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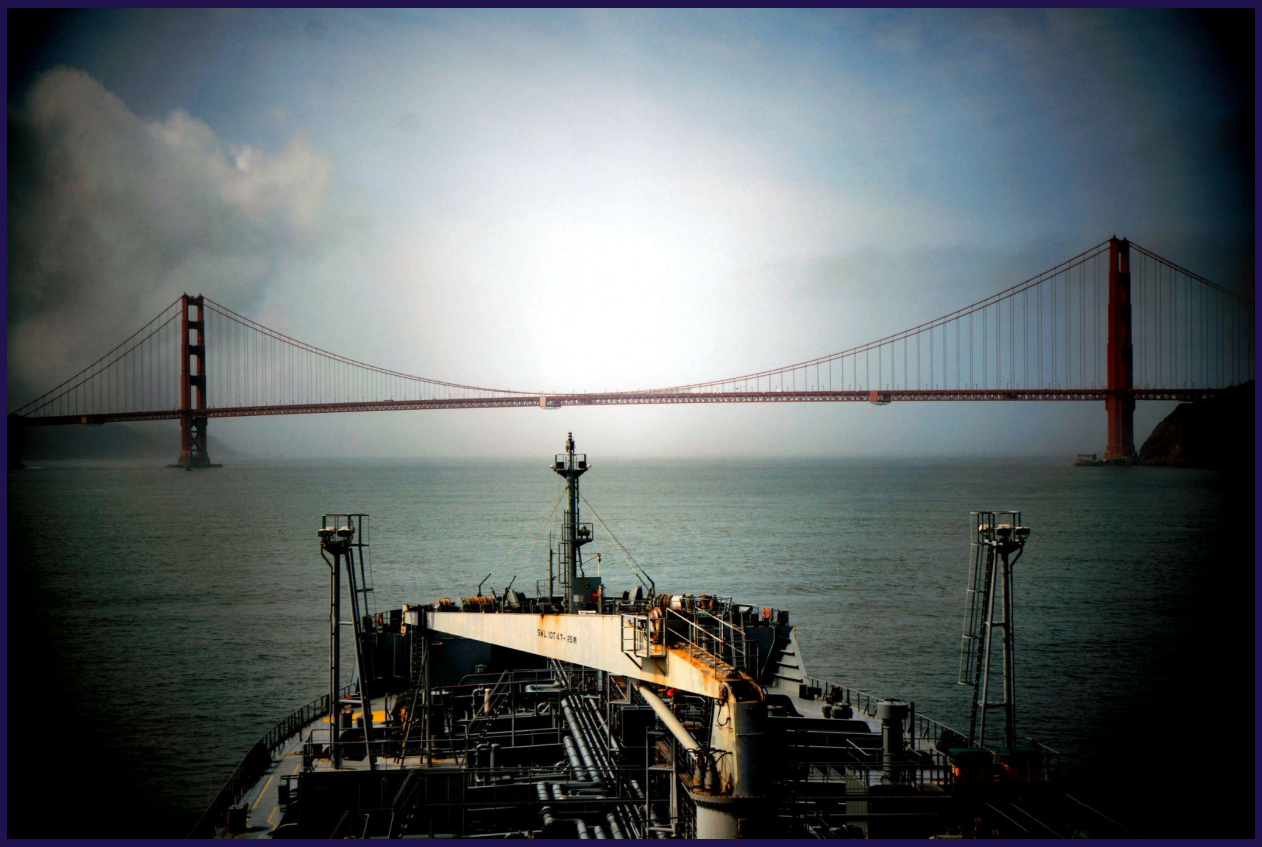
A Democratic Intervention in Blue Denmark



A call for neutral transdisciplinary facilitation and bridge-building across disciplines to enhance the possibility of a future capable of sustaining human lives.

Abstract

As the maritime industry encounters technical experts emerging en masse and governmental agencies mandating rapid transformation to be eligible to satisfy the criteria of the climate crisis, there will be a necessity for multidisciplinary awareness among all actors involved. As it can appear society looks to technological advancements to be the savior of our continued existence, the responsibility given to technology seems utopian and the purpose of technology seems forgotten. Although the term technology can seem ubiquitous it is defined as the use of tools to assist people to conduct tasks more efficiently. If technology is replacing any human practice then comprehending that practice must be as important as the artifact itself. Critical Theory of Technology suggests that technology can both *emancipate* as well as *oppress* people, it depends on how it is deployed and for what purpose. By broadening the understanding of technology to a system of human practices a holistic conception of how technology works in the real world can be achieved, thus enabling technical experts to construct more adaptable technology that can help us ensure a sustainable world for the future.

This paper will explore the sites that constitute the multi-situated system of developing technology in Blue Denmark and investigate why incorporating the practices of users are absent. This will be executed through an anthropology-driven approach i.e. collecting data from sites and actors through ethnographic work. More precisely, the goal is to document the author's experiences of being immersed amongst the actors of the system. Lastly, the project will formulate and suggest an alternative system structure to facilitate multidisciplinary collaboration.

Keywords: Ethnography, Transdisciplinarity, Critical Theory of Technology.

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1.0 - Preface

It is widely recognized that maritime transport contributes to most of the world's goods being shipped, up to 80% (OECD 2019). However, the shipping industry is also held accountable for 3% of the world's human-generated emissions. Additionally, goods are transported in conditions that sometimes result in catastrophes (AGCS 2017). Emissions from ship operations are projected to increase thus darkening the potential for the world's future to sustain human lives. Consequently, we need zero-emission shipping to be realized by 2030 (MI 2022). This could be considered ambitious given shipping's current constellation. The maritime industry is multinational, affected by heavy competition, and governed by international, supra-national, national, regional, and local legislators. Legislators with high demands for safety and security. Demands that arguably make change more difficult than peer businesses. Still, many have set out to achieve the proposed solution of grand technologification. According to Danish key maritime actors, by claiming quality assurance from being *made in Denmark*, political backing, and "quantum leaps" within technological development, the future looks brighter (Braat 2022). However, the legacy of being one of the world's most tradition-rich and conservative industries is still in these world-altering times hanging as a stationary cloud over the world of shipping. A cloud that obstructs the clear view of what must change for the greater good. Legacy struck as it is regardless, climate change finds shipping in a somewhat forced transition, noticing the pressure mounting as the industry is faced with politicians, customers, and the public calling for radical action to be taken immediately. Recently worsened by an unprovoked attack on Ukraine sparking an actual energy war in Europe the green transition becomes even more urgent and the debate more heated with the majority looking to technology as the solution.

2.0 - Introductory Pages

This project has been written by a Master Mariner, a navigator in the Danish merchant fleet intending to understand the *total nexus* of technology. I have gone ashore to try to understand the perspectives and challenges of the *other side*, that of the land-based actors. The incentive for undertaking such a quest stems from the notion that the very idea of technological advancement has been lost. Lost by technical experts and other actors involved capable of achieving such advancement. I have by studying Techno-Anthropology (TAN) extended my vision and interdisciplinary understanding to levels previously thought nonexistent. This master thesis will put the findings from this quest on display.

Through extensive submersion into the multidisciplinary socio-technical maritime constellation, addressed as Blue Denmark. I have come to understand the processes of developing technology, what actors are included, and what influences them. Although the different disciplines in Blue Denmark have a considerable diversity of expertise and interests, they can appear united. On a micro-level, most actors are enrolled in a well-connected network and can deal with problems on a person-to-person basis. However, collaboration on a macro-level has proven to be quite difficult. There is a lack of mutual understanding, expectation alignment, and consensus on methodology among organizations. Important keystones for actors in a multidisciplinary setting who wish to collaborate on unraveling the complex problems of today (Renn 2021). On a meta-level, actors appear to agree that technology is the way forward. It seems as if technology has been put on a pedestal as a core element for the success of the green transition. But consensus on what technology is and its purpose seem weak. This project will try to demonstrate that technology in its umbrella term, cannot stand alone as a solution for a *wicked* problem such as the climate crisis but requires consideration of social practices as well (Børsen 2020).

Beginning this research a little under a year ago to investigate to what level seafarers are included in the decision-making stages of developing and implementing technology. I have come to learn about specific land-based actors' level of *agency* in Blue Denmark. More precisely how shipping companies and project managers operate. This will be referred to as the pre-project era. The research found that seafarers rarely felt included (Kristensen 2022). Extending said research I will dive in further to investigate what lies beyond. To comprehend the *system* of processes that constitute technological development in Blue Denmark and why the user is excluded. During my research, I have by following relevant actors in Blue Denmark mapped this system. Processes of the system were observed as pursues; a directional change in society, something needs to be committed regarding the climate crisis. This change, in turn, influences Blue Denmark to dream of greenifying shipping operations. It is thus decided that funds should be used to develop *green* technology. Funds are now to be distributed to those who claim to have a solution (arguably where prospects of user involvement initially should be contemplated). Project facilitators or managers can now operate to secure funds for their projects. Once funds are secured project execution can commence (arguably where actual user involvement should take place). The system ends in a potential implementation with the following *nursing* phase pursued. The system can thus be divided into two parts, pre, and post-execution. The scope of this project is to unfold the first part post-execution. Whereas part two was the focus of my pre-project, as illustrated in figure 1.

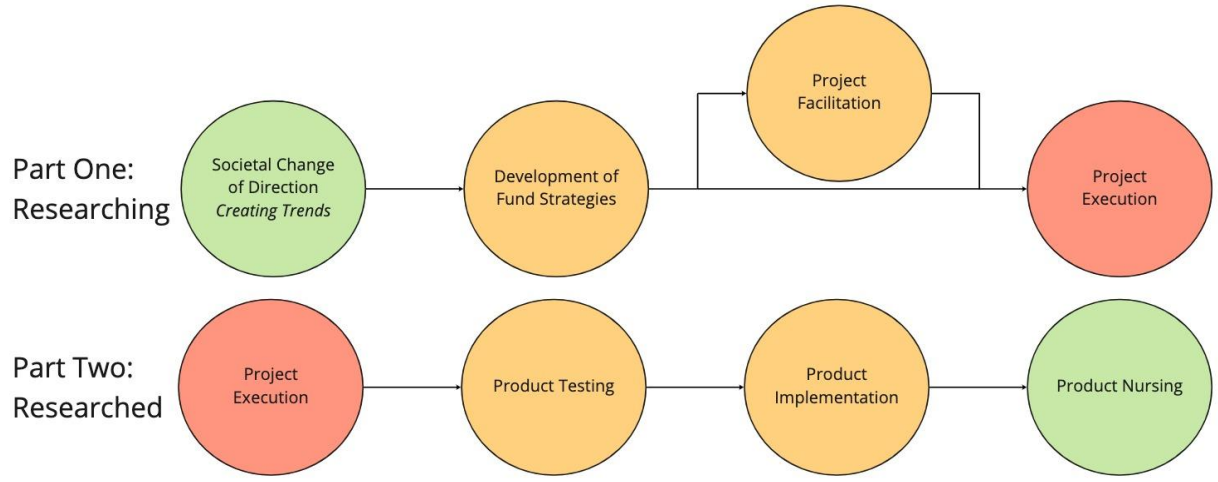


Figure 1 - a synthesis of the system and its processes of developing technology in Blue Denmark, inspired by Mariana Mazzucato. Divided into two parts; part one, the focus of this project, and part two, the focus of my pre-project.

