IMPROVING THE COMFORT OF CREW AND PASSENGERS ON BOARD WORKING VESSELS

PhD student: Elma Ramić **Principal supervisor:** Marie Lützen **Duration:** 15-03-24 to 14-03-27

BACKGROUND

In the efforts to meet international goals for reducing greenhouse gas emissions while balancing the rising energy demands, the number of installed offshore wind turbines has increased extensively over the past decades and is expected to continue increasing [1]. As the count of wind farms rises, so does the demand for technicians and working vessels to handle the needed maintenance activities. Maintenance strategies for wind farms are based on complex variable optimization, accounting for factors such as vessel availability and maintenance equipment, with the aim of maximizing energy production while minimizing maintenance costs [2]. Despite the developed strategies, the weather and sea state ultimately have the final say due to operational constraints associated with extreme environmental conditions [2]. This means that the decision to sail or not-sail is based either on fixed parameters associated with environmental conditions or on rules-of-thumb [2]. These decision constraints aim to ensure the safety of operations, both during transit and maintenance of turbines [2]. However, amongst these considerations, one critical and equally important factor remains overlooked: the risk of motion sickness experienced by crew and technicians on board working vessels [3]. In addition to discomfort, seasickness can affect both cognitive and physical performance, potentially leading to hazardous events for the technicians during operations. Currently, no models are available to predict seasickness for this specific purpose as existing work primarily focuses on the operational criterion Motion Sickness Incidence (MSI) as a quantitative measure of sickness [2]. The MSI index corresponds to the percentage of subjects (here crew and passengers) who will vomit after being exposed to two hours of motion with specific vertical accelerations [4]. Furthermore, existing research on the topic is based on larger boats, such as ferries and warships, whose structural and dynamic behavior are strongly dissimilar to those of working vessels [2].

Figure 1: CTV "MHO Grimsby" [5].

OBJECTIVES

The project aims to develop a machine learning tool capable of estimating and predicting the probability of seasickness based on given weather forecasts and sea conditions. The tool will serve as a part of the sail or not-sail decision support system. By accounting for the probability of seasickness, the decision-making process will be more considerate compared to fixed parameters and rules-of-thumb practices currently used to assess operational limits of working vessels. In addition to supporting the sail-or-not decision-making, the tool will propose alternative sailing, with a focus on minimizing the risk of seasickness. To ensure that the suggested solutions do not impose an environmental burden, energy efficiency analyses will be conducted.

REFERENCES

[1] Díaz, H. and C, *Review of the current status, technology and future trends of offshore wind farms*. Ocean Engineering, 2020. **209**: p. 107381.

[2] Earle, F., et al., *SPOWTT: Improving the safety and productivity of offshore wind technician transit*. Wind Energy, 2022. **25**(1): p. 34-51.

[3] Uzuegbunam, T.D., R. Forster, and T. Williams, *Assessing the Welfare of Technicians during Transits to Offshore Wind Farms*. Vibration, 2023. **6**(2): p. 434.

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[5] MHO-Co. 2020.

METHODOLOGY

The development of the tool requires multi-factorial analyses where technical factors are combined with human and psychological factors. Thus, the basis of the tool heavily relies on interdisciplinary collaboration across multiple scientific fields. An overview of the comprehensive information needed to build and test the tool is provided in *Figure 2*.

