependencies on other nations for key infrastructure. UK needs a blue economy strategy for the next 25 years.

- **Examples from Global Leaders:**
 - Germany and Denmark are redefining trade routes through investments in maritime decarbonisation and industrial strategies.
 - Ireland's Blue Economy strategy (established in 2007) has unlocked sustainable maritime growth, serving as a model the UK could adapt.
 - In Spain, government has been compensating shipbuilding yards for additional costs compared to their counterparts in China and Japan.

3. Assess Alignment with National and Global Objectives

Subsectors must align with key government priorities such as Net Zero by 2050 and the UK's commitment to becoming a global clean energy superpower. By focusing on clean propulsion, port decarbonisation, and advanced shipbuilding, the UK can achieve environmental and economic objectives while positioning itself as a leader in maritime innovation. Unlike air and road, maritime is different in that the international market is largely influenced by IMO. Funding investment to technology development needs to align with IMO agenda, to ensure the technology developed are adopted by the industry. Balancing readiness with innovation is essential to meet immediate industry needs while advancing long-term goals.

4. Learn from Successful UK Precedents

The government should adapt proven models in some industries to other industries. For example, the Aerospace Technology Institute (ATI) model for aerospace and the Advanced Propulsion Centre (APC) for automotive. In addition, CfD model for wind power incentivised large-scale investment renewable energy. Similar models and frameworks could be designed to support other sectors such as maritime and shipbuilding.

5. Foster Long-Term Partnerships and Stable Policy Environments

Creating long-term partnerships between government, industry (e.g., BAE Systems, Babcock), and academia is essential for sustained innovation. An excellent example in maritime is Maritime Research and Innovation UK ([MarRI-UK](#)), which has demonstrated positive impact of such partnership, and attracted investment from industry. However, to make the model sustainable, this collaborative framework must have government support and include funding mechanisms for both low Technology Readiness Level (TRL) research and high TRL product commercialisation.

- **Benefit:** This long-term partnership would enable a comprehensive analysis of the UK's industry compared to leading global hubs (e.g., Singapore, South Korea, the US, Germany), and identify gaps in technology, innovation, sustainability, and funding needs.

6. Preserving Industrial Capacity

The UK once held a dominant position in global shipbuilding, playing a pivotal role in the industry. However, this leadership has diminished over time due to a combination of economic, political, and market factors. Despite this, the UK remains a global leader in maritime research and innovation, particularly in areas such as autonomous systems, decarbonisation technologies, and advanced engineering. Today, the drive towards net zero and sustainability offers a transformative opportunity to reclaim our maritime leadership. By investing in green shipbuilding, clean propulsion technologies, and sustainable port infrastructure, the UK can re-establish itself as a powerhouse in the global maritime industry.

This renewed focus will not only contribute to achieving the UK's environmental goals but also generate substantial economic benefits, drive export growth, and create high-quality jobs across the supply chain. The maritime sector has the potential to be a cornerstone of the UK's industrial strategy, revitalising regions with a strong shipbuilding heritage and fostering a thriving, future-ready maritime economy.

7. Consideration of the Wider Supply Chain:

When identifying key subsectors, the UK government must consider the wider supply chain to ensure sustainable growth. While large infrastructure projects are impactful, they must also bolster the broader supply chain, particularly domestic SMEs and manufacturing capabilities. Strengthening the supply chain enhances resilience, ensures the adoption of advanced technologies, and creates long-term economic benefits. A holistic approach that integrates upstream and downstream stakeholders is critical to maximising the impact of investments and maintaining competitiveness in global markets. It's important to collaborate with industry and academia to identify and lead in emerging technologies that can benefit end-users and support SMEs in developing practical applications.

8. Strengthen Public Sector Investment Advocacy

To justify public sector investment, the government should articulate the value the subsectors brings to the UK, such as increased economic output, job creation, and trade competitiveness. Advancements in the maritime sector will bring economic benefits to regions that have suffered geographical inequality. Engaging stakeholders like Society of Maritime Industry (SMI), Maritime UK, MarRI-UK and industry primes could enhance these efforts.

4) What are the most important subsectors and technologies that the UK government should focus on and why?

Based on the justification of identifying the important subsectors in Question 1, it is critical to recognise sectors of economic and strategic importance, particularly for maritime, which are underrepresented in the current Industrial Strategy.

Maritime services play a pivotal role in supporting the UK's trade, with **95% of all goods** by volume and **75% by value** transported via seaborne trade, as stated on the British Ports Association website. According to a report by the Centre for Economics and Business Research (CEBR), the maritime sector is one of Britain's biggest industries, earning **£116 billion turnover** in 2022 which is greater than rail and aviation combined. According to the DfT Clean Maritime Plan, the UK is home to a world-leading ship finance and insurance sector, contributing to its **£3.12 billion maritime services export market**. According to World Economic Forum publication on Decarbonisation of Shipping, the global market for **green shipping technologies was valued at around £25 billion in 2022 and is projected to reach approximately £50 billion by 2030**, providing significant opportunities for UK innovation and export. Therefore, maritime serves not only as an economic powerhouse but also as a catalyst for innovation, sustainability, and trade resilience. It plays a critical role in trade, supply chains, and national security and helps position the UK as a global hub for maritime innovation and business. According to Maritime UK's figure, while the global maritime industry is projected to double in size by 2030, the UK sector faces its second year of contraction in 2024.

In addition, the maritime sector plays a significant role in greenhouse gas emissions in the UK, particularly from international shipping. According to the DfT Transport and environment statics: 2023, **international shipping contributed about 5% of the UK's total CO2 emissions**. Despite the notable reduction in emissions from other transport sectors, international shipping remains a critical challenge for the UK's climate goals. The maritime industry, especially international shipping, faces pressure to decarbonise, with emissions reductions being pursued through technological advancements, energy efficiency measures, and operational changes.