This alleged system indicates that attention to user involvement appears late, after initial implementation attempts. As the complexity of the real world unfolds it becomes clear that user practices are *not* confined to a restricted set of scenarios. Thereby indicating that user-technology collaboration is dealt with *reactively* instead of *proactively* i.e. recognizing problems that could have been identified at much earlier stages. Indeed, value is not necessarily only created if the technology prospers. However, suppose failure purely occurs due to a deficiency to appreciate the actual problem. Then failure seems more potent as a *failure* i.e. if nothing was learned from failure it is arguably a complete waste of time, money, and resources. It appears profitable to search for a systemic approach to ensure the appropriate actors' involvement and that funding is funneled in the right direction and reaches its destination more or less uncut, not financing a pointless bureaucratic system along its journey.

It can appear as if technology has been established as a superpower in society as the only solution to the climate crisis. This likely contributes to the belief that liberation through technology is succumbing to a total technocracy where solutions *must* be based on technical expertise. It seems forgotten to consider alternatives to technology e.g. societal and administrative alterations such as optimization, compromise, and removing unnecessary spending. Therefore, the discourse of technological advancement contains a social dilemma and context (Johnson and Andersson 2016; Viktorelius, Varvne, and von Knorring 2022). Nevertheless, while everyone sets their eyes on the development of technology, in a *changing technology landscape* (Man, Lundh, and MacKinnon 2019) not much attention is devoted to the user's practice that technology is thought to effectivize.

I believe that technology *will* improve human existence. Alas, looking to technology to be the savior of our continued existence in this manner, the true definition of technology and its purpose seems forgotten. Although the term technology can come off ubiquitous it is defined as; "the use of tools and machines to help people conduct tasks more efficiently and with less effort" (Cambridge University Press 2021). Even more to the point, technology can be seen as an extension of oneself i.e. a hammer is a better and more efficient fist (Ihde 2010). So, if technology is replacing any current human practice or

extending human elements then understanding that practice is paramount for the development of such technology (Sunderland and Denny 2007). More precisely comprehending the practice must be as important as the artifact itself. The word artifact is used as a term that encompasses the technology itself in its material manifestation (Børsen and Botin 2013). The artifact has become the center of the discussion with the practices receding, see figure 2.

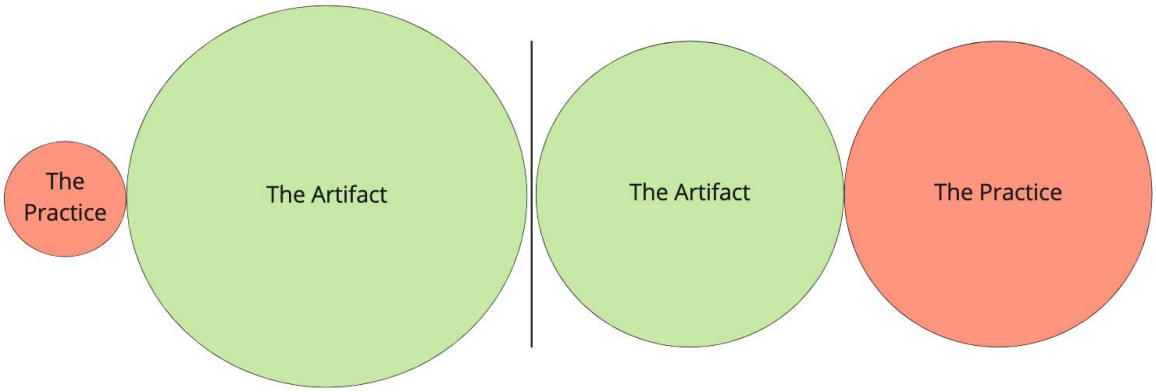


Figure 2 - an illustration of the observed current spread of interest in the Artifact vs the Practices (left) and the desired spread (right). As the current model arguably has a low rate of success for technology, it could be desirable to search for an alternative. A model where the focus of the practice equals that of the artifact.

To bring practices back into focus and underline the importance of multidisciplinary understanding in a more complex and specialized world. This project will draw on theories and philosophies of Science and Technology Studies (STS). These theories will illuminate the significance of practitioners' inputs in the discourse on how to *innovate* our way out of this crisis. And further, call to broaden the definition and the perception of what constitutes technology to a nexus of artifacts *and* human practices. Critical authors in STS suggest that if we neglect the fact that technology is supposed to *help and emancipate* people it can be seen as a controlling force by projected users. This inevitably creates animosity towards technology thus harming progress towards a sustainable future. Such an inclusive definition of technology could offer us the chance to consider how technology is utilized in the *real world* and to discover how to design more democratic and adaptable technology, ultimately increasing the chances of our future generations' survival.

3.0 - Problem Field

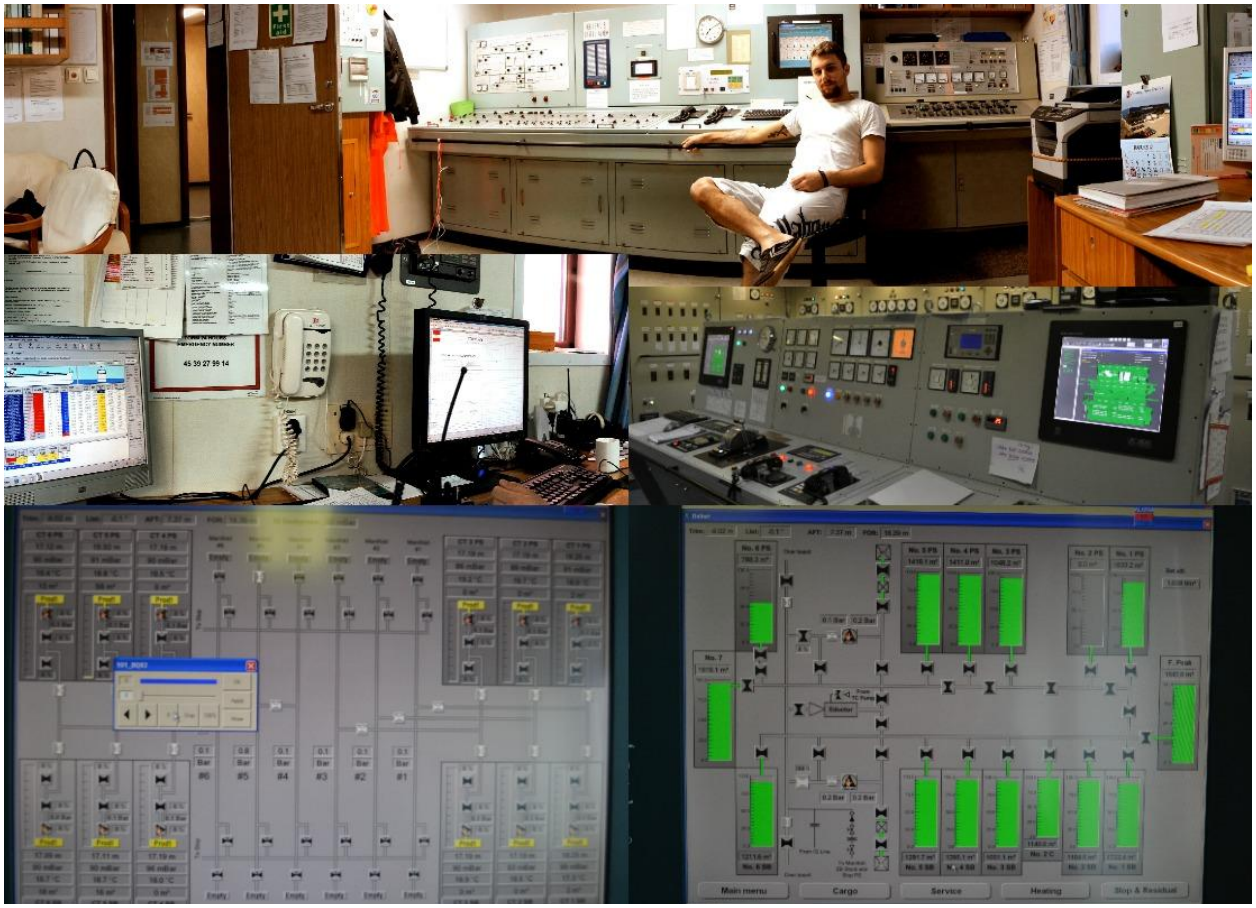
The research has primarily taken place in Blue Denmark. Blue Denmark refers to maritime businesses and industries, maritime researchers and educators, legislators, etc. which nearly occupy a hundred thousand people. Denmark has a great and long history as a seafaring nation going back to the time of the Vikings. Today Denmark ranks as the world's 6th largest commercial fleet, according to operating tonnage (Steffensen and Torstensen 2021; DMA 2022). However, Blue Denmark is merely a piece of the world of shipping thus not limiting research.

The Danish government has released a report on how to ensure that Denmark maintains its international status as a global hub for maritime expertise running until 2025. The topic of digitalization has long been a part of the agenda of Blue Denmark's strategy for international success (Gyldensten 2017). As the implications of climate change have become evident Blue Denmark has further mobilized to reduce emissions. Danish Shipping a key actor, as the voice of Danish shipping companies, affirmed the coming drastic changes;

> "The shipping companies face new challenges led by ambitious climate goals, environmental regulation, increased digitalization, and new business models. With large parts of possible solutions for the future being unknown. Innovation is, therefore, higher on the shipping companies' agenda than ever before. Development, new research, and innovation projects are, among other things, crucial for Danish shipping companies to achieve the climate goals and remain competitive in an increasingly digital world" (Vesterlykke 2019)

However, there is still somewhat consequential confusion as to what these innovative solutions consist of and what is implied by certain buzzwords (Møhl, Krause-Jensen, and Skårup 2022, 5).

Conveyed agendas must be mutually understood (Renn 2021). Therefore, I must specify the type of technology this endeavor focuses on. The technology addressed in the system cf. 2.0 and the focus of this research is characterized as *exploitative interactional* automated digital systems. An interactional system imposes heavy interaction between system and user, where the user operates or supervises the system as a final decision-maker. Exploitative technology is a somewhat known and graspable technology that can be applied soon. As opposed to explorative technology, a *farfetched* futuristic technology that only exists on a conceptual level. This hopefully leaves out much-anticipated criticism the research was to receive in the absence of such a clarification.



Picture 1 - examples of such systems; in the top, the Cargo Control Room[1] (CCR), right-side in the middle, Engine Control Room[2] (ECR), and screenshots of their various systems.

Such systems are found throughout a vessel, see picture 1. A textbook example of such a system is the digital navigation chart called an ECDIS. The navigator often must interact with the system to gain an overview of the vessel's situation. Such as depth, navigational marks, route, traffic, safety information, and much more. The navigator uses the trackball and keyboard to enter and read the information on the display, see picture 2.

[1] The CCR is where cargo operation is supervised. Depending on what type of vessel, the CCR can vary greatly in purpose and equipment.

[2] The ECR is where the main engine and auxiliary engines are monitored.

Picture 2 - an example of a system on the bridge[3]. In the bottom middle, the ECDIS can be seen with its trackball and keyboard and the RADAR to the left. Around them are screenshots, top-left navigation monitoring, and right-side route planning.

Still to this day, the ECDIS, despite its more than 20 years in the market, raises questions about the lack of user involvement in the development of the system. The development failed to employ knowledge of practices as it gave more attention to standardized technical features in place of the adaptability required for accommodating the navigator's dynamic practice. It also lacked the proactiveness required to rectify residual processes that emerge when automating manual work (Grech and Lemon 2015, 3; ECDIS Survey 2021). Residual processes are one of the *ironies of automation*. The designer often imagines life will become easier once the operator is removed and a process has been automated. However, the truth is that the more automation the more complex a system becomes. Thus requiring the operator to be more specialized (Bainbridge 1983, 775). The ECDIS revolutionized navigation by transforming the practices around traditional analog navigation although many residual processes persist today (ECDIS Survey 2021). How automation changes practices are critical to consider along with ensuring the right competencies of system operators (Bainbridge 1983, 777).

