Smart seas: unveiling AI-powered IoT for sustainable shipping excellence

February 2024

pwc

Overview

Charting a course for change: transforming shipping with smart ship solutions to drive ESG excellence

Did you know…?

75–95%

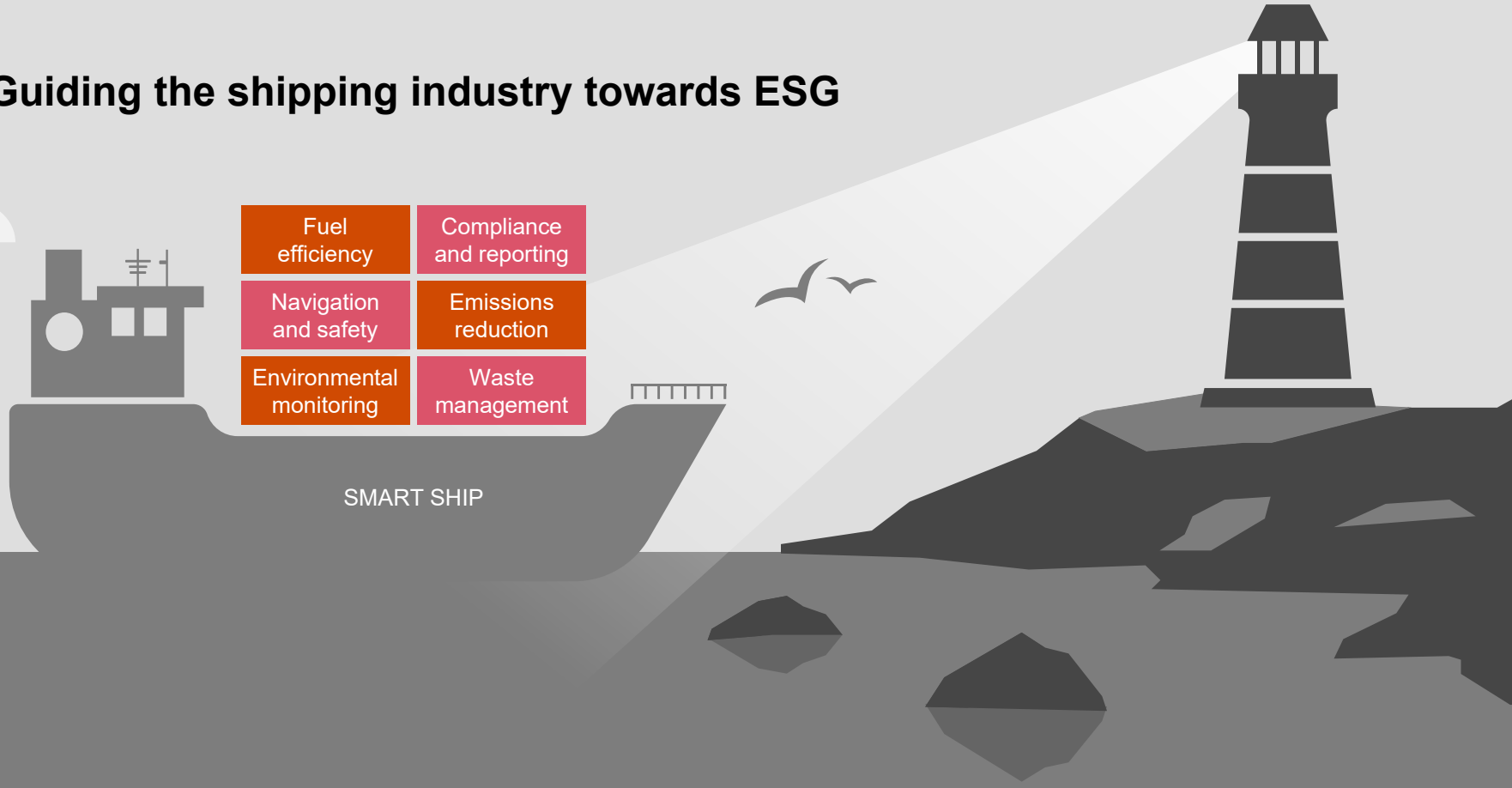
of waterway accidents are caused by human error.

The shipping industry accounts for almost

3% of global greenhouse gas emissions –

1.5 times that of global civil aviation.