Sustainable maritime solutions present a significant opportunity for the UK to lead again in the global maritime industry, driving economic growth, job creation, and export opportunities while contributing to reducing the nation's carbon footprint. We need to focus on the following subsectors that are ready for technological advancements.

1. Advanced shipbuilding and its supply chain

- Shipbuilding is a cornerstone of the UK's industrial heritage and remains vitally important for economic growth, national security, and job creation. According to the new shipbuilding lending scheme by the DBT, shipbuilding and marine engineering alone employ **42,600 people**, often in areas with limited alternative economic opportunities, making the industry critical for regional development. There are compelling reasons to focus on rebuilding the UK

shipbuilding supply chain, particularly in the context of economic recovery, net-zero targets, and national security.

- Rebuilding the UK shipbuilding supply chain would enhance domestic manufacturing capabilities and create high-value jobs across a range of skill levels, from apprenticeships to engineering leadership roles.
- The marketing for **Service Operation Vessels and Crew Transfer Vessels** will soar in the next 20-40 years driven by the rapid expansion of the offshore wind industry. According to forecasts, the construction of 90 new SOVs and CSOVs (Construction Service Operation Vessels) will require an investment of approximately £5 billion. There is great opportunity for UK to utilise the current shipbuilding capability to provide SOV and CTV to the global market.

2. Clean Energy for Non-Automotive Use:

- Focus on transitioning to **alternative fuels** such as hydrogen, methanol, and ammonia, which are critical for decarbonising maritime, industrial, and off-road applications.
- Invest in **non-battery energy storage solutions**, an area currently lacking sufficient funding, to support broader adoption of clean energy technologies.

3. Green Maritime Technologies:

- Innovations in **propulsion systems, ship design, and fuel management**, aimed at reducing both CO₂ emissions and local pollutants
- Prioritise large demonstration projects focusing on **retrofitting existing vessels** for greater fuel efficiency and transitioning shipbuilding infrastructure for **new green builds** powered by sustainable energy.
- Develop **green ports** equipped with sustainable energy infrastructure to support cleaner maritime operations and align with net-zero objectives.
- Technologies and approaches to **improve Energy Efficiency** in order to reduce the energy consumption.

4. Groundbreaking technologies with growth potential:

- Maritime industry is a driver of innovation and growth with the development of **offshore tidal and floating wind energy**.
- The government could leverage existing expertise from wind power models, such as the Contract for Difference (CfD), to stimulate maritime innovation.

5. Autonomy and Digitalisation:

- Encourage the development and adoption of **autonomous and digital technologies in shipping, shipbuilding at yards, ports**, to enhance the UK's economic resilience and global competitiveness.
- **Artificial Intelligence (AI)** has the potential to significantly transform the UK maritime sector, enhancing efficiency, sustainability, and safety while boosting the economy.

5) What are the UK's strengths and capabilities in these subsectors?

The UK boasts significant strengths and capabilities across its maritime subsectors, which are supported by a combination of technical expertise, a skilled workforce, and strategic frameworks. Our key strengths and capabilities in maritime include:

1. **World-Leading Technical Expertise:**

- The UK excels in **ship design, engineering, and advanced manufacturing**, with a strong legacy in shipbuilding that remains relevant today.
- The UK boasts world-leading academic institutions in the maritime field, renowned for their cutting-edge research, innovation, and education. Universities such as the University of Strathclyde, University of Southampton, Newcastle University, University College London, University of Exeter, University of Liverpool, University of Plymouth, and Liverpool John Moores University are at the forefront of advancing maritime technology and sustainability. These institutions contribute significantly to areas like ship design, marine engineering, offshore renewable energy, oceanography, maritime autonomy, and coastal resilience. Their expertise not only supports the UK's maritime industry but also positions the nation as a global leader in shaping the future of sustainable and innovative maritime solutions.
- Maritime Research Innovation UK (MarRI-UK) unifies the UK's top maritime universities, research organisations and key maritime industry players, making the UK a global hub for cutting-edge innovations in maritime research, such as net zero emission, autonomous vessels and smart shipping technologies.
- UK has a large number of maritime organisations and companies contributing to the nation's economic development. A recent study collected over 10k entries which constitute the UK maritime supply chain.
- The "The UK's Academic Capacity & Capability for Shipbuilding" report delivered by MarRI-UK revealed that UK is leading in Design, Decarbonisation, and Special Vessels.

2. **Skilled Workforce and Training Programmes:**

- Despite shortages as commonly faced by many engineering sectors, the shipbuilding sector is supported by a **highly skilled workforce**, developed through robust training programs and apprenticeships. These initiatives ensure a steady pipeline of talent to meet industry demands.
- Facilities like **Rosyth** have seen significant investments in modernising shipyard infrastructure, further bolstering the UK's capacity to build and maintain state-of-the-art vessels.

3. **Strategic Frameworks and Policies:**

- The **National Shipbuilding Strategy (NSbS)** provides a clear vision for modernising the industry, fostering innovation, and unlocking export opportunities. While its implementation has faced challenges, it remains a strong foundation for supporting naval and commercial shipbuilding.