In an STS context, it is fundamental to recollect and appreciate why we *do* technology. It is to do better, to be better. If technology does not make us better it has failed and should not be. For technology to

[3] The Ship's bridge is the vessel's command central so to speak, it is where the navigator oversees the vessel's situation and sends commands to the machinery.

make us better there must be an artifact and a practice, a nexus of the two creates technology. It can never be one isolated. In shipping, *shelved technology* is not uncommon. It is an artifact stripped of its practice. Asking the crew about a shelved technology the answer will be, “we have it, but we cannot use it” or “yes we have it, but we do not know what it is for” (Krause-Jensen, Hansen, and Skårup 2020, 50; Kristensen 2022). This happens when an artifact is pushed to the vessel without social context, inclusion, information, or instructions. When land-based actors deplete time and resources on developing technology to effectivize ship operations only to find it on a *shelf* collecting dust at sea, nobody wins.

3.1 - Research Questions

Based on this brief presentation on the constellation of Blue Denmark, the discourse surrounding technology, and the specified type of technology this project aims to address, the following questions are posted;

- Why does the system of developing exploitative interactional automated digital technology fail to encompass the perspective of the users, the seafarers?
    - What processes constitute the system?
    - Is the system democratic?
    - How do different actors in Blue Denmark comprehend the system?
    - What influences these processes?
- How can the system come to include seafarers?

4.0 - Methodological Setup

> “If a man sets out on an expedition, determined to prove certain hypotheses, if he is incapable of changing his views constantly and casting them off ungrudgingly under the pressure of evidence, needless to say, his work will be worthless” (Malinowski 1922, 26)

Can a research design be 100% objective and written without any bias or assumption as to what the researcher intends to find? As for me being a navigator studying TAN for the very reason this research takes place, it is hardly likely. During my time at sea, I tried multiple times to improve established practices of implementation. Attempts that have given me and colleagues hilarious or rather sad stories. Stories that demonstrate the divide between land-based actors and seafarers. Because of my affiliation with the sea, I find it difficult to produce unbiased research. However, I recognize the significance of an objective hypothesis to bring validity to research. Being conscious of these biases I, therefore, took critical steps to structure my research to avoid attenuating its findings (Turabian 2007).

4.1 - Storyboarding

As my projects gradually became greater in size I have learned to structure the approach from the beginning. This is an important effort in keeping committed toward an outcome. I wanted an organized way of gaining an overview of the planned substance. To do this I created a storyboard where I assigned the planned themes in the desired narration of the project. Gaining such an overview would allow me to get a wide viewpoint on my subject matter. Thus providing a favorable perspective of facts that could alter the course of the project, as written by Turabian; “a working hypothesis is a risk only if it blinds you to a better one or if you cannot give it up when the evidence says you should” (Turabian 2007, 20). Therefore, the storyboard is an important element to help get rid of preconfigured desires. I started to scribble down headlines of themes with small descriptions. These were easily moved around to rearrange the narrative (Turabian 2007, 20–21). To accommodate this method I set up a Trello board and created two lists one called themes and one called questions, see figure 3. Investigating the themes should resolve my questions which in turn would unravel the research questions cf. 3.1. I was now free to edit, add, and delete as I pleased. Likewise, adding or changing what type of data was supposed to be used for each theme. This helps plan future tasks and to comprehend the lengths of the different themes and the project in total. Lastly, the overview also enables an experienced individual within a certain field to remain critical of a hypothesis (Turabian 2007, 21).

Research Cause

Lack of understanding of user practices leads to failed technology. This is a problem because, more than ever we need efficient solution to combat the climate change.

Research Objective

Zooming out from the developer/seafarer setting to understand the entire system of developing technological solutions

Specifically applicable solutions with extensive socio-technical interaction

Themes

The Green Transition

Human-Computer Interaction

Barriers to Technology

Co-Production

Aligning Expectations

Transdisciplinarity

Undemocratic Technology

The Life at Sea

Project Facilitators

Funding & Economic

The World of Shipping

Science & Technology Studies

Questions

Does trends affect the system?

What can be done against the Shipping Divide?

How can multiple disciplines collaborate?

How does land-based actors view seafarers?

What influences the different actors and what is their agenda?

How does the funding system work and does have an impact on development?

How can the world of Shipping be understood?

What is technology and why should we *do* technology?

Figure 3 - an overview of the final themes and initial questions.

4.2 - Literature

Setting off with the above-stated themes I needed to understand them better, again as Turabian writes; “often, we know we must do something to solve a practical problem, but before we can know what that is, we must research to understand the problem better” (Turabian 2007, 25). Therefore, a structured literature search was completed. See Appendix 1 - Literature Search, for the Five W’s strategy. Literature from the pre-project will also be reinterpreted. Through an examination of the literature, I have identified several studies that offer relevant insights into the interaction between humans and technology in maritime socio-technical settings. See Appendix 2 - Domain-Specific Literature, for an overview of the domain-specific literature.

4.3 - Ethnography

Scaffolding a thorough design to resolve the research questions stated is important for validity. As TAN is concerned with inducing change to flawed socio-technical configurations the perspectives of all actors should be included. To appreciate the microcosmos of the different instances that constitute the system behind technological development the chosen method needs to be able to handle the actors' variety. Variety in location, individuals, and organizations, as well as their influences. The data should provide a rationale for an analysis chapter where the system and the surrounding factors are described. The

findings of the analysis should then be summarized and juxtaposed to the pre-project findings resulting in a complete view of the system.

TAN intends to develop interdisciplinary masterminds to undertake a mediating role in a multidisciplinary world where technology too is regarded as an actor. Hence ethnographic work at the sites of these actors is the method of choice. It is a core concept of TAN to try and decipher why and how humans do what they do with technology. Technology will eventually be employed by people. People with lives that are not limited to single topics such as growth, economy, and politics, but constructed of a mesh of all combined, as stated by Sunderland and Denny; “if we accept the notion that technology refers to the use of artifacts in practice then it becomes clear that understanding human practice is an integral part to developing technology” (Sunderland and Denny 2007, 5). Observing, visually and audibly, the actors in a socio-technical configuration is a valuable way to attain perceptions of contexts and constructions (T. H. Eriksen 2010). Learning about a discipline by acquiring basic knowledge and language, might be an achievable task. But; “having the data is, of course, never the same as understanding what they mean, but ethnographers must also understand what they mean to their informants” (Munk 2019, 160). Researchers who practice ethnography strive to understand the meaning humans ascribe to their lives. Not by quantifying numerical data, something the shipping industry has long suffered from (Viktorelius, Varvne, and von Knorring 2022, 2), but by spending time with the people.

4.3.1 - Multi-Sited Ethnography

Traditional ethnography is characterized by focusing on a single location or setting to intensively immerse oneself into a socio-cultural installment. To observe and make sense of a specific or unique group of people’s lives. Ethnography in its early stages was understood as a tool for the civilized and powerful to examine the unknown contexts of the *subaltern* (Marcus 1995, 96). As globalization of the world *succeeded,* ethnography in its original state became less relevant. A concern the great Malinowski predicted some time ago recognizing globalization as a force that would deconstruct local cultures as they continuously were integrated into the imperial world (T. H. Eriksen 2001, 294). At the turn of the century, the world began to become a connected system without new remote and exotic locations left to explore. This gave prominence to *multi-sited* ethnography (Marcus 1995, 96). As a local, single-site, could no longer be understood as isolated from the rest of the global system. However, local settings still prevail within the global system which gave birth to the *glocal* setting (T. H. Eriksen 2001, 294). A strong ethnographic bastion withheld in multi-sited ethnography, however, is the ability to translate from one cultural language to another (Marcus 1995, 96). It is such a translation that potentially is needed among the disciplines of Blue Denmark.

Pre-project, the agenda was to understand the *lifeworld* of people enrolled in a unique cultural setting, the one found on a ship among its crew. The scope now differs and the system that I intend to understand is not situated at a single site. Multi-sited ethnography moves away from focusing on the internal scenarios, objects, and meanings. Instead, zooming out to understand a local setting's place in its larger network. By including a macro perspective, this method is suitable for understanding the system of the multi-situated processes of developing technology. To do this requires the multi-sited ethnographer to demonstrate a level of mobility as research moves from site to site. The mobility allows

the researcher to follow initially unknown sources to their origin. Thus, investigating the original site in question through the different perceptions of the system (Marcus 1995, 96). When researching the context in a socio-technical setting (such as the system) it is possible to both follow the people and follow the thing (Marcus 1995, 106–7). The contents of the people or the thing may be completely or partially unknown as research begins. As a people or a thing is mobile and found in various settings so must the researcher then move to understand the entirety of the system. When setting out with this thesis many of the representatives and organs I am now familiar with were unknown. This method enables me to pursue the system's actors to where they have been influenced. By applying comparative studies of the different sites' perceptions I gain a holistic view of the system in lieu of a *monolith* (Marcus 1995, 102).

4.4 - Empirical Data

Beginning in August 2021 as an intern at the late cluster organization MARLOG, they brought me onto the land-based scene of Blue Denmark. Providing me with a strong offset for my agenda of democratizing technological development. In early 2022, I got connected to the shipping company, DFDS. Mid-project I secured a part-time job as a System & Process Analyst starting full-time post-project. These two organizations have enabled me to be at the front of what is occurring in Blue Denmark involving research, projects, start-ups, and the branch organizations' agendas. Entitling me to reach out to interesting actors and participate in many events where I have observed the many actors and sites of Blue Denmark. Additionally, during the last year I have been connected to Aalborg University's (AAU) start-up program, the *incubator*, as an optimistic entrepreneur myself. Non-maritime-related however. Before introducing the informants, see Appendix 3 - Approached Actors for a list of actors that I would have liked to include but have not been able to reach.

The dataset thus consists of many smaller parts. Therefore I recommend the reader to consult Appendix 4 created for a convenient overview. This appendix will also include abbreviations and can be consulted throughout the project, see Appendix 4 - Abbreviations.

4.4.1 - Informants

15 official interviews represent the different sites of the system (figure 4) along with the other data. For part one 9 official interviews and in part two (pre-project), 6 official interviews were conducted. For a brief overview of the sites and informants, see Appendix 4 - Sites of the System.

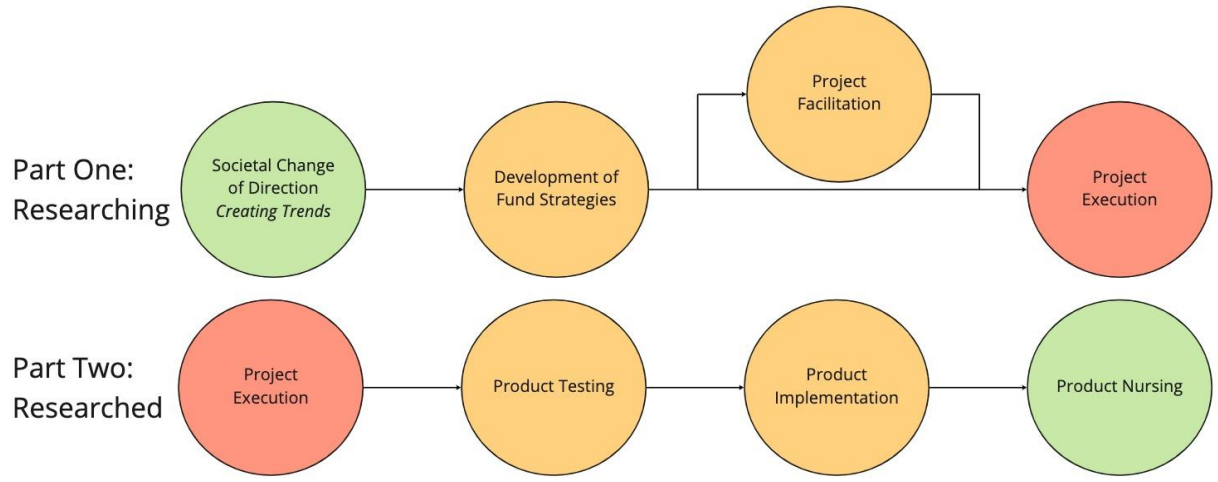


Figure 4 - the alleged sites of the system cf. 2.0.