Guiding the shipping industry towards ESG



Source: 1

The shipping industry is lagging behind with ESG, making it all the more important that companies act

Shipping companies are being pressured by investors…

When it comes to the environment, the industry needs to…

- mitigate high levels of uncertainty in shipping, as this makes it difficult to follow climate change initiatives and environmental regulations,
- explore opportunities for reducing energy consumption to enhance the industry's environmental performance, and
- take proactive measures to reduce the environmental impact of shipping by shrinking its carbon footprint and promoting sustainable practices.

Regarding social issues, the industry needs to…

- collaborate among industry stakeholders to address challenges and ensure the well-being of workers and stakeholders in the supply chain.

On the issue of governance, the industry needs to…

- establish a comprehensive governance approach to effectively address shipping challenges, and
- collaborate among industry stakeholders to establish clearer governance frameworks, taking geopolitical tensions and global trade dynamics into account.

…to achieve net zero carbon emissions

The shipping industry causes almost **3%** of global greenhouse gas emissions – 1.5 times that of global civil aviation.

75–95% of waterway accidents are caused by human error.

Up to **100%** of vessels could be autonomous in the future.

The International Maritime Organization (IMO) wants to achieve **net zero** GHG emissions in international shipping by 2050.

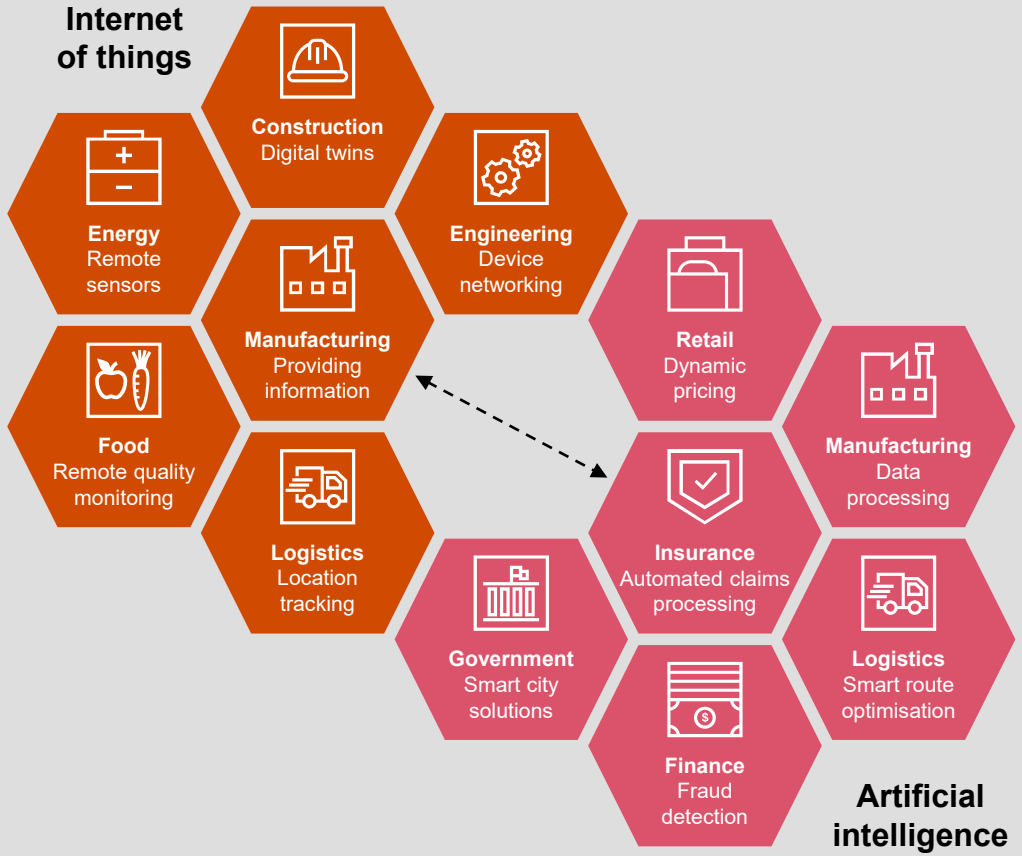
Source: 2 3 4 5

Combining IoT and AI creates ideal synergies, setting the stage for a future-ready shipping industry

The internet of things **(IoT)** is a **network of physical devices** connected by **sensors** and **software** over the internet to **exchange data.** These devices range from ordinary **household items** to sophisticated **industrial machinery**.