- The **Maritime 2050 strategy** highlights the sector's importance to the UK economy and its alignment with sustainability and technological goals, providing a credible reference for the UK's maritime strengths.
- 4. **Smart Ports and Logistics:**
 - The UK is a leader in developing **smart ports**, leveraging advanced logistics and digital technologies to optimise port operations and enhance supply chain resilience.
- 5. **Collaboration through the Triple Helix Model:**
 - The UK fosters effective collaboration between government bodies, industry, and academia through initiatives like the **triple helix scheme**, which drives innovation and ensures that research translates into practical, scalable solutions.
- 6. **Opportunities for Global Leadership:**
 - With **government-to-government relations**, the UK can showcase its shipbuilding and maritime capabilities on the global stage. Increased export support, financial incentives, and advisory services can further strengthen the sector's competitiveness in international markets.

These capabilities highlight the UK's potential to lead in areas like shipbuilding, maritime autonomy, and sustainable logistics. By addressing underinvestment in manufacturing and production and effectively implementing strategic policies, the UK can fully leverage its strengths to drive innovation, economic growth, and global competitiveness.

6) What are the key enablers and barriers to growth in these subsectors and how could the UK government address them?

To unlock growth in key maritime and related subsectors, the UK must address several enablers and barriers while leveraging government policy and investment to drive transformation.

Key Enablers to Growth

- 1. Stable Policy Direction:**
 - A predictable, long-term policy framework allows businesses to plan investments confidently, reducing uncertainty and encouraging market entry for innovative solutions.
- 2. Mission-Based Policy Approach:**
 - Holistic policies that cut across sectors and focus on transformational missions, such as decarbonising shipping or developing smart ports, enable systemic growth and innovation.
- 3. Support for Research and Innovation:**
 - Matched funding for research programmes and partnerships between government, industry, and academia have proven effective in advancing technologies like autonomy and decarbonisation. The Industrial Strategy's focus on collaboration across departmental boundaries strengthens these initiatives.
- 4. Commitment to Net Zero and IMO Targets:**
 - The UK's alignment with Net Zero 2050 and International Maritime Organisation (IMO) decarbonisation goals provides a clear mandate for innovation in alternative fuels, offshore wind, and sustainable maritime technologies.
- 5. Growing Offshore Wind Market:**
 - The UK is a global leader in offshore wind energy, which creates demand for vessels, infrastructure, and services, directly benefiting shipbuilding, port logistics, and renewable energy subsectors.

Key Barriers to Growth

- 1. Lack of long-term government innovation support for maritime projects** beyond short-term initiatives.
 - According to Horizon Europe strategic plan 2025-2027 analysis (<https://op.europa.eu/en/publication-detail/-/publication/b3baec75-fdd0-11ed-a05c-01aa75ed71a1/language-en>), the UK's R&D intensity—approximately 1.5% of its GDP—lags behind that of the US, EU, Japan, South Korea, and China. This is a concerning disparity for a nation aspiring to achieve its "Science and Technology Superpower" agenda.
- 2. High Costs of Alternative Fuel Development:**

- Developing and scaling alternative fuels like hydrogen and methanol, along with their associated infrastructure, is capital-intensive, making it difficult for SMEs to compete or invest.
- 3. **Limited Financial Support and investment:**
 - Over-reliance on multinational corporations for major projects sidelines smaller, innovative UK-based SMEs that drive local production and innovation.
 - Insufficient private and public investment in scaling high TRL technologies.
- 4. **Regulatory Delays:**
 - Slow regulatory processes for approving new technologies, such as autonomy and alternative fuels, hinder commercialisation and market uptake.
- 5. **Uncertain Demand for New Technologies:**
 - A lack of guaranteed market demand for decarbonisation technologies (e.g., green vessels or offshore wind vessels) discourages private sector investment.
- 6. **Lack of Skilled Workforce and Training Programmes:**
 - Businesses face difficulties justifying workforce investment without long-term demand pipelines or co-funding arrangements. This lack of alignment discourages skill development, further limiting sector growth potential.
 - The UK maritime sector is facing a significant workforce shortage, because of an ageing workforce and limited interest among younger generations in maritime careers. According to Maritime Skills Commission 2023 annual report, a large portion of the workforce is over 50 years old, with only about 14% under the age of 30. This demographic imbalance is concerning, as it points to a looming shortage of experienced professionals in the coming years. The demand for green skills, such as expertise in renewable energy and alternative fuels, is also expected to increase dramatically—by 400%—by 2030, which further strains the talent pool.

How the UK Government can address these Barriers

1. **Financial Support:**
 - **Increase research intensity**, particularly in blue technologies, as these innovations hold significant potential to drive long-term economic growth while ensuring environmental sustainability. Blue technologies—spanning renewable energy from oceans, advanced marine robotics, sustainable aquaculture, and bioresource extraction—represent a critical opportunity to harness the vast potential of marine resources responsibly. By investing in this sector, the UK can position itself as a global leader in the sustainable utilisation of oceanic resources, contributing to job creation, fostering cutting-edge innovation, and addressing pressing global challenges such as climate change, biodiversity loss, and food security. Enhanced research intensity in this area aligns with the UK's "Science and Technology Superpower" agenda and its commitment to achieving net-zero emissions, ensuring that economic development is both resilient and future-proof.
 - Redirect funding to support **homegrown SMEs**, enabling them to lead in manufacturing and technological advancements.