To introduce the latter first; Jonas Pedersen a Master Mariner and active Captain; Anders Nilsson Schening an engineer and CEO at LifeFinder; Kresten Wium Petersen a former Seafarer, Master of Technology Management, and Lecturer at Marstal Maritime Academy; Oessur Jarleivson Hilduberg a former Seafarer, MSc., Human Factors & System Safety, and Head of the Danish Maritime Accident Investigation Board (DMIAB); Stig Eriksen a former Seafarer, Assistant Professor at SIMAC, and Researcher with a Ph.D. in Autonomous Shipping; Perle Møhl an Anthropologist, Author, and Senior Researcher at AU. For extended information see Appendix 4 - Pre-Project Informants.

The 9 informants of part one will, as it is the focus of this project, be more elaborately presented, for a shorter presentation see Appendix 4 - Informants; the maritime project facilitators ShippingLab and Green Ship of the Future (GSF) were approached immediately to achieve insight into their operation. Having been an intern at MARLOG I hesitated, this was a misstep as they were closed in early April 2022.

Project Director Magnus Gary from ShippingLab was delighted to elaborate on their projects and operation as was Frederik Schur Riis from GSF. As the former head of GSF Gary had a lot of insight into their organization as well. After GSF he partook in launching INNOship. A huge innovation project with 120 million DKK to use across universities, companies, manufacturers, and consultants, such collaboration proved a success (INNOship 2014). Then to bring that collaborative model further to address the climate crisis, in 2019 ShippingLab was realized through public funding. ShippingLab thus concentrates on the green transition through 3 themes; digitalization, autonomy, and decarbonization (ShippingLab 2022b). ShippingLab is financed through the InnovationFund with support from the Lauritzen Fund, the Orients Fund, and the Danish Maritime Fund (DMF) (03:50 Gary).

GSF began operation in 2008 and today they have 48 members. In the beginning, projects were managed by Force Technologies [who still exist today] after a few years project management commenced in-house. In early 2019 GSF gained complete independence with a board of directors. The board is half appointed and half elected, and 4 representatives are elected too. GSF aims to act as a platform where actors in Blue Denmark can come together and collaborate on practically anything. Not only the green transition (GSF 2022). Riis, acting as Head of GSF, tells me that they are a private organization primarily

funded by subscription fees from members consisting of actors across the maritime sector. When specific projects emerge they will apply for extra funding. This differs from ShippingLab as they are founded with a particular purpose. A purpose agreed to, with the fund managers which means they have expectations. Riis is rather new to Blue Denmark, as he tells me; “I am from something completely different, I started as an entrepreneur while studying Innovation and business development at CBS [...]” (03:55 Riis).

From the perspective of academia, Thomas Roslyng Olesen, Project Manager at Maritime Research Alliance (MRA) was interviewed. MRA is a non-profit organization aiming to facilitate and engage Danish research institutions and support maritime academic research (MRA 2022). MRA primarily works with; 1) coordinating and facilitating research across universities. Coordinate to avoid overlapping research or at least make researchers aware. Facilitate to provide a more multidisciplinary and holistic approach to research; 2) Coordinate and facilitate maritime education to address the same; 3) Olesen describes; “maybe most importantly, we exist to get research and information out to society and ease society's access to the knowledge and competencies that we possess” (02:54 Olesen). MRA was created from within. A group of researchers across institutions saw the problems of not having internal coordination across universities, but also across a university itself. After bringing the problem to light, Olesen tells me they; “established a network and applied for the funding at DMF to hire a coordinator for the network” (05:51 Olesen). He continues to tell me that although MRA may have been initiated from within; “the industry has also requested something like this [...] even governmental actors mentioned the need for facilitation of academic knowledge” (07:01 Olesen).

From the universities, I have had encounters with RUC and DTU. RUC has not been interviewed but is a member of MRA and I have joined various workshops with their maritime representatives. Mette Sanne Hansen, an expert on applied science and Head of Maritime DTU (DTUM) was interviewed. DTUM is also a member of MRA. Lastly, Torben Elgaard Jensen, an STS professor at AAU, an expert on digitalization, Head of the TAN research group, and board member of AAU’s Incubator Programme (AAU 2022b; 2022a).

For start-ups and businesses. First, SearchMaster, which is an Esbjerg-based start-up providing innovative searchlights for vessels (SearchMaster 2022). Founded by Søren Mogensen who although not being a navigator managed to base his invention on qualitative data by spending time with the navigators. Next, the newly formed Aprendio is developing a platform for facilitating mutual learning and competencies development (Aprendio 2022). Co-founded by Mikkel Hansen, a former navigator, Aprendio is an initiative based on real-world practices too. Although Schening from LifeFinder was interviewed pre-project they are worthy to mention here as I have been collaborating with them since. LifeFinder has made an innovative personal location beacon (LifeFinder 2022).

From the perspective of the Funds, Lotte Lundberg the Head of DMF (DMF 2022a) was interviewed. Lundberg has been in the maritime business for a long time and knows it well. DMF publicly calls for maritime entrepreneurs and encourages innovators to apply for funds to realize their tech projects (DMF 2022b). It was very interesting to learn about the Fund like what they value from entrepreneurs and how they operate. Around 50 million DKK is the amount that, yearly, DMF divides among applicants. From where ⅔ are to help the maritime industry with growth and creating jobs. Half is for research and the

other for promoting the industry. The last ⅓ are for maritime start-ups and entrepreneurs. For the past years, the focus has been the green transition, digitalization, and automation (05:49 Lundberg). DMF does not have any standardized procedure where they look for start-ups to have a substantial plan for user involvement. And the reason is that they, the three staff members, simply do not have the resources for such in-depth analyses. DMF has about 60 projects a year and around 200 ongoing projects. They have 5-6 parameters from where they value applications. DMF is rated as "high-risk" as they look for "wild ideas" to test. As soon as there is a minimal viable product, the Væsktfonden or the InnovationFund typically takes over. So DMF is merely the first step on a potentially lengthy funding journey, as Lundberg states; "we are a small-time player" (33:32 Lundberg). Whether other Funds have protocols in place is not known. DMF looks mostly at the team itself. If it is a solid team with a broad set of competencies or a one-man team. One of the most appreciated parameters is that the team already has had contact with the industry to validate the product. Also if they have a realistic business plan. But in the end, she determines that; "gut feeling" is very important (36:17 Lundberg). DMF recommended I talk to the InnovationFund as they were more in "my field". However, it has not been possible for me to get a comment from the InnovationFund. I also tried to get an interview with the Orients Fund. They, in an email, redirected me to DTUM. Through my interview with S. Hansen, I had the opportunity to get some clarification but I was not able to go to the more in-depth queries about the Fund's practices.

From the shipping companies, I interviewed the Head of Business Development, Nils Overgaard from Esvagt. As I have been a navigator at Esvagt it is a familiar company to me. Esvagt participates in various innovation projects within Blue Denmark (05:27 Overgaard). I did not know that Esvagt engaged in innovation projects before. This might be a result of my engagement as a navigator or Esvagt's ability to involve seafarers. Nevertheless, it shows a discrepancy that is often found between land and sea (Kristensen 2022). Esvagt's operations are mainly in the offshore sector[4] including the wind energy[5] sector and the standby vessel sector[6].

Recalling the alleged constellation of the system cf 2.0, the system can arguably be illustrated as more complex with many more *sites*. However, to simplify I have chosen to visualize the system with the sites seen in figure 5. Additionally, the informants and what sites they represent in the system have been added. Note that only project facilitators are labeled by name as they are seen as initiatives to an existing system and also because the other sites can overlap. Therefore, it is important to underline that the project will not follow the sites of the model chronologically. The project will move in and out of the sites addressing how various themes at the sites are interpreted.

[4] The offshore sector is regarded as what is in the vicinity of the coast. Such as oil rigs and wind farms.
[5] The wind energy sector is involved with construction and maintenance of the wind farms.
[6] Standby vessels are deployed as guard vessels for oil rigs possessing multiple responsibilities, e.g. rescue rig personnel if they fall overboard.

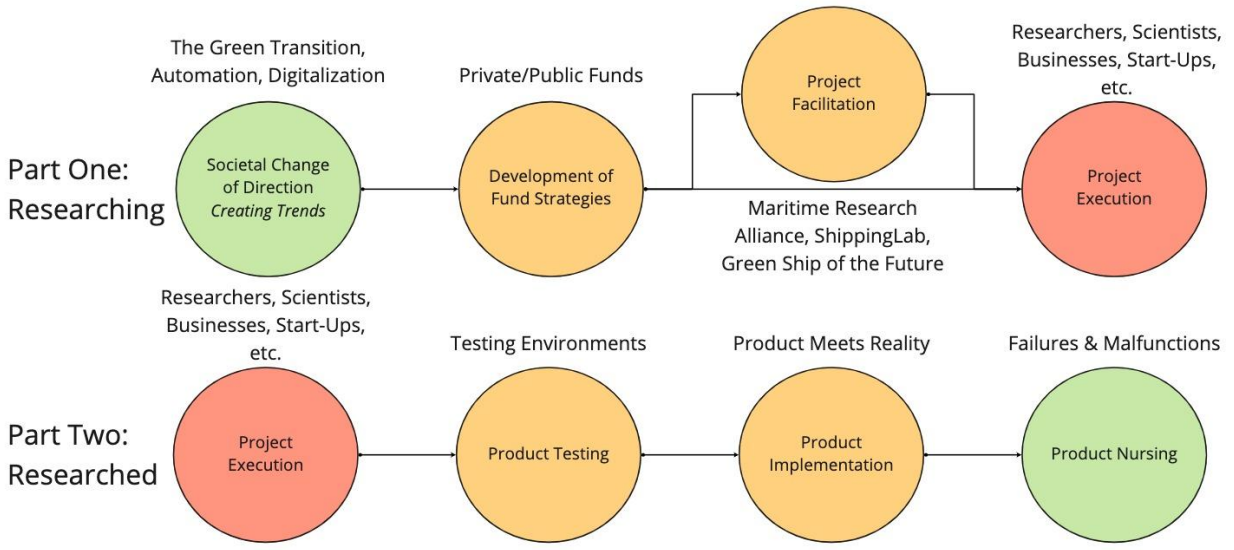


Figure 5 - the system with added site labels.

4.4.1.1 - Interview Method

The interviews were conducted as formal semi-structured with prepared interview guides. The interview guides were developed uniquely for the individual based on the desired direction of the interview, see Appendix 5 - Interview Guide (MRA) for an example. General ethics, interviewer practice, and sensitivity to the topic are essential for validity and professional courtesy. Furthermore, the mediator role of a TAN also requires a high level of impartiality. As one should be able to converse meaningfully with actors of different values and expertise (Botin, Bertelsen, and Nøhr 2015, 215).