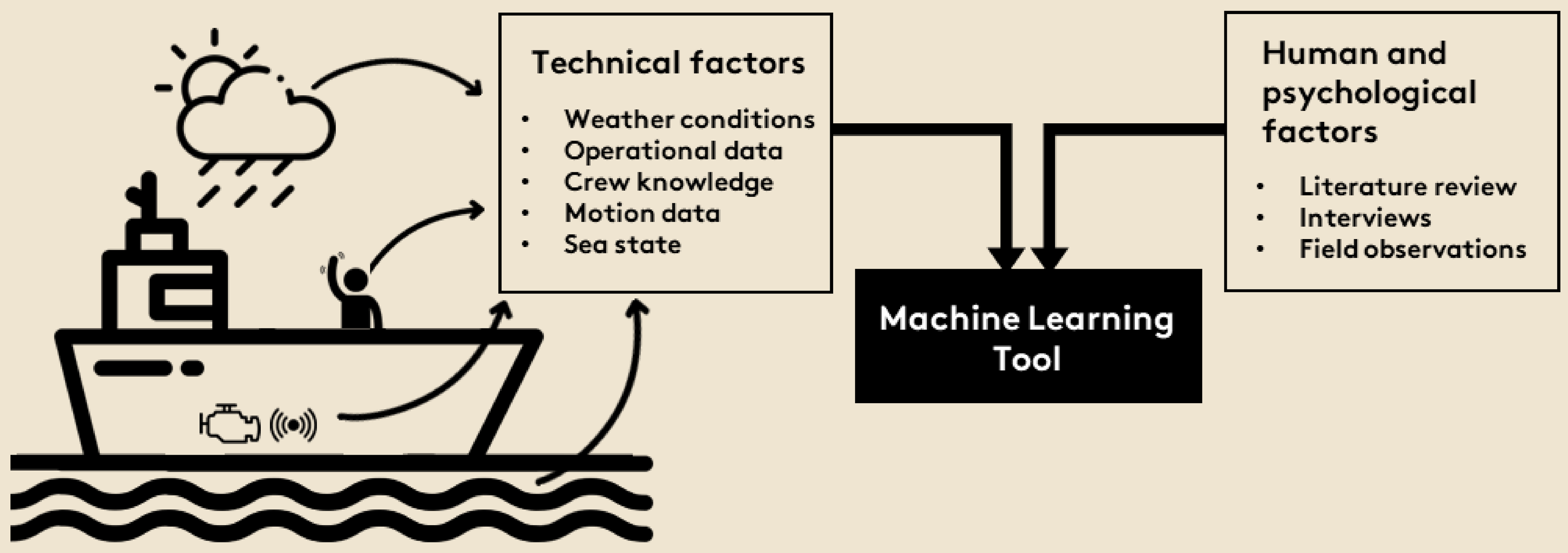

Figure 2: Overview of data required to build the desired tool.

While some technical factors are collected through direct data logging on board a working vessel, others are extracted directly from sensor systems of the considered vessel. Knowledge regarding the human aspect is obtained through literature review, interviews, and field observations. The latter aspect is the scope of a separate project and will thus be managed by researchers from the Faculty of Health Sciences.

As stated in *Background*, there is currently no decision-making tool that incorporates all the factors illustrated and listed in *Figure 2*. The crossover of the two primary scientific fields is categorized as a Technology-Human Decision Support System. To further visualize the framework, the crossover is depicted in *Figure 3*.

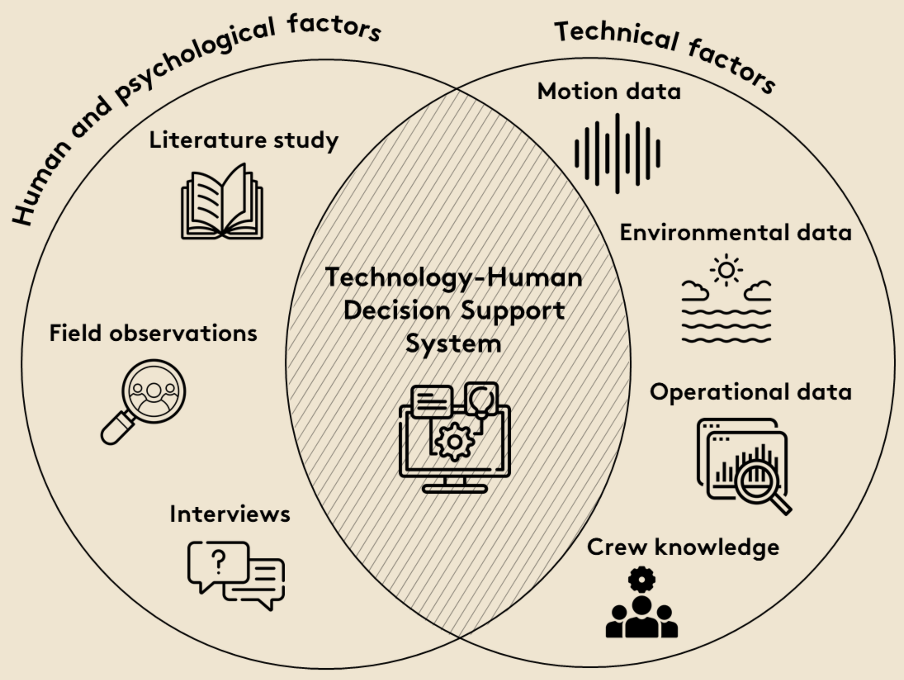

Figure 3: Diagram illustrating the overlap between the human and psychological findings with the technical factors.

COLLABORATION

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FORCE TECHNOLOGY

FUNDING

Shipping Lab – Driving Future Maritime Technology

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