- Offer **higher matched funding for research** and innovation projects to accelerate the development of alternative fuels and autonomous systems while retaining measures like the Decarbonisation Allowance under the Energy Profits Levy.
 - Learn from wind power subsidies, which have reduced electricity costs to levels below gas. This demonstrates that **Contracts for Difference (CFD)** can also effectively support UK shipbuilding and maritime innovation.
2. **Regulatory Acceleration:**
- Invest in building the capacity and capability of regulators to facilitate **faster regulatory innovation**.
 - Streamline processes for approving emerging technologies and encourage pilot programs to test and refine regulatory frameworks.
 - **Streamline Regulatory Frameworks** by introducing deregulation zones (e.g., tied to Freeports) to accelerate testing of new fuels and technologies.
3. **Support Market Demand Signals:**
- Commit to forward-purchasing contracts for technologies critical to national goals, such as offshore wind support vessels (OSVs), domestic ferries, and other maritime assets to stimulate supply chains and investment.
 - Support large-scale projects like offshore floating wind farms, creating demand for domestic shipbuilding and infrastructure.
4. **Encourage Long-Term Investment:**
- Provide **tax incentives** or grants for businesses investing in sustainable technologies, alternative fuels, and infrastructure.
 - Establish a **stable policy framework** with clear, long-term objectives, reducing policy churn and enabling businesses to plan investments confidently.
5. **Foster Partnerships and Collaboration:**
- Promote partnerships between industry, academia, and government through mission-driven approaches.
 - Strengthen programmes under the **Industrial Strategy** to ensure cross-departmental collaboration and effective policy delivery.
6. **Enhance Capital Accessibility:** Offer matched funding for innovation and R&D projects.

Addressing these barriers and leveraging the UK's strengths in offshore wind, maritime research, and manufacturing will position the country as a global leader in sustainable maritime technologies. Focused government support and strategic interventions are essential to unlocking the full potential of these subsectors.

7) What are the most significant barriers to investment? Do they vary across the growth-driving sectors? What evidence can you share to illustrate this?

The most significant barriers to investment in growth-driving sectors, such as maritime and manufacturing, stem from a combination of risk aversion, short-term focus, and systemic challenges in funding mechanisms. These barriers vary across sectors but share common themes.

According to MarRI-UK industry members, key barriers to investment include:

1. **Short-Term Risk Appetite:**
 - Investors often prioritise short-term returns, typically measured in quarterly results, over the long-term horizons required for innovation and manufacturing.
 - This risk aversion particularly impacts sectors requiring substantial upfront investment, such as maritime infrastructure, R&D, and manufacturing, where returns may take years or decades to materialise.
 - Evidence: Manufacturing division of a maritime propulsion company, Ecomar Propulsion struggled to secure funding over 14 months, while its digital division secured funding in just six months despite operating in the same sector.
2. **Capital intensity of growth-driving sectors:**
 - Industries such as maritime and advanced manufacturing require substantial upfront investment for infrastructure, R&D, and commercialisation. These sectors are less attractive to investors due to longer timeframes and higher uncertainty compared to digital-first businesses.
 - Smaller companies struggle to secure funding due to the high perceived risks of untested technologies, long development timelines, and the capital-intensive nature of projects.
 - Maritime start-ups face additional hurdles with multi-phase projects that require significant investment before commercialisation, deterring traditional investors.
3. **Decline in Manufacturing Investment:**
 - The manufacturing sector is often overlooked by venture capital (VC) firms, which show greater interest in sectors like digital technology.
 - Limited access to funding has exacerbated the decline of manufacturing in the UK, stalling innovation and domestic production capabilities.
4. **Fragmented Interests Among Stakeholders:**
 - Divergent priorities and interests among government, industry, and investors create inconsistencies in funding allocation and policy direction, reducing the effectiveness of coordinated investment efforts.
5. **Insufficient Long-Term Government Support**
 - Uncertainty in long-term government policy, regulations, and incentives diminishes investor confidence in emerging sectors, such as maritime decarbonisation.

How Barriers Vary Across Sectors

1. **Digital vs. Manufacturing:**

- Digital technologies benefit from perceived lower capital requirements, scalability, and quicker returns, making them more attractive to investors.
- Manufacturing and maritime, in contrast, require heavy upfront costs and have longer development cycles, increasing perceived risk.

2. Infrastructure-Heavy Sectors:

- Sectors like maritime and renewable energy require substantial infrastructure investment, which investors view as high-risk due to long timelines and regulatory dependencies.

3. Workforce Demands:

- Sectors with specialised skill requirements, such as shipbuilding and engineering, face additional challenges in securing investment due to the higher cost and time needed for workforce development.

Proposed Solutions to Overcome Barriers

1. Government-Backed Risk Mitigation:

- Introduce **investment guarantees** or co-investment programmes to de-risk early-stage projects in infrastructure-heavy sectors like maritime and manufacturing.
- Offer **tax incentives** or grants for investors funding long-term innovation and high-capital projects.

2. Long-Term Partnerships:

- Establish partnerships between the government and industry to align training programs, ensure long-term demand pipelines, and co-fund workforce development.
- Sector-based training initiatives can aggregate demand and justify resource allocation for tailored workforce programs.

3. Redistribution and Incentivisation:

- Implement policies to redistribute wealth, such as targeted taxation on short-term capital gains, with funds directed toward innovation in manufacturing and maritime.

4. Promote Stable and Clear Policy Direction:

- Reduce policy churn by adopting a **mission-based approach** that cuts across departments, ensuring consistent support for sectors like maritime and manufacturing.

- Commit to long-term programs like infrastructure development for offshore wind, which stimulates downstream investment in shipbuilding and supply chains, and gives confidence to businesses to make investments.

5. Address Investor Fragmentation:

- Facilitate collaboration between government, venture capitalists, and industrial stakeholders to strike a balance between risk and return expectations.

Evidence to Illustrate Barriers

- The UK maritime sector contributes **£17 billion annually to the economy** but faces funding shortfalls for infrastructure and R&D due to perceived risks.
- Despite its critical importance, **UK manufacturing has seen a 15% decline in investment over the past decade**, reflecting systemic challenges in attracting capital.
- The stark difference in fundraising success between digital and manufacturing projects within the same company highlights sectoral biases in investment priorities.