Being a researcher molded under the restrictive settings of COVID digital solutions are native tools for me. However, generally physical meetings have taken place during this project. I have found a combined method to be preferable. It might be an odd assessment and I might tread into deep waters as I try to justify this statement. The physical and the digital meetings each have their advantages. I find the explorative mind easier satisfied during a physical meeting. But when the meeting is not necessarily to explore, but to clarify, I find digital methods just as pleasing. Furthermore, digital methods allow flexibility and efficiency such as the use of recording and auto (raw)transcribing. There are obvious barriers to the digital meeting e.g. connectivity and instability. But I argue that similar barriers are found surrounding the physical meeting e.g. traffic and room availability. Depending on personalities i.e. introverts vs extroverts. I have found that the digital technique is preferred by introverts as it eases tension. I have tried to accommodate informants with the methods that best suited them. I also tried combining interviews with both methods e.g. to gain a bigger and wider perspective on the scene before initiating interviews. Pre-interview meetings were conducted with; MRA, ShippingLab, and Aprendio. These informants were invited to an informal discussion in person to learn how to present these questions to ensure that informants would not feel *attacked*. This is important as the topic can be interpreted as criticism of the current system. In textbook interviewer practice such consideration can help in breaking down barriers, such as *apprehension*. Apprehension is the idea that the interviewer and the interviewee lack connection and trust. This can be strengthened by showing openness and

consideration of the interviewee's standpoints (Spradley 1979, 45). Deterring apprehension can also be done by initiating the interview with *grand tour questions*, to get the talking started. Grand tour questions are simple questions about what the interviewee does regularly. It provides valuable insights into tacit behavior that may have relevance to the system in question (Spradley 1979, 50). Following the grand tour question, the interview guide would be consulted and carry the interview forward.

All interviews were carried out in Danish (except the interviews with Eriksen and Schening). This adds a link to relaying data as it will be a personal translation. To acknowledge the risk of misinterpreting these citations the reader should notice all Danish interview citations have been translated. The interviews were transcribed and sorted in their native language and only translated if parts were to be used. Sorting commenced through the themes from the storyboard (cf. 4.1) and areas of expertise. Such systemic storage proves convenient as it becomes cataloged and easily accessible for the later analysis stage (Kvale and Brinkmann 2014, 225).

4.4.2 - Observational Studies

Ethnographic fieldwork has been essential for comprehending the socio-technical setting of Blue Denmark. It is widely agreed that one should remain in the field long enough to become a *natural* presence by the hosts (T. H. Eriksen 2010, 24). Aided by my past as a seafarer this has been relatively achievable. But it is only now that I start to feel truly accepted among the land-based actors. I have particularly felt my presence accepted in the maritime academic domain. Ethnographic fieldwork has enabled me to gain a meta-perspective of the culture, language, and behavior that connects the sites in the system. Taking up the role of the *clown* I have not refrained from asking questions with incorrect terminology, questions thought as a given, and at times provoking questions to sort of *stick my fist in the beehive* and stir the natural order (T. H. Eriksen 2010, 24–25). Why such activities are valuable is because, as Spradley writes; “all human beings act as ordinary participants in many social situations. Once we learn the cultural rules, they become tacit and we hardly think about what we are doing” (Spradley 1980, 53). Such tacit knowledge is precisely what I need to understand the system. And as it can be difficult to extract tacit knowledge from the formal setting of interviews, participatory observation is a wonderful supplement. A supplement to understand what is *trending*. Participant observation is about diving into the scene and becoming exposed to the lives of the actors in it. While at times remaining unnoticed as an outsider to casually observe life as is. However, unethical practices such as deceiving informants are not something I endorse. As Malinowski replied to an aspiring ethnographer asking how to do fieldwork; “not to be a bloody fool” (T. H. Eriksen 2010, 26). For an extended description of official events observed, see Appendix 4 - Events and Other.

4.4.3 - Autoethnographic Inspiration

I will have to elaborate on one last source of data. Having a past as a navigator onboard vessels of various sizes and purposes accentuates the causality that the hypotheses stem from past experiences. There is undoubtedly a desire and preconfigured attraction to what outcome I as a navigator seek. An outcome infused with my, former colleagues', and friends' interests. However, there is also neutrality in this desire as I believe that the inclusion of *us* and *our* practices in the system will steer to additional

technology prevailing i.e. transforming ship operations for the better. Being right or wrong in this belief is to be determined. Yet the cause stands as a proposed remedy to ensure a human-sustaining world for us all, including me.

Picture 3 - a picture of me performing a standby maneuver in the North Sea.

I study TAN *because* of my past. My pre-project was composed *because* of my past. All of this happens *because* of the foreshadowed dilemma I felt in my own life as a seafarer. Research is often based on an assumption that something can be found to be a *problem* (Hammersley and Atkinson 2019, 21). In this case, it originated from the lack of inclusion and its consequences that I felt as a navigator. As I mentioned in my earlier project; "I am the very thing I investigate and I have felt the problems in my own life and as such, they are real-life problems" (Kristensen 2022, 11). Hammersley and Atkinson write; "each new researcher must discover for him or herself what is required to produce an ethnographic study" (Hammersley and Atkinson 2019, 20). I have decided to use my past as an essential storytelling instrument. Stories from the real world of real people. Writing academic pages shall not deprive me of my hard-earned emotional experiences. I will persistently keep recalling life at sea, and still practice navigation[7] to apply research with firsthand empirical anecdotes. I believe it has an enriching effect on binding my work and my stories to you, the reader. And ultimately amplify my call for increasing multidisciplinary knowledge and collaboration. I will remain true to the concept of autoethnographic content in my endeavors. Elaborating on citations from selected literature, interviews, or observations with unique personal narratives can help to illustrate contexts in real-life (Jones, Adams, and Ellis 2013, 20–23). I will not make an autoethnographic passage. Instead, I will elaborate throughout the project with personal experiences when applicable.

[7] I intend to keep my papers and certificates valid and sign-on vessels as a navigator to remain aware of current practices. This has been agreed to by my employer and will be an important part of my new job.

4.5 - Ending the Setup

This research is heavily grounded in qualitative data. The point is not to discredit one source and praise another. Instead, I intend to draw attention to what I feel is wanting. If the system exhibits an inflated interest in technological artifacts isolated from their practice then I will try to infuse the system with a counter move. As argued by Viktorelius, Varvne, and von Knorring shipping has historically been fonder of quantitative data (Viktorelius, Varvne, and von Knorring 2022, 2). Thereby not asserting my method as the one true. Rather a call for an equilibrium. It is only when these fields merge that socio-technical adaptations and interpretations can be justified (Guba and Lincoln 1994, 205).

To Sum up, the data will be cited as; pre-project interviews (title, timestamp); Interviews (timestamp, name); events (fieldnotes, event name); autoethnographic epiphanies (ae); and others (fieldnotes). These can also be found in Appendix 4 - Citation Style. Communicating where data originates illuminates its level of uncertainty. Where an interview is arguably the most direct as it is recorded for playback, observed testimonies can be blurred as they can be extensively mitigated.

In chapter 4 I sought to justify and address certain limitations of my method to bring more validity to the research and the selection of data. By that I mean I apply a sense of quality assurance by promoting transparency on thoughts, reflections, and challenges in the data collection process (Brinkmann and Tanggaard 2015, 10).

5.0 - Theoretical Framework

This research is conducted on the belief that technology can be declared a success when it is integrated into a socio-technical configuration with healthy relations between the *user, expert,* and *artifact*, see figure 6. The relations can be described as; 1) *User - Artifact*, how can users identify with their purpose in the artifact and the capability of the artifact to manifest itself as a co-user; 2) *Expert - User*, the discrepancy of purpose in the ultimate solution between creator and user; 3) *Expert - Artifact*, consideration of residual process and potential discrimination and exclusion of social groups by the appearance of technology (Børsen 2020, 220–21).

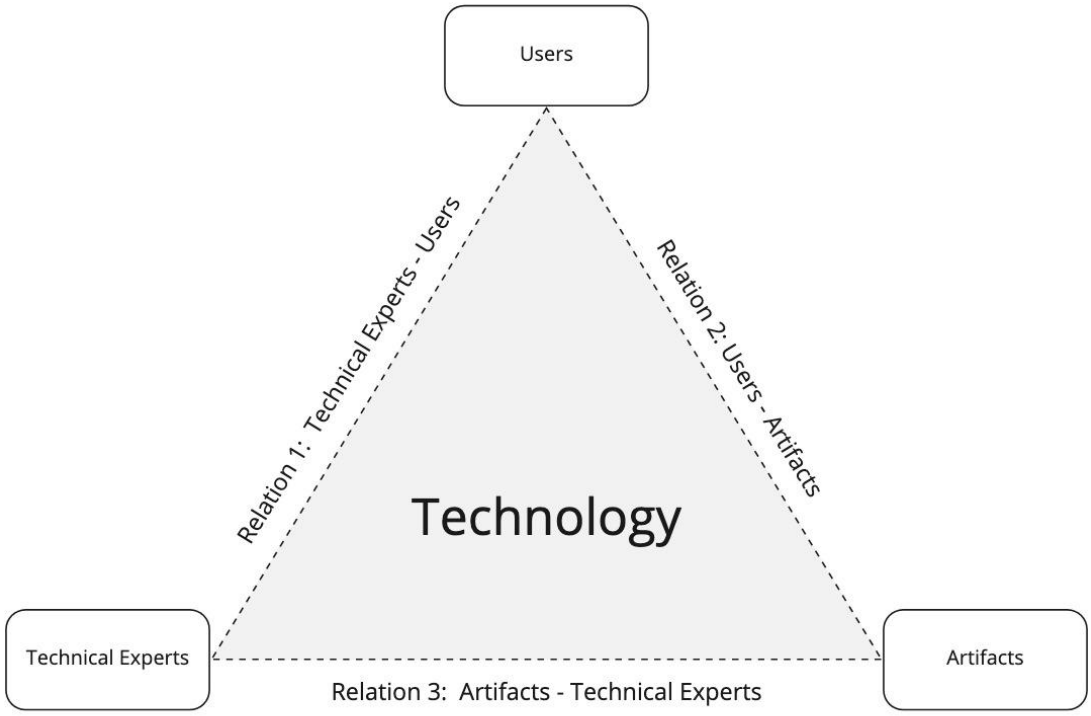


Figure 6 - the TAN triangle, inspired by (Børsen 2020, 220).

To debate if there is more than one truth to such success is in my opinion completely valid. However, these criteria are set free of any capitalistic affiliation, only the value of a future world capable of sustaining life as we know it. Will one argue for a monetized agenda solely infused with economic growth and revenue thus stating said criteria are deceitful, I concur but do not care. Three relations stand as fundamental totems to be erect for the glorification of technological emancipation. To understand the task at hand we can break down these relations into recognizable themes; 1) the user-artifact relation can be facilitated through e.g. participatory design (Simonsen and Robertson 2013); 2) the expert-user relation through e.g. anthropology-driven design (Christensen 2014) and interactional expertise (Collins, Evans, and Weinel 2017); 3) the expert-artifact relation should be built on ethics and sustainable solution this could be ensured through e.g. responsible research and innovation (RRI) (Felt, Fochler, and Sigl 2018). And as the material of these relations reveals it is further important to understand the user, the expert, and the artifact, in their confined states (Børsen 2020, 220–21). A solitary user is without technical tools; the expert is alone with their invention; the artifact is merely a

piece of junk. The alleged dilemma appears to be with the technical experts. Experts who seem extensively privileged in being permitted to develop technical solutions as they please. Neglecting social context. As everything is bound by context technology cannot exist detached from social context (Manning 2018).

The constellation of Blue Denmark is vast and many different actors call it their workplace. Yet Blue Denmark is merely a part of the behemoth of the maritime world. The maritime world crosses businesses of all characters on national and international levels. For a framework to adhere to the complexities of such an environment it must be able to deal with the power of technical experts and bring them to the people acknowledging the multiplicity of technology (Collins, Evans, and Weinel 2017). This is vital as artifacts often are interpreted oppositely by various groups (Pinch and Bijker 1984).