Artificial intelligence **(AI)** refers to **computer algorithms** designed to perform tasks such as problem-solving, data analysis or decision-making. This technology enables machines to **replicate human-like abilities.**

Combining both technologies can create many **real-world use cases,** such as **predictive maintenance** for vessels, **smart healthcare systems** for remote workers, optimised **route planning** and navigation, and improved **cargo monitoring** and management.



Source: 6 7

Empowering intelligent decision-making and unlocking insights and value with AIoT

Add value to data and make AIoT operational

- Use AIoT to **apply** advanced **data analysis solutions** that add value to the data generated by IoT devices on land and on board ships.
- Utilise machine learning algorithms and data processing techniques.
- Extract **meaningful insights and patterns** from the vast amount of data collected from the IoT devices deployed in shipping operations.
- Drive informed **decision-making** and make vessel operations more efficient.

Leverage data for enhanced product deployment

- Provide a **valuable source of data** for operations and decision-making.
- Develop data-driven strategies to create additional value in the industry.
- Utilise data in R&D processes **to enhance existing and future maritime products.**
- Use data insights to boost the **reliability, security, and adaptability** of maritime products and services.

Safeguard workers, the environment and data

- Harness the power of maritime data.
- Identify potential **health risks,** take preventive measures and enhance the **well-being** of workers.
- Minimise **environmental impacts** and optimise resource use in shipping.
- Enhance **data security** by detecting anomalies, mitigating risks, and ensuring privacy and integrity of sensitive information.
- Align data-driven strategies with ESG goals and customer needs.

Artificial intelligence of things (AIoT) serves as a formidable toolkit for elevating ESG performance within the shipping industry, with a specific focus on health, sustainability and data security. By unleashing synergies around connected products, advanced data processing capabilities and cutting-edge AI algorithms, companies can unleash the full value of maritime data, boosting reliability and security while driving positive outcomes in line with sustainable practices.

Source:8 9

Smart strategies for revolutionising emissions reduction and fuel efficiency in the shipping industry

Environmental (E)

- Smart asset monitoring to track and manage containers, or to manage fuel consumption to ensure transparency and compliance with emissions restrictions
- Sensors, processing units and mobile transmitters to manage temperatures in refrigerated containers and notify staff of any issues
- Route optimisation systems to track ship positions in real time and share location info automatically with ships in the vicinity or on the same network
- Process a wide range of factors such as weather conditions, ocean data, currents, ballast levels, wave height and engine performance
- Dynamically adjust variables such as speed over ground, fuel flow, shaft torque and shaft RPM

Some companies are using dry containers equipped with electronic devices that transmit near-real-time data on the movement and condition of any cargo in transit. This delivers transparency, safety and cost effectiveness, along with reducing CO_2 emissions – helping companies to achieve environmental goals in the near future

Source: 10 11 12 13 14 15 16 17

Navigating social issues: keeping workers safe and preventing accidents

Social (S)

