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Gyroscope: Exploring futures of marine logistics

Science Shaping Tomorrow: Research at the Core of the Green and Digital Transition (RRF2025 Closing Event)

9 December 2025

Toni Ahlqvist & Gyroscope consortium

Gyroscope project

- GYROSCOPE project investigated **opportunities provided by and risks associated with smart digital solutions** in the context of green transition of the marine sector
- Project applied **stakeholder-participatory processes** and modern risk analytics
- Project produced **a systemic picture of sustainable transition to green and sustainable marine logistics** in Finland, and **potential policy pathways** to achieve it
- **Partners:** University of Turku, Kotka Maritime Research Association, Aalto University, University of Helsinki
- https://sites.utu.fi/gyroscope/

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Gyroscope tackled these challenges

- **Digitalisation**
  - Impacts of novel digital solutions in the marine logistics
- **New systemic risks**
  - Parallel changes may increase the risk of both technical issues and human misperformance
- **Possibilities of systemic interactions**
  - Collaborative identification of risks, building adaptivity and resilience
- **Digital solutions from the systems perspective**
  - Systemic impacts, efficiency and costs

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Two examples of results

Marine system transformation

- Given the growth of emissions from marine logistics, we need **a rapid transition to green fuels with technological & regulatory solutions**
- These solutions may succeed only partially; however, we cannot afford to wait, as **delaying action increases the likelihood of crossing socio-ecological tipping points**
- We propose **a solution to this dilemma of excessive caution;** initiate the implementation of broad technological and regulatory changes despite the associated risks, closely monitor outcomes, and adjust course as necessary

Analysis of operational alternatives for autonomous marine technologies for winter ship navigation

- Development of **a framework to identify the critical risk influencing factors (RIFs)** for winter navigation
- **A model for identifying high-risk situations** by evaluating how different RIFs interact
- **A risk analysis model** to evaluate how the formulation of different levels of autonomous operations can be adopted
- Frameworks and models **help evaluating alternatives when autonomous technologies** can be utilised, e.g., in supporting icebreaker assistance operations
- **Human presence** is still required in transitional phases of autonomy and during emergencies, making safety a priority under hazardous winter conditions

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