5.1 - Critical Theory of Technology

The framework is thus built from the indication that technology's success requires it to become an integrated part of society by creating the aforementioned relations. The construction of these relations should be established democratically. The idea emanates from the Critical Theory of Technology (CTT) where we learn to see technology as an entity and not just as a *thing*. This entity can assist, reinforce our values, or even emancipate us. However, where there is light darkness will follow. If technology can empower and emancipate us then it inevitably also can oppress and enslave us. To avoid this, CTT aims to recognize multiple actors' value in the design of technology. Democratizing design and implementation by distributing power, not to an elite but all. Democratizing such a system can prevent stronger actors from determining what technology is good for the rest. In the words of Andrew Feenberg;

> "It is this control which orients technical development toward disempowering workers and the massification of the public. I call this control "operational autonomy", the freedom of the owner or his representative to make independent decisions about how to carry on the business of the organization, regardless of the views or interests of subordinate actors and the surrounding community" (Feenberg 2005, 53).

Feenberg, a key figure in CTT, has been influenced by two other prominent STS theories. The first is Actor-Network Theory (ANT). ANT gained fame by proposing *symmetry* of actors in a network. Symmetry to not only address those of flesh and blood but also the so-called *non-humans* i.e. technologies. Technologies should be considered actors as they also have influential power, or *agency*, in the network. In the classic ANT example of a hotel and lost room keys. Latour narrates how a hotel owner adds non-human actors to the network so the *program* can defeat the *anti-program*. The owner adds actors in the form of *material semiotics*, such as signs prompting guests to leave their keys to his program. In this case, the program is the hotel owner aspiring *not* to lose his room keys. The anti-program is the guests who relieve them of their room keys elsewhere. Finally, the hotel owner introduces the bulky metal hanger to his program by attaching it to the room key. The hotel owner (program) triumphs as the hotel guests (anti-program) are now immediately motivated to get rid of their keys and this cumbersome object (Latour 1991). This justifies Feenberg's critique as he calls ANT deterministic (Feenberg 2017, 39).

As the hotel owner has an obvious goal and will manipulate hotel guests to achieve it. Technology should not be imposed by a powerful program (shipping company) to manipulate the anti-program (seafarers). Where Latour's symmetry is towards non-human actors Fenberg's symmetry is towards the anti-program. He implies that both sides of an argument should be heard and that technical experts should be bound by the logic of the people (Feenberg 2017, 48–49). Thereby, avoiding the technical contributions of the marginalized to be undermined by experts. Nonetheless, ANT is praised for recognizing the influence technology has on a system. This develops a greater perception of the actors in a socio-technical configuration such as Blue Denmark.

The second theory that influenced Feenberg's CCT is the Social Construction of Technology (SCOT). SCOT examined how actors can mobilize as social groups with different interests at heart to exploit the construction of technology. The behavior and power of these different groups can determine how the *closure* of technology might be reached. Such behavior is affected by a concept known as *interpretative flexibility*. Interpretative flexibility encompasses the different perceptions social groups ascribe to the technology. Some constructions reach a closure less laden with conflict than others. Pinch and Bijker's SCOT analysis of the development of the bicycle discovers how different social controversies affect the evolution of the bicycle. Controversies such as what level of safety should be prioritized as opposed to potential maximum speed resulted in a major tug of war in the early stages. Later the introduction of the female rider created further social disruption. Eventually, the bicycle became equipped with rubber tires, brakes, helmets, and a gender-sensitive catalog. Pinch and Bijker noticed how groups formed and affected the bicycle's construction (Pinch and Bijker 1984). Feenberg points out that groups consisting of stronger and more influential actors can be more manipulating and defining than weaker ones thus affecting outcomes in their favor (Feenberg 2017, 45). Additionally, more powerful groups possess the ability to inscribe certain qualities in technology promoting potential bias and inequality (Feenberg 2017, 59). CTT calls this *instrumental rationality* which is obtaining a purpose through any means necessary (Feenberg 2017, 51). Technology is undemocratic if it is developed by designers free to achieve a form of social control (Feenberg 2017, 49). As technology often is created for a problem-solving purpose in society it matters significantly what influences its creators. Feenberg, therefore, criticizes SCOT for being biased by economic interest, racial and gender prejudice, and inequality regarding social groups' ability to mobilize (Feenberg 2017, 45).

Feenberg proceeds to do some patchwork on what is lacking appreciation in the field of STS (Feenberg 2017, 50–51). That is, the critical view on technology and dominant institutions as they can deploy technology as a powerful actor infused with biases to marginalize vulnerable groups. Despite Feenberg being inspired by neo-Luddites such as Martin Heidegger and Jacques Ellul who post technology as the certain doom of mankind, Feenberg welcomes technology as an empowering source. Although in the hand of the just and the right. Once again applying the light and dark principle that one cannot exist without the other. It is a question of situated context determining technology's possibility to emancipate or oppress the system's inhabitants (Feenberg 2005, 48).

5.2 - Applying the Theory

What Feenberg implies with *democratizing technology* is to recognize the *technical code* i.e. things made possible through technology should never be controlled by an elite enabling them to practice instrumental rationality. In other words, to accommodate a myriad of interests and values in the development of technology. He writes; “a technical code is a criterion that selects between alternative feasible technical designs in terms of a social goal” (Feenberg 2005, 52). CTT seeks to correct the issue with SCOT and be more ethical and unbiased as technology should be in the interest of a wholly community (Feenberg 2005, 51–52, 55–56). Feenberg critiques ANT for not including the perspective of the anti-program. The story does not contain any context of why the hotel guests do not leave their keys. Implying that the only concern is how the manager can *win*. Only one perspective is noteworthy, hence the scarcity of symmetry between the program and the anti-program (Feenberg 2017, 51). This is a problem as there are multiple conflicting interests in a system. For example, if you become a driver you acquire an interest in the quality of roads. However, if you mainly identify as a pedestrian you might be more interested in sidewalks (Feenberg 2017, 53). The two interests are opposing each other and will inevitably cause friction and frustration as the interest of being a driver in having good roads contradicts the interest of the pedestrians who want less traffic and wider sidewalks (Feenberg 2005, 48). Technology is thus shaping humans and making us pursue new knowledge to better accommodate our needs in society. This is called a dialectic relation with technology (Feenberg 2017, 62).

Therefore, many different perspectives are needed to understand the entirety of a system. It is in this way seafarers as a social group are of relevance to a given technology e.g. a route optimization program; navigators will use the program to carry out their work; IT employees oversee cyber threats; charters are interested in time schedules for the vessel; operations are concerned with fuel expenses, etc. They all share a connection to the system but their perception of why the system exists is different. It is important to identify these groups' perspectives and what they look for the system to solve. This is difficult as different social groups often have different values and cultures. However, if there is inequality in these actors' agency then the more powerful can be more influential than the weaker ones. If seafarers are prone to be excluded and thereby not contributing to developing technology the system is undemocratic and the relations fail to evolve. This must not happen. A group may appear minor but the group's impact on the outcome of technology can be inescapable. Avoiding centralized decision-making is what CTT tries to avoid by democratizing technological development and this will be the ideology going into the analyses. In Blue Denmark, if technology can empower seafarers the chances for collaboration, thus effectivizing ship operations, increase. Instrumental rationality is not the way to make positive changes in society (Feenberg 2005, 55) therefore this theoretical framework is built to support the democratization of further technological development in Blue Denmark. It will thus be the core concept that actors' positions are evaluated during the analysis.

6.0 - Analyzing the System

It is important to state that the system is rather complex. It is affected by multiple different sites as stated earlier cf. 4.4.1. The analysis will not chronologically go through the sites but rather examine them through different themes. As I am limited by project size it is not possible to include and analyze all the data I have collected. I have chosen to *quickly* progress through the selected data as I feel this is the best way to realistically present the system. I implore the reader to have patience as the *rapid* introduction of the many different types of empirical data can appear overwhelming. To provide a synopsis the analysis has been split into 4 parts consisting of 4 problems/questions. The answers to these will in turn help answer the research questions stated cf. 3.1. In part 1 (6.1), we investigate if the original purpose of technology has been forgotten; in part 2 (6.2), we evaluate if the development of technology in Blue Denmark is undemocratic; in part 3 (6.3), we look at what influences technological development in the system and how technology can positively be applied here and now; in part 4 (6.4), we look at the system itself, what constitutes the system, what are the different actors' perspectives on technology, and why it fails to include the user. The 4 parts will continuously be condensed and in chapter 7.0 the entire analysis will be summarized and discussed making an overall assessment of the system. In chapter 8.0 I will reflect on the findings and submit a judgment while plotting[8] a recommended alternative course going forward. Before continuing, please remember to consult Appendix 4 for an overview of the different informants as it can be difficult to remember what area the different actors represent.

6.1 - Forgotten Purpose of Technology

Part 1. It is somewhat ironic that technology has made it possible to get where we are, yet now we depend on technological advances more than ever. In investigating why to *do* technology at the different sites of the system it boils down to three categories; 1, mostly from an operative point of view the more technology that can replace humans the fewer expenses (Petersen 10:26) and fewer errors i.e. removing human operators equal fewer disasters and more revenue (Man, Lundh, and MacKinnon 2019, 3); 2, simply because it is technologically possible and cool (Petersen 10:20); 3, more important than ever to reduce emissions from shipping, as the Head of GSF mentioned; "moving people and goods creates a lot of value for the world. However, there is also a dark side, in this case, a negative impact on the environment, we work to bring that down" (08:05 Riis). One I find highly valid and one we should pursue with all our power. But before we get into that I will address, or rather deconstruct the two others.

6.1.1 - Removing Crew

Category 1, removing human operators from ships seems implausible for two reasons. First, technology is not capable e.g. the unmanned autonomous vessel is not able to deal with the dynamics of the seas or to possess the level of adaptability of humans (cf. 6.3.1.1). Secondly, there is a false belief that human operators solely exist on the vessel to *steer* the vessel. To address the latter first. The auto-pilot technology has existed for years, the ship is *steering* itself. Most of the work that happens on a ship is that of maintaining systems (S. Eriksen, Utne, and Lützen 2021, 9). Along with other workloads,

[8] Plotting a course is a way of saying that the needed direction of the vessel is this way.

maintenance is not something an autonomous vessel is exempt from even though Danish Shipping anticipates robots will be able to overtake this task (RINA 2018). Regarding workload (the aspect of workload will be elaborated, cf. 6.2.), it has not spiked yet and it is still increasing (Ljung and Lützhöft 2014, 3). I was even told by Eriksen that; "companies, at the moment, have more crew than legislation requires, simply because there is too much maintenance work" (Eriksen 23:39). Therefore, it is unlikely to see significant reductions in crew size soon. Furthermore, the heated discussion on human vs machine has not had much real substance. The main argument revolves around a number, roughly 85%, of accidents that can be attributed to human error (AGCS 2017). The problem is that human error does not classify as an error isolated to a human making a mistake, but rather because of multiple factors failing. As noted by Rothblum; "human errors are generally caused by technologies, environments, and organizations which are incompatible in some way with optimal human performance" (Rothblum 2011, 5). It is also explained as a human error if the operator is incapable of comprehending the complexity of a system (Grech and Lemon 2015, 3). And as no apparent data exists on how many times a human prevented a system from making a critical error that could have resulted in an accident, it is a very one-sided argument. When asked to comment on this statement, maritime lecturer and tech enthusiast Petersen answered; "[...] show the other perspective, if that statement is to have any validity, I want to know how many accidents did not happen because a human told a computer it was wrong" (Petersen 12:36). However, a study on the near-miss[9] system showed that 87% of such occurrences had been discovered by humans (S. Eriksen 2020, 99). However, as told by the Head of DMAIB; "it is important to say that safety cannot be understood by some numerical value as it is bound by the context in which it emerges" (Hilduberg 46:41). Ultimately, Petersen assesses that we should; "let humans do what humans do best and let machines do what they do best, then assist each other" (Petersen 30:02).