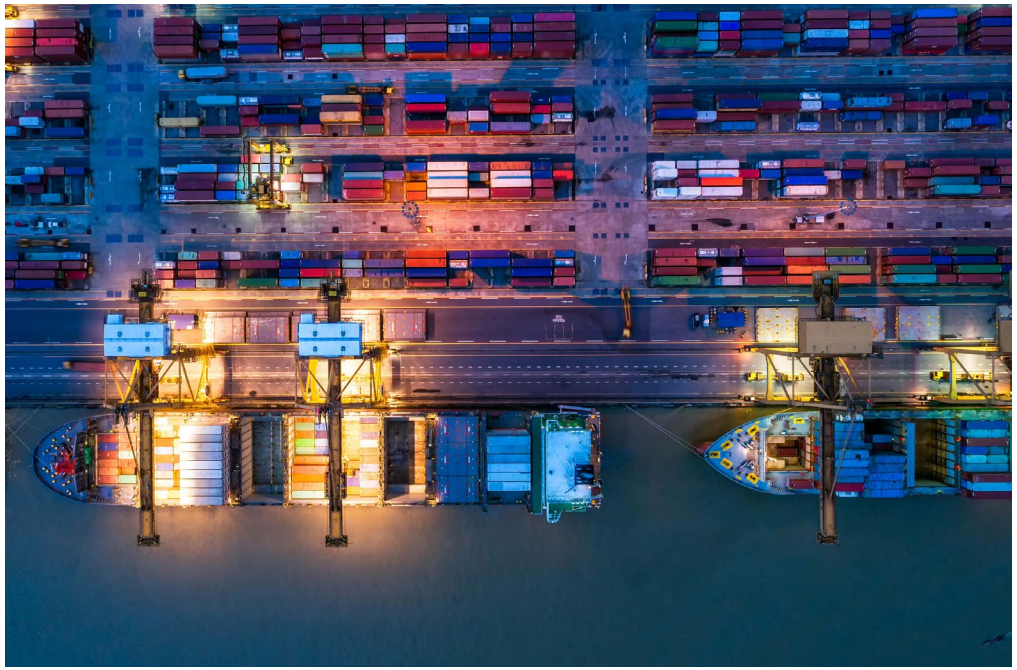
- Manage surroundings with computer vision and keep ships away from shallow waters and potential hazards using advanced navigation systems
- Benefit from wearable devices for staff that are part of a connected worker platform, such as smart watches
- Monitor vital signs, provide alerts for rest management, and identify hazardous work zones in real time
- Facilitate tracking of shipments throughout the value chain by leveraging smart contracts to ensure traceability and accountability
- Replace laborious processes and therefore decrease the risk of fraud and loss

Companies can use cargo screening tools to detect misdeclared and undeclared dangerous goods in containers. This prevents improper loading of dangerous cargo, improves safety and reduces the frequency of container fires. AI allows constant improvement of these tools, enhancing the screening process with validation results and feedback from container inspections and improving safety throughout the dangerous goods shipping process.

Source: 18 19 20

Leveraging AIoT for seamless governance: improving compliance with regulations

Governance (G)



- Comprehensive data collection at terminals and on board ships
- Analyse and manage this data to ensure compliance with regulations and minimise the risk of external disruption
- Provide accurate and real-time insights for decision-makers to use, enable proactive planning and predictive performance improvements
- Automate documentation processes, reduce the chance of human error and ensure compliance with shipping regulations
- Analyse patterns and irregularities in the data to identify potential fraudulent activities and alert the relevant personnel to take immediate action

Companies can utilise real-time digital tools such as container status notifications, APIs and terminal alerts to keep customers informed about the status and location of their shipments. This transparency improves governance and compliance by providing stakeholders with up-to-date information and allowing a prompt response to any issues or delays.

Source: 21 22

“Smart ships” combine solutions to leverage environment, social and governance in one use case

Fuel efficiency

- Optimised vessel performance, reducing fuel consumption and greenhouse gas emissions
- Real-time engine monitoring to prevent breakdowns and optimise fuel usage

Environmental monitoring

- Monitoring of water/air pollution and marine life
- Early detection of oil spills, harmful algal blooms and other ecological threats for immediate response

Emissions reduction

- Intelligent energy management systems to reduce CO_2, NOx and SOx emissions
- Advanced emissions monitoring and reporting mechanisms to ensure compliance with regulations

Navigation and safety

- AI-based navigation for optimised route planning, avoiding sensitive marine areas
- Safety features such as collision avoidance systems to reduce accidents and protect marine ecosystems

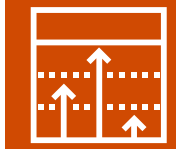
Waste management

- AI-powered sensors and data analytics for effective waste management, reducing pollution
- Smart waste disposal systems to ensure proper handling and recycling of waste materials

Compliance and reporting

- Automated data collection and reporting to comply with environmental standards
- Integration with reporting frameworks, enabling disclosure of environmental performance

AIoT has already proved itself in the shipping industry – in four key areas

Category	Benefits
 **Efficiency**	• Provide crew with real-time feedback and optimise vessel performance. • Minimise unexpected vessel downtime and identify improvements to make (fleet and crew). › AI-powered robots with smart sensors at a port in Tianjin (China) improved efficiency by 20% and optimised loading and unloading, using wind and solar energy.
 **Quality**	• Guarantee higher-quality shipped goods and reduce damage. • Detect and mitigate potential risks and deviations with automated quality control processes. › A consumer goods company improved governance by monitoring supply chain quality for palm oil, which also helped reduce human rights violations, deforestation and greenhouse gas emissions.
 **Revenue**	• Increase customer trust and enable premium services that will pay off in the medium term. • Enable additional revenue generation with new business models and revenue streams. › Among many other use cases, a raw material producer was able to increase sales by up to 10% by leveraging AIoT to predict rainfall and adjust inventory levels as needed.
 **ESG**	• Reduce environmental and social impacts of the shipping industry. • Meet current requirements such as the Supply Chain Act or stakeholder demands. › New York City reduced emissions from lighting by 900 tonnes, while also increasing waste efficiency by 80% and reducing residents' water bills by $73 million.