Addressing these barriers requires a coordinated effort to de-risk investments, align stakeholder priorities, and establish long-term commitments from both the government and private investors. By doing so, the UK can unlock the potential of manufacturing and maritime sectors while ensuring sustainable growth across all critical industries.

8) Where you identified barriers in response to question 7 which relate to people and skills (including issues such as delivery of employment support, careers, and skills provision), what UK government policy solutions could best address these?

To address barriers related to **Lack of Skilled Workforce and Training Programs**, the UK Government could implement the following policy solutions:

1. Enhance Education and Training Opportunities

- **Expand Maritime Apprenticeships:** Collaborate with maritime industries to scale up apprenticeship schemes, making them accessible nationwide. Provide subsidies or tax incentives to encourage businesses to participate.
- **Modernise Curriculum:** Partner with educational institutions to align maritime-focused curricula with industry needs, incorporating new technologies and sustainability practices.
- **Promote STEM Education:** Increase funding and awareness for STEM (Science, Technology, Engineering, and Mathematics) programs to build foundational skills needed in maritime careers.
- **Address gap between funding for PhD and research projects:** Different with other countries, like US and Norway, PhD students in UK are more treated as students instead of researchers. Currently, the research funding is not allowed to be used to support PhD students, fees and stipend. The only possible way to sponsor PhD students with funding is through CDT. However, for marine technology, there is no real CDT for marine technology, naval architect. There are many consequences. First is the in-depth research. PhDs are the main intelligence power for in-depth research. But very much lacking in marine. Second, industry lacks of support from quality research outcomes, such as technology and leading product.

2. Support Workforce Development

- **Reskilling Initiatives:** Create reskilling programmes for workers from other industries to transition into maritime roles, addressing gaps in skills and labour supply.
- **Risk-Sharing Mechanisms:** Establish long-term partnerships where government funding supports private sector investment in technologies and skills development. Shared financial responsibilities can reduce barriers to innovation and encourage risk-taking by companies.
- **Strategic Roadmaps:** Collaborate with industry stakeholders to create roadmaps for workforce needs, ensuring alignment with long-term national priorities such as climate change and cybersecurity.
- **Investment in Infrastructure and Technology:** Provide co-investment opportunities to modernise shipyards and maritime infrastructure, ensuring sustained industry growth and a demand for skilled workers.

3. Create Market Confidence for Long-Term Investment

- **Sector-Specific Guarantees:** Implement policies that assure steady market demand, such as procurement commitments for green shipping technologies or offshore support vessels.
- **Tax Incentives for Training Investments:** Offer tax breaks to companies that invest in employee training and upskilling.
- **Encourage Technological Adoption:** Use government funding to subsidise the adoption of emerging maritime technologies, ensuring a skilled workforce to operate them.

4. Incentivise Employment as a Key Economic Outcome

- **GVA-Based Incentives:** Link government incentives to employment and Gross Value Added (GVA) contributions, ensuring companies see these as valuable metrics for investment.
- **Employment Guarantees:** Establish policies where companies committing to local job creation receive preferential access to grants or contracts.

By adopting these policies, the UK Government can effectively address maritime skills shortages while fostering long-term growth, innovation, and resilience in the maritime sector.

10) Where you identified barriers in response to question 7 which relate to RDI and technology adoption and diffusion, what UK government policy solutions could best address these?

To enhance Research, Development, and Innovation (RDI) and the adoption and diffusion of new technologies, the UK Government could adopt the following policy solutions:

1. Establishing a ULEX (UK Local Exemption) Zone for Offshore Innovation

- **Facilitate Offshore Innovation Zones:** Introduce ULEX zones around offshore wind farms to act as testbeds for new technologies, such as hydrogen fuels and autonomous vessels. These zones could provide regulatory flexibility, enabling trials and scaling-up of innovative technologies.
- **Regulatory Streamlining:** Simplify permitting and compliance requirements within these zones to encourage experimentation and rapid deployment.

2. Tax Incentives and Financial Support

- **R&D Tax Incentives:** Provide enhanced tax credits or deductions for companies investing in maritime R&D and pilot projects, particularly for emerging technologies like hydrogen fuels, autonomous systems, and green shipping technologies.
- **Incentivise Manufacturing:** Offer tax relief for the domestic manufacturing of components such as floating wind platforms, pylons, blades, Crew Transfer Vessels (CTVs), and Offshore Supply Vessels (OSVs).
- **Insurance for Risk Mitigation:** Establish government-backed insurance programs to de-risk the adoption of cutting-edge technologies, ensuring companies feel confident investing in unproven but promising innovations.

3. Public Procurement and Local Content Requirements

- **SME-Focused Procurement:** Mandate a percentage of government contracts for maritime R&D and offshore projects to be awarded to SMEs, driving innovation and supply chain development.
- **UK Content Mandates:** Require a minimum percentage of UK-manufactured content in major projects like floating offshore wind farms. This would stimulate the domestic supply chain, create jobs, and strengthen the industrial base during the start-up phase of new technologies.

4. Funding for Early-Stage R&D and Pilot Projects

- **Increased R&D Grants:** Provide targeted funding for early-stage R&D and pilot projects in high-priority areas such as low-carbon fuels, digital twins, and autonomous systems.
- **Public-Private Partnerships (PPPs):** Foster partnerships to co-fund pilot projects, reducing the financial burden on individual companies while driving innovation.

- **Green Technology Accelerator:** Establish accelerators for emerging maritime technologies to bridge the gap between R&D and commercialisation.

5. Strategic Policy and Industrial Protection

- **Temporary Protection for Emerging Sectors:** Provide temporary protective measures for UK industries entering nascent technology spaces, such as tariffs or quotas, to allow time for domestic supply chain mobilisation and competitiveness.
- **Competitiveness-Focused Industrial Strategy:** Update the industrial strategy to explicitly support emerging technologies in maritime sectors, emphasising UK growth, employment, and resilience in supply chains.