Picture 4 - a picture of a near-miss suggestion box on a tanker

[9] A near miss is a situation that was likely to result in an accident if it had not been discovered in time. Such a system often has a quota to meet, resulting in crewmembers becoming very creative at times to meet this quota.

Technology appear incapable of replacing humans, otherwise, it would have happened already as the business case would be too lucrative for any shipping company to pass, as Petersen argues; “if the technology were a product you could just go and buy off the shelf, then it would already be implemented” (Petersen 17:13). The crew is present to act on sudden, unforeseen, dangerous situations and handle such situations all the time without drawing on external parties (S. Eriksen 2020, 89).

6.1.2 - Technological Glorification

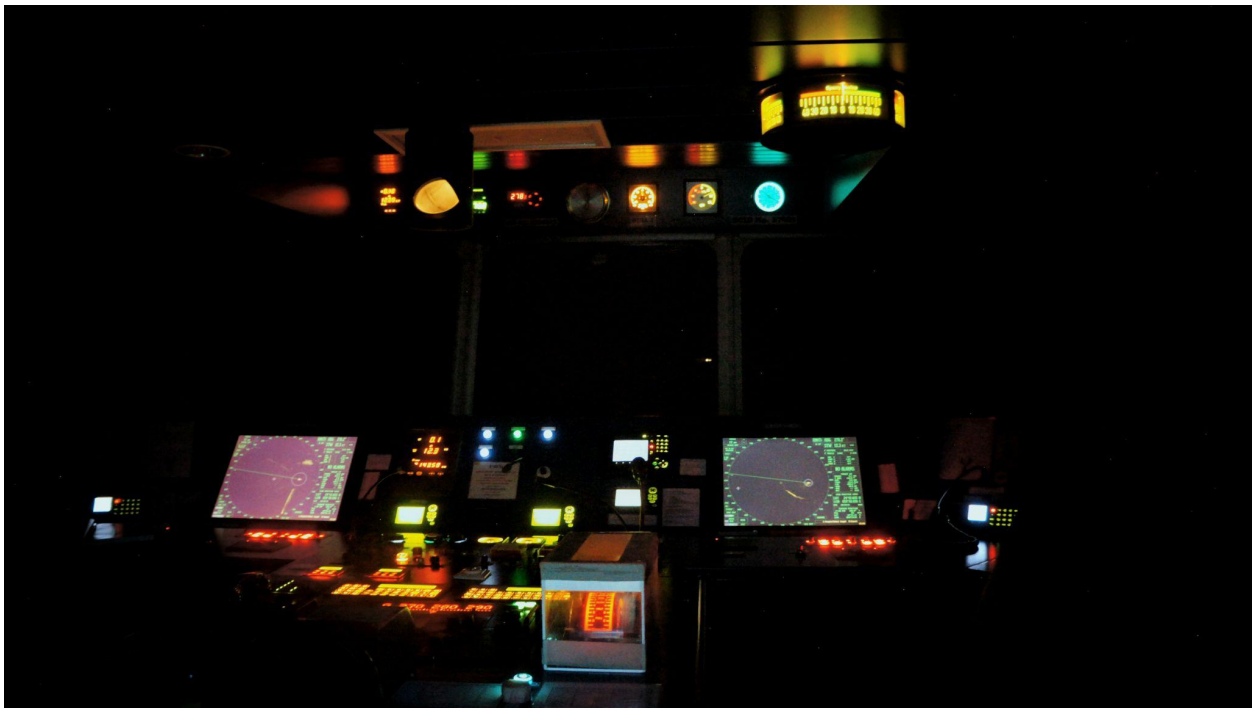
Category 2, to do technology because it is cool and possible is just *wrong*. There has shown to be a discrepancy between the land-based actors’ idea of a modern vessel and what is currently possible with the given infrastructure of the sea. Such misalignments and unreal expectations lead users to abandon technology as critical issues and constant problems inhibit adoption (Krause-Jensen, Hansen, and Skårup 2020, 7, 19). The reliability of systems at sea carries important significance. The technician is not just around the corner and consequences can be devastating at unfathomable levels. Where an entrepreneur might be willing to take risks resulting in losing their investment, the risk measures somewhat more for a Captain and their crew. The risks include human lives, man-made natural disasters, and innumerable amounts of money, (this will be further elaborated, cf. 6.2.1). *Toying* with new and fancy technology *just because one can*, should not be an argument. Such a discrepancy can be harmful to the much more useful technological development that we so desperately need (Hancock et al. 2013, 10; Krause-Jensen, Hansen, and Skårup 2020, 41; Kristensen 2022, 25). Furthermore, Hilduberg argues that the technical characteristics of a ship need to be understood by all;

> “We need to remember when characterizing a ship, it is extremely low-tech [...] nothing like a plane or a train [...] a ship is multiple different systems connected from multiple different brands and manufacturers using different methods and having different rules, so nothing is standardized. A ship works, yes, but at the same time, it never really works [...] so you place 20 crew members on board, running around 12 hours a day to try to keep the vessel afloat and get from A to B. This is the context we should think about when thinking about automating ships” (Hilduberg 16:06)

Noting that this quote only deals with the complexity of one ship and does not recognize that similar ships in a fleet[10] further differentiate in equipment and systems (Krause-Jensen, Hansen, and Skårup 2020, 8). It is sort of a microcosmos constructed by elements from all over the world. It is quite normal for systems to be supplied from more than 15 different manufacturers.

[10] This means that a seafarer can become familiar with the equipment on a given vessel, however, if they are transferred to another vessel, even within the same company, for their next trip, the equipment can be completely alien.

Picture 5 - a picture of me on the bridge of a vessel, notice the different electronic equipment, mostly from different manufacturers.



Picture 6 - a picture taken at night on a tanker vessel's bridge. Notice the many illuminated technologies, from various manufacturers.

The lack of streamlining systems is problematic for progress. Manufacturers often worry about production costs, not integration capacities resulting in a low ability for the system to work together with the operator. This causes technology, even though introduced to reduce error, to in some cases be

directly contributed to accidents (Grech and Lemon 2015, 2–4). A vessel's sole purpose is to get from A to B without any unnecessary negative effects on the environment, cargo, or crew. Not a test facility for futuristic technology. If it should act as such necessary precautions need to be well established. Assessing that because something is *technologically possible* within the confines of well-established and connected Copenhagen should not incentivize the thought of imminent success at sea on a heterogeneous structure that is a vessel.

6.1.3 - Sustain Our Existence

Category 3, is that we collectively should *do* technology to sustain our way of life for generations to come. Essentially this is why a democratic intervention in Blue Denmark is needed. Therefore, the rest of the analyses will address how this can be achieved. By analyzing how *all* actors in the system can collaborate to develop and implement technology to effectivize ship operations to such an extent that it does not destroy our world any further.

Picture 7 - a picture I took at a port in Belgium (you might think, it is a black and white picture).

6.2 - Undemocratic Technology

In part 2 of the analysis, the concern of how the seafarer is positioned will be unfolded by evaluating the seafarer from the perspective of CTT. More precisely, is there cause for calling seafarers a social group, and if so are they necessarily marginalized and more excluded than others? Furthermore, does that mean technological development can be assessed as undemocratic?

A vessel at sea can be described as a *closed institution*. Describing life at sea as Aubert and Arner did in a 1958 article (Aubert and Arner 1958) fits nicely with my way of describing social life at sea in my Bachelor thesis in 2015. I used the metaphor that a vessel at sea could be two types of closed

institutions. One, a prison, the other, the Danish concept of a *Højskole*. It is conditional on the crew and their social relations (Kristensen 2015).

Picture 8 - the picture I used when presenting the findings of my bachelor thesis, from left; Gerlev Idrætshøjskole, a tanker, and Alcatraz Island.

Life at sea is not only doom and disappear it has attractive features too (Thomas 2004). However, times are changing and so is the life of the seafarer. Seafarers are unique and, in many ways, vulnerable social groups. From many stances, they accept to live significant parts of their lives at sea where many aspects of life are in a lesser condition, which was affirmed by former seafarer M. Hansen; "[...] you just put up with the fact that everything is just a little worse than at home" (03:10 M. Hansen). Notably, the rising use of digital methods is a problem for many at sea with poor internet connections[11]. While at home Danes want even better internet although currently rated among the best in the world (Jyllands Posten 2022). Understandably so, as the Danish government continues to push for more digitalization as they in May 2022 announced the biggest leap in digitalization yet, affecting many *public chores* (Ministry of Finance 2022). However, while this is being announced many social groups still struggle with current digital changes to societal duties. Where ethnographer and STS professor from ITU, Brit Ross Winthereik argues that "the human behind the user has been forgotten" and interdisciplinary expert and Director of TeknoEtik, Klavs Birkholm, further calls it a "democratic problem" (Schropp 2022)**.** The digital infrastructure at sea is not as reliable as the one onshore in Denmark. Therefore, such democratic unalignment is amplified regarding seafarers.

> I remember well when NemID[12] was launched and everyone sang and danced to the tune of digital liberation from the physical municipality services. While expediting times were cut in half. I sat at sea receiving email after email that payment was lacking, with no opportunity to react, as I had no means to sign in to public platforms with NemID. Either due to poor internet or the company blacklisting certain features. Alas, fear not, there is a backup, the only other alternative was to get a code by phone which might come as a surprise, but does not reach the middle of the Atlantic Ocean (ae)

[11] Internet usage at sea is often on a metered connection. A crew member e.g. has 2 GB available each month. This of course varies a lot from the area of trade along with the digital infrastructure. However, there are still many places with no connection at all. Furthermore, the heading of the vessel is a contributing factor to whether there is an available connection. If the heading results in the internet antenna being obstructed, then there is no internet until the vessel changes its heading.
[12] NemId is the official digital signature to governmental services.

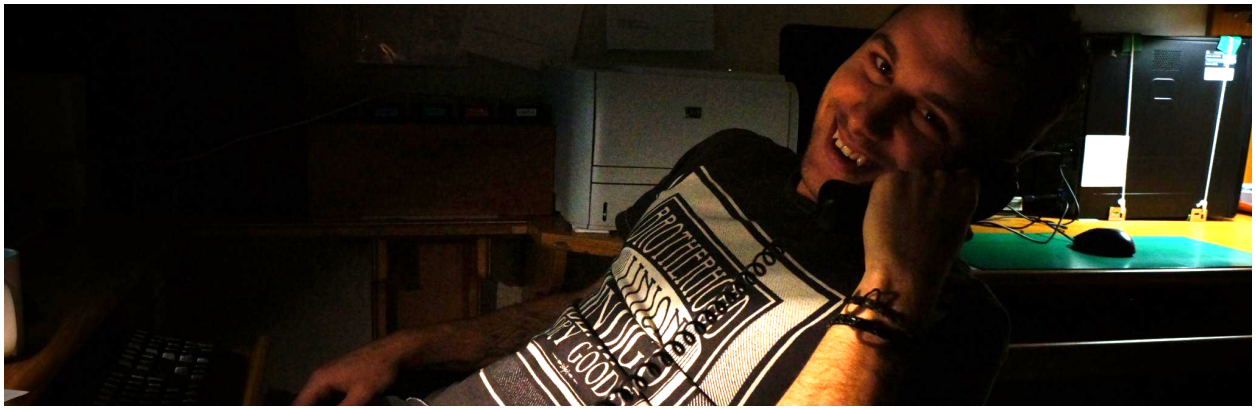
Picture 9 - a picture of me on a navigational watch, no land in sight.