Source: 23 24 25 26 27 28 29

AIoT isn't always plain sailing: companies need resilience against key risks

Category	Threats and mitigation strategy
 Regulation	• Compliance challenges, privacy concerns, loopholes, conflicting regulations › Set up a regulatory compliance team to monitor and interpret evolving regulations, conduct audits to ensure adherence to industry standards and develop a roadmap for adapting to new regulations and addressing potential conflicts.
 Information	• Data security risks, privacy concerns, algorithmic bias, data quality challenges › Implement data encryption and multi-factor authentication to protect information, audit and assess data security protocols, incorporate bias detection and mitigation techniques into AI algorithms and focus on data quality by carrying out data validation and standardised collection processes.
 Implementation	• Resistance to change, potential job displacement, need for proper training and upskilling › Develop a change management plan that includes stakeholder engagement, communication and training programmes, highlight the benefits of AIoT adoption (emphasising how it complements human roles rather than replacing them) and provide workforce training and upskilling opportunities.
 Technology	• Technological issues, cyber threats, system failures, dependence on infrastructure › Regularly assess and update infrastructure to identify and address vulnerabilities, implement security measures such as intrusion detection systems, firewalls and real-time monitoring, and create a contingency plan to mitigate any system failures.

Source: 30 31 32 33 34 35 36 37 38

AIoT is the key lever to achieve ESG goals in the shipping industry

Key takeaways

Relevance of ESG

- ESG is an important megatrend, leading to integration of sustainability, social and governance factors into IT.
- Tech-based ESG strategies are becoming crucial as stakeholders demand transparency and accountability from the shipping industry.

AIoT: the ideal toolkit

- AI is the brain of a smart system.
- Connectivity and data exchange enables AIoT to understand, observe and decide.
- Ability to process and analyse human-centred, machine-generated data empowers companies to extract value from IoT-generated data and enhance decision-making processes.

Applying AIoT

- Smart ships can increase sustainability by improving energy efficiency and reducing emissions.
- Safety management systems improve crew well-being, mitigate risks, and promote compliance with safety regulations.
- Better compliance with regulations optimises governance practices.

Collaboration among stakeholders is necessary to fully harness the potential of AIoT and drive change, allowing the shipping industry to contribute to a greener future, safer operations and improved governance practices. With the right implementation strategy, AIoT can serve as the ideal tool for the shipping industry to enhance ESG and prepare for the future.

Sustainable shipping with AIoT and PwC's expertise

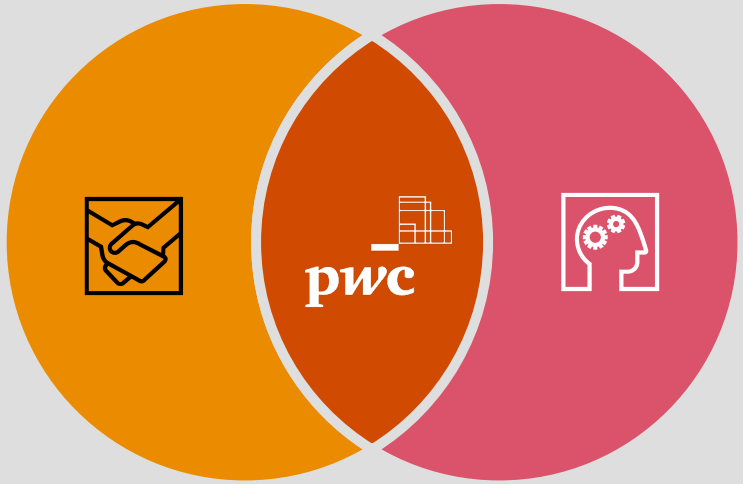
Strong strategic partnerships…

…combined with…

…PwC expertise

Tech expertise for seamless implementation

We will assist you in implementing AIoT solutions seamlessly within your existing systems. Our strategic partners ensure a smooth integration process, optimising your tech infrastructure.