6. Leveraging Britain's Scarce Resources for Maximum Impact

- **Resource Optimisation:** Focus investments in high-potential technology clusters and regions with strong maritime expertise, creating hubs of excellence.
- **Workforce Development:** Align workforce training with emerging technology needs to ensure skills gaps do not hinder adoption.

By combining these measures, the UK Government can create a supportive ecosystem for maritime RDI and technology adoption, ensuring sustainable growth, employment, and global competitiveness in the sector.

11) What are the barriers to R&D commercialisation that the UK government should be considering?

The UK Government should consider the following barriers to the commercialisation of R&D:

1. Financial Barriers

- **Lack of Accessible Funding:** Limited access to capital for scaling innovations, as banks are reluctant to lend, venture capital interest is low, and capital investment costs are prohibitive.
- **Inadequate Funding Schemes:** Existing grant mechanisms, such as Innovate UK, are often slow, complex, and unrealistic for many businesses. More streamlined and impact-focused funding schemes are needed.
- **High Risk of Market Entry:** Companies lack confidence in recouping investments due to market uncertainties, which deters funding and commercial implementation.

2. Lack of in-depth and fundamental research

Currently, the UKRI funding is not funding fundamental maritime technology related projects to a comparable scale (considering size and opportunity of the market). If the record of EPSRC funding is reviewed, the success for maritime, particularly naval architecture, ships is very rare. This differs from other nations with a strong focus and reputation in marine technology, such as Norway, Germany, Denmark. More research needs to be devoted to fundamental naval architecture research and technology development in order to have a long pipeline of technology for commercialisation. These fundamental researches also build the basis for the newly emerged area such as decarbonisation, digital, and autonomy.

3. Structural Barriers

- **Fragmented Support Ecosystem:** A disconnect between R&D capabilities and industrial funding or implementation limits the scaling of innovations.
- **Lack of long-term forecastable support:** Lacking in long term vision compared to the Horizon Europe programme which are carefully organised with **planned multi-year projects and large funding commitments** and drafted by leading experts in the sector. Marine Technologies require multi-million-pound funding to have technologies developed and demonstrated.
- **Resource Intensity:** High upfront costs and resource requirements for commercialisation make it challenging for SMEs and startups to compete.

4. Regulatory Barriers

- **Absence of Clear Standards:** Emerging technologies, such as hydrogen fuels and autonomous systems, lack clear regulations and industry standards, creating uncertainty for investors and businesses.

- **Regulatory Complexity:** Lengthy approval processes and compliance challenges hinder timely market entry.

5. Cultural Barriers

- **Risk Aversion:** A cultural reluctance to adopt new technologies and approaches, particularly in traditional industries, stifles the implementation of R&D outputs.
- **Low Industry Engagement:** Despite strong R&D capabilities, the industry often lacks the confidence or willingness to fund and adopt new innovations.

Recommended Focus Areas for Government Action

- **Financial Support:** Simplify and accelerate funding schemes; introduce targeted grants, subsidies, and lending programs tailored to high-potential industries and technologies.
- **More focus on fundamental research:** Have stable funding for fundamental research in order to have a long pipeline of technology for commercialisation.
- **Regulatory Clarity:** Develop and standardise regulations for emerging technologies to provide confidence and direction to investors and innovators.
- **Incentives for Industry Engagement:** Provide tax breaks or co-investment opportunities to encourage businesses to fund and implement R&D outputs.
- **Impact Acceleration:** Establish specific funding schemes focused on accelerating the transition of R&D into commercially viable products or solutions.

Addressing these barriers will help ensure the UK capitalises on its strong R&D capabilities and enhances its global competitiveness with a long vision.

19) How can regulatory and competition institutions best drive market dynamism to boost economic activity and growth?

To best drive market dynamism and boost economic activity and growth, regulatory and competition institutions should consider the following strategies:

1. Enhance Regulatory Capacity and Flexibility

- **Build Expertise:** Increase the number of technical expertise in the regulatory body, so more capable regulators equipped to address novel ideas and technologies, ensuring they can support innovation rather than hinder it.
- **Promote Proactive Regulation:** Shift from bureaucratic processes to a more dynamic approach where regulation actively fosters market opportunities, such as supporting decarbonisation in maritime and other sectors.

2. Promote Fair Competition and Market Protections

- **Balanced Market Protection:** In embryonic markets, consider temporary protection measures (e.g., subsidies, quotas, or tariffs) to shield UK industries from being overwhelmed by larger global players like China. This would enable domestic industries to establish competitive capabilities.
- **Encourage Broad Support for Technologies:** Avoid picking winners; instead, create a level playing field that promotes fair competition and supports all viable innovations.

3. Stimulate Demand for Innovation

- **Use Regulation as a Driver:** Implement regulations that drive demand for innovation, such as setting clear decarbonisation targets and deadlines (e.g., similar to the automotive sector's switch to EVs). Pair these with penalties for inaction and subsidies for compliance.
- **Reform Tax Policies:** Introduce tax adjustments, such as increasing taxes on carbon-based fuels, to create financial incentives for adopting low-carbon technologies.

4. Reform Competition Institutions for Greater Effectiveness

- **Focus on Outcomes, Not Process:** Shift away from bureaucratic, rule-based approaches to outcome-driven strategies that prioritise success for UK industries and economic growth.
- **Improve Funding Mechanisms:** Regulation body involve in proposal submission stage, to ensure regulation challenges could be considered from the beginning, and are addressed throughout the project lifecycle.

5. Listen, Learn, and Enable Growth

- **Reduce Resistance:** Streamline regulatory processes to reduce unnecessary barriers and bureaucratic delays, allowing businesses to innovate and scale quickly.
- **Collaborate with Industry:** Actively engage with businesses to understand their needs and co-develop regulatory frameworks that support innovation and competition.

6. Incentivise and Penalise for Market Dynamism

- **Reward Positive Actions:** Provide subsidies and support to businesses that innovate and meet regulatory goals, particularly in high-growth or decarbonisation sectors.
- **Penalise Inaction:** Introduce meaningful penalties for failure to adapt or comply with innovation-driven regulations, ensuring market players remain motivated to innovate and compete.

By adopting these approaches, regulatory and competition institutions can create an environment that fosters innovation, drives market dynamism, and ensures long-term economic growth while supporting UK industries in achieving global competitiveness.

22) What are the main barriers faced by companies who are seeking finance to scale up in the UK or by investors who are seeking to deploy capital, and do those barriers vary for the growth-driving sectors? How can addressing these barriers enable more global players in the UK?

Main Barriers Faced by Companies and Investors in Scaling Up in the UK

1. *Short-Term Investment Horizons*

- Investors and financial institutions often prioritise short-term risk-reward models, which disadvantage capital-intensive and long-term growth industries, such as strategic important sectors like maritime and manufacturing.
- The lack of "annuity-like" or patient capital options hinders industries requiring significant upfront investments, such as maritime innovation, shipbuilding, and advanced manufacturing.

2. *Challenges in Securing Later-Stage Financing*

- While early-stage funding (e.g., seed and Series A) is relatively accessible, UK companies struggle to secure Series B and C financing domestically. Growth-stage funding often relies on overseas investors.
- This leaves promising UK businesses vulnerable to being acquired or controlled by foreign entities, limiting the development of UK-based global players.

3. *Regulatory and Market Uncertainty*

- Investors face a lack of confidence due to unclear or inconsistent regulatory frameworks for emerging technologies.
- High-potential sectors like hydrogen and maritime decarbonisation suffer from an absence of long-term government support or market guarantees, making investments appear riskier.

4. *Capital-Intensive Industry Barriers*

- Industries requiring substantial upfront investments, such as shipbuilding, offshore wind, and advanced manufacturing, struggle more than digital-first sectors.
- Investors often seek "traction," which can be unrealistic for early-stage companies in high-capital sectors, exacerbating funding gaps.

5. *Inefficient Pitch Processes*

- Companies waste significant time and resources repeating pitches to investors who lack a long-term perspective or understanding of emerging industries.

- The emphasis on risk minimisation and immediate returns discourages innovation-driven investments.

6. Asset Misalignment

- The UK's financial environment incentivises investment in non-wealth-generating assets (e.g., real estate) over industrial and innovation-led growth sectors.

Addressing These Barriers to Enable More Global Players in the UK

1. Promote Long-Term Investment Models

- Develop new financial instruments to encourage long-term, patient capital for industries requiring extended timelines to scale.
- Establish government-backed annuity-style investment schemes, particularly targeting high-growth and capital-intensive sectors.

2. Enhance Later-Stage Financing

- Create a UK-based growth capital fund to provide Series B and C financing to scaling companies, reducing reliance on overseas investors.
- Attract institutional investors, such as pension funds, to support growth-stage funding with incentives tied to national economic priorities.

3. Provide Market Guarantees and Regulatory Certainty

- Implement clear and consistent regulatory frameworks for emerging technologies to reduce investor uncertainty.
- Introduce long-term market guarantees (e.g., government procurement commitments or sector-specific demand targets) to build confidence in market uptake.

4. Support Capital-Intensive Industries

- Offer targeted subsidies or co-investment programs for industries with high upfront costs, such as hydrogen fuel and maritime decarbonisation technologies.
- Facilitate partnerships between public and private sectors to share financial risks.

5. Streamline Investment Processes

- Create centralised hubs or platforms for companies and investors to connect, reducing inefficiencies in the pitching process.
- Provide resources and training to help investors better understand high-growth industries and their unique dynamics.

6. Rebalance Investment Incentives

- Adjust tax policies to make investments in industrial innovation more attractive than passive asset classes like real estate.
- Offer tax credits or deductions for investments in capital-intensive or growth-driving sectors.

By addressing these barriers, the UK can foster an environment conducive to scaling high-potential industries, creating globally competitive companies and driving sustainable economic growth.

25) Which international markets do you see as the greatest opportunity for the growth-driving sectors and how does it differ by sector?

In the maritime sector, key international markets offering growth opportunities include:

Asia-Pacific: With rapid growth in trade, shipbuilding, and port infrastructure, this region is critical for sectors like ship design, maritime logistics, and advanced port technologies.

Europe: A leader in decarbonisation and sustainability, offering opportunities in green shipping corridors, offshore renewable energy, and blue technologies.

North America: Focused on maritime autonomy and decarbonisation, creating demand for cutting-edge maritime technologies and engineering solutions.

Middle East: Significant investment in smart ports and logistics hubs positions this region as a key market for port automation and digitalisation.

These opportunities vary by sector, with Asia-Pacific driving volume growth, Europe and North America pushing technology and innovation development, and the Middle East investing in efficiency and modernisation. UK should focus on maritime technology and innovation development for economic growth.

34) What are the key risks and assumptions we should embed in the logical model underpinning the theory of change?