An alliance of industry, ESG, legal and tech experts

Ongoing support for ESG excellence

We will identify use cases to drive up your ESG performance, ensuring alignment with your objectives. Our work doesn't end after implementation: we remain committed to supporting your strategic initiatives in the long term.

Navigating your pathway to better ESG in the shipping industry

1

Contact our experts to delve deeper into your specific operational needs and design an AIoT strategy aligned with your ESG goals.

2

We'll work with you to develop a focused proof of concept that demonstrates tangible efficiency gains.

3

Assess the potential ROI, ESG impact and competitive advantage that the proposed AIoT solutions could bring to your company.

4

Engage with key stakeholders, address concerns and showcase the potential of AIoT for enhancing your ESG profile.

5

We'll work with you to outline a phased approach for integrating AIoT into your operations, ensuring seamless deployment and measurable ESG enhancements.

BXT: a philosophy for the future

Combining diverse perspectives from **business, experience** and **technology** forms the core of our **BXT philosophy.**
We want to popularise a human-centric, tech-powered approach across consulting.

B

Business view

We'll help you to look beyond the challenges in your organisation of today to harness the market opportunities of tomorrow. We'll support you in creating the value that defines businesses and changes your industry.

X

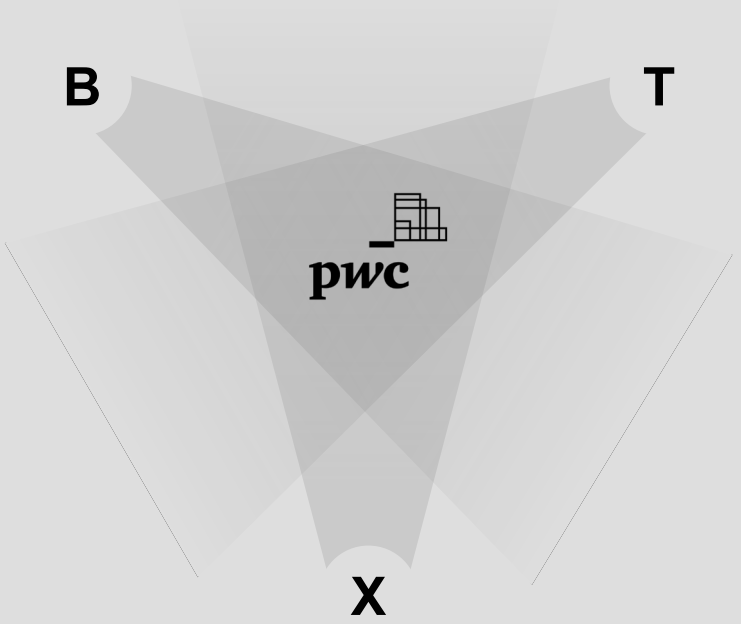
Experience view

We provide the X factor – a vision for the future that is both innovative and customer focused. We'll help you to design a customer experience that builds loyalty and gives you a competitive edge, as well as delivering the creative skills required to draw up a roadmap to the future.

T

Technology view

We must live by the principle of "Think it. Build it. Ship it. Repeat."
We have the insights to know the difference between what's trendy and what's trustworthy, giving our clients the ability to consistently flex and grow.

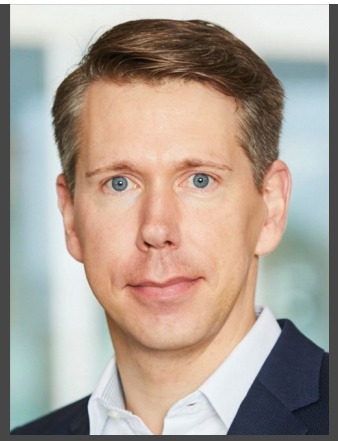


By viewing all problems from a variety of perspectives, we can identify solutions that may not be obvious when viewed through only one lens.

Your contacts from our Digital Innovation and Platform Business Practice

Martin Röser
Director

Practice Sponsor
martin.roeser@pwc.com



Arne Linnemüller
Senior Manager

Practice Co-Lead
arne.linnemueller@pwc.com