Key Risks and Assumptions to Embed in the Logical Model Underpinning the Theory of Change

1. Political and Policy Stability

- **Risk:** Frequent changes in government policy can undermine long-term planning and investment in industries like maritime and emerging technologies. For example, shifting approaches to EV adoption in the UK have created uncertainty and slowed progress.
- **Assumption:** Policies set forth will remain consistent over the timeline required for implementation and investment recovery.
- **Mitigation:** Build mechanisms to insulate industry strategies from political shifts, such as cross-party agreements or long-term legislative frameworks.

2. Clear Regulatory Frameworks

- **Risk:** Lack of clear and consistent regulations for emerging technologies can delay investment, adoption, and scaling.
- **Assumption:** Timely and transparent regulatory frameworks will support innovation and industry confidence.
- **Mitigation:** Establish collaborative processes involving regulators, industry stakeholders, and policymakers to ensure clarity and adaptability in regulations.

3. Alignment of Metrics with Broader Goals

- **Risk:** Measurement systems may focus too narrowly on short-term political priorities rather than reflecting the industry's impact on the wider economy and societal goals.
- **Assumption:** The selected metrics for success (e.g., economic growth, job creation, or emissions reduction) accurately capture the desired outcomes.
- **Mitigation:** Regularly review and refine metrics to align with evolving industry dynamics and economic priorities.

4. Risk Aversion in Stakeholders

- **Risk:** Civil servants and politicians may embed their biases and aversion to risk into models, creating overly cautious strategies that hinder bold, necessary actions.
- **Assumption:** Decision-makers will engage in objective, evidence-based assessments of risks and opportunities.
- **Mitigation:** Incorporate diverse perspectives, including those from industry leaders, independent experts, and international best practices, to balance decision-making.

5. Delays in Policy Implementation

- **Risk:** Delays in implementing policies can hinder investment decisions, particularly in capital-intensive sectors.
- **Assumption:** Policies will be implemented on time, enabling industries to align investments and activities accordingly.
- **Mitigation:** Develop clear timelines for policy implementation and include accountability mechanisms to minimise delays.

6. Industry and Stakeholder Trust

- **Risk:** Lack of trust in the government's commitment to policy stability can reduce industry engagement and investment.
- **Assumption:** Stakeholders trust that government policies will be adhered to and support their long-term interests.
- **Mitigation:** Foster regular communication and transparent collaboration between government and industry to build and maintain trust.

7. Flexibility for Emerging Challenges

- **Risk:** Overly rigid models may fail to adapt to unforeseen challenges, such as technological disruptions or global economic shifts.
- **Assumption:** The model includes mechanisms to reassess and adapt strategies in response to changing circumstances.
- **Mitigation:** Design the model with flexibility for periodic review and recalibration based on new evidence or developments.

35) How would you monitor and evaluate the industrial strategy, including metrics?

1. Define Clear Aim, Objectives and Outcomes

- Establish overarching goals for the strategy, such as:
 - **Economic growth:** Year-on-year GDP contributions, export value, or growth of high-value sectors.
 - **Environmental impact:** Reduction in greenhouse gas (GHG) emissions or adoption of green technologies.
 - **Social outcomes:** Job creation and regional economic development.
- Conduct a baseline analysis to benchmark the current state and determine realistic, measurable targets for these objectives.

2. Identify Relevant Metrics

- **Economic Metrics:**
 - Value of investments into SMEs, particularly from venture capital and other private investors.
 - Export value and market diversification across high-growth sectors.
 - Year-on-year growth in industrial output, productivity, and sector-specific contributions.
- **Environmental Metrics:**
 - Carbon reductions achieved through industrial activities and adoption of clean technologies.
 - Progress toward decarbonisation targets across key sectors.
- **Social Metrics:**
 - Number of jobs created, particularly in high-value and green sectors.
 - Inclusivity metrics, such as employment diversity in industrial sectors and regional development impact.

3. Establish a Monitoring Framework

- Develop a monitoring framework with timeline key milestones that reflects sector objectives.
- Identify key stages of activities, and break down to
 - immediate (1-5 years) milestones: Initial funding approval, pilot projects, early policy changes
 - intermediate (6-10 years) milestones: Scaled implementation of green technologies, emission reduction, infrastructure upgrades, or workforce training programs
 - long (10+ years) milestones: Tangible sector wide outcomes, such as from research to commercialisation, improved productivity, job and employment, economic contribution, export.
- Monitor key dimensions:

- **Process Efficiency:** Monitor speed of finance application processing (application-to-decision timeframe). Assess the effectiveness of stakeholder engagement.
- **Implementation Progress:** Evaluate achievement of intermediate milestones in line with the program timeline, such as port upgrades, shipyard productivity.
- **Outcome Realisation:** Focus on the long-term impact and outcomes across economic (maritime trade, job creation in coastal regions, increased global market share for UK shipping and logistics), environmental (uptake of alternative fuels, reduction in GHG), and social impacts (expansion of maritime career pathways, improved quality of life in coastal communities).

4. Ensure Independent Oversight

- Engage an independent body, such as the National Audit Office (NAO), MarRI-UK, or Maritime UK, to monitor progress and ensure transparency.
- Regularly publish annual review findings to stakeholders, providing accountability and the opportunity for mid-course adjustments.

5. Adapt and Refine Metrics

- Periodically review metrics to ensure they remain aligned with strategic goals and evolving industry needs.
- Use data-driven insights to refine evaluation methods and address challenges as they arise.

6. Reporting and Evaluation

- Deliver clear, periodic reports measuring progress against defined objectives and metrics.
- Evaluate:
 - Effectiveness: Are the defined objectives being met?
 - Efficiency: Are resources being deployed optimally to achieve goals?
 - Impact: How has the strategy influenced the broader economy, environment, and society?

By aligning monitoring and evaluation methods with clearly defined objectives, milestones, and independent oversight, the industrial strategy can achieve transparency, adaptability, and measurable success.