Being at sea for long periods has an unusual effect on people. It isolates them from society and its comforts. However, it is not only the isolation of being at sea that forms a seafarer's identity but also the decisions made by those who stay onshore and the constant monitoring from the same (Thomas 2004; Kristensen 2022). There are vast differences between lives lived at sea and on land. As the land-based worker typically is at work for 8 hours five days a week. The seafarer is at work 24/7 for months (Lundh and Rydstedt 2016, 1). Months where they are spatially disconnected from their loved ones. While set to navigate in a world of technology through which decision-makers onshore express their agenda. An agenda that might not always include those at sea. At sea, the crew is in many ways bound by the rules and policies of the *institution's* owners. Including *free time*. The institution is a metal box where an internet supplier, food, and bed are not chosen by oneself but by an employer (Lundh and Rydstedt 2016, 1). Subjects that are deemed essential for living (Maslow 1982).

Picture 10 - various pictures; from top-left and clockwise, tea kitchen for the bridge, gym, messroom, and pool.

Picture 11 - a picture of my bed, on a tanker vessel sailing worldwide, a sign-on period of up to three months.

In a world where growth is only synonymous with more capital, institution owners are doing everything they can to minimize expenses e.g. by implementing digitalization strategies to reduce crew and looking for a cheaper workforce elsewhere. Like the sacking of 800 seafarers by a UK ferry operator, P&O. P&O had a clear plan to replace them with *cheaper* alternatives. Furthermore, the message was conveyed through a video call on what was to be the employees' last day at P&O. The action caused outrage with some seafarers refusing to leave their ship in frustration (Martin 2022).

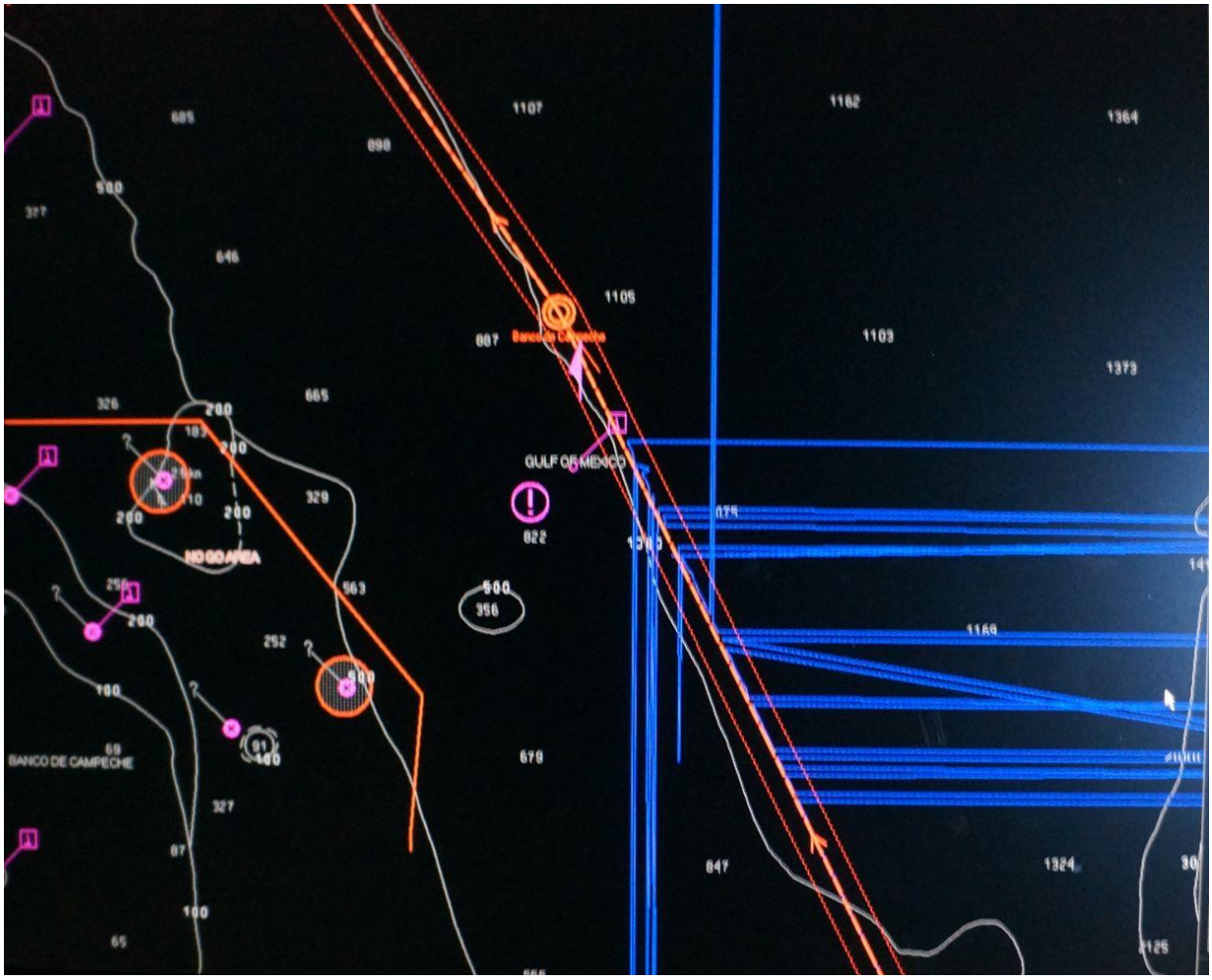


Picture 12 - a picture of me at sea calling my girlfriend on a metered call in 2012 (I am laughing because my colleague indicated I spent too much money on the call already).

Through the eyes of CTT, seafarers are a unique social group formed through their shared experience of being at sea. Despite its significance to the global society, seafaring is often a lonely and isolated existence. This isolation unites the ship's crew in their goal of reaching their destination with no occurrences of accidents, disasters, or deaths (AGCS 2017). Safety does not take breaks hence securing the vessel, crew, and cargo is of utmost importance. The captain and their crew are handed a vessel and cargo for unimaginable sums of monetary value. A situation where one is not likely to take risks and gamble on partially operational technology (Krause-Jensen, Hansen, and Skårup 2020, 7, 20; Kristensen 2022, 24–25).

6.2.1 - Changing Systems, Not Responsibility

As technology increasingly becomes a vital support function for humans the role of the navigator is changing from being a *controller* to a *supervisor* of systems. Technology is furthermore becoming more complex and systems' full capabilities can be overwhelming. As technology is changing and becoming steadily more complex the way humans and machines interact is changing too. Actors of the network are increasingly non-humans and more advanced. While systems become more advanced the human operator seems to remain stationary not following the exponential path (Grech and Lemon 2015, 2; Lundh and Rydstedt 2016, 2–3; Man, Lundh, and MacKinnon 2019, 2). Seafarers will arguably be most affected by this change as they frantically try to gain sufficient knowledge and skill in the system. The established decision-making processes at shipping companies are, commonly known, not capable of providing enough attention to crew competency development (Froholdt 2010). It is a major democratic problem as responsibilities are not subdued to change. As the final decision maker, the navigator should be included to ensure the operator has the required skill and knowledge to sufficiently operate and supervise the system (Man, Lundh, and MacKinnon 2019, 2–3). Navigators still have the final call, they will decide what action to take and be held responsible. In shipping, *gut feeling* is a term used to express the hard-earned expertise of the navigators (Man, Lundh, and MacKinnon 2018, 801). Cf. 6.1.2, it is necessary as it is all but uncommon that systems fail.



Picture 13 - a picture of the ECDIS failing while I was on watch. The connection to GPS malfunctions and the vessel's position jumps to various locations around the world.

Looking at the aviation industry, such a statement is contradictory to one of the root causes of the China Airlines flight 006 disaster. Traveling to Los Angeles from Taiwan on the 19th of February 1985 the pilots lost complete visual orientation in the clouds after a nose-down dive commenced. Completely sure of their *gut feeling* they ignored their instruments. Unfortunately, the instruments were true and the plane was lost (NTSB 1985). Due to the poor interoperability in ship systems, it has become a habit that not much works as intended (Krause-Jensen, Hansen, and Skårup 2020, 8). Aviation and shipping differ in this way. In aviation the reliability of technology is so outstanding that pilots must always adhere to them, resisting gut feelings. However, gut feeling is paramount in shipping as the reliability of technology is very low. Yet, since navigators increasingly are required to depend on systems for a correct course of action, this very fact needs to be recognized (Man, Lundh, and MacKinnon 2019, 8). The importance of the system's ability to facilitate the navigator in the unique settings where the *pot is boiling* and an overview of the situation is vital e.g. in the unavoidable case of system or machinery breakdown. Those are the situations where the systems are needed most (Grech and Lemon 2015, 11). These are the situations that can only be prepared for by involving those who have the experience. And in the deliberate absence of the same, the technology is arguably undemocratic. Cf. 6.1.1, even though

shipping has undergone major modifications in operation through digitalization and technologification many characteristics remain static (Lundh and Rydstedt 2016, 2). Reductions in crew size have left the remaining crew responsible for the not reduced workload (Ljung and Lützhöft 2014). Administrative work, maintenance, residual processes, and technological offsets keep increasing the workload (Bainbridge 1983; Lundh and Rydstedt 2016; ECDIS Survey 2021). A former navigator said at the World Maritime Technology Conference (WMTC) 2022; “in all my time at sea they have talked about the work offload by digitalization and automation, and they keep saying it, but it is still not happened, the contrary it keeps increasing, more administration” (Fieldnotes, MRA WMTC).

To sum up, when a socio-technical configuration such as Blue Denmark enables land-based actors to determine the course of technological development to assert their power and gain social control of a selected group, it is arguably correct to suggest seafarers *can* be oppressed. More so when the crew remains responsible for the vessel, its cargo, and their safety, while barriers such as faulty, non-accommodating systems are forced upon them. Even more so when seafarers are shown to be as expendable as in the P&O case cf. 6.2.

Using a powerful word as oppression requires justification. Oppression will be used as a term describing certain social groups’ exclusion from established institutions. In this case, seafarers are excluded from technological development and implementation determined by land-based decision-makers.

6.3 - Trends & Blind Faith

Part 3. Now, while taking a *glance* at what influences the system of technological development in Blue Denmark I should advise the reader that this part might initially appear as a detour, though it is not. Exploring this question is partially to appreciate how the term technology is understood and used in Blue Denmark, but also in a much larger context. Part 3 will also extend the concept to other terminologies and buzzwords that appear as the green transition establishes itself as a force to be reckoned with and how such terminology reaches mutual consent. This appears problematic since actors' opinions in Blue Denmark vary significantly on what different values and norms to ascribe to the green transition (Møhl, Krause-Jensen, and Skårup 2022).

Technology is not a new thing and has arguably been around since the first tools of flint. Also, automation was introduced (if not earlier) with the steam engine. As the Head of DMF expressed; “in my almost 44 years in the maritime industry, I mean, digitalization and automation is not a new thing, especially in shipping” (07:38 Lundberg). What is rather new, however, is the complexity and the need for a multidisciplinary perspective in its construction.

Even for lonesome me, it has been a dilemma to find the right words and ensure what is meant by *technology*. Technology in itself is ubiquitous as it can address a hammer or a supercomputer, both being valid. That introduces the variety of technology and that using the term can mean a lot of different things to different actors which complicates multidisciplinary collaboration. Before the different sites in the system can be evaluated we need to understand the meta-perspective of *technology*, what technology means to different actors, and if a common language around technology exists.

Picture 14 - a picture of me using an older *technology* of celestial navigation equipment.

6.3.1 - What is Technology?

A LinkedIn post seen on the 11th of April 2022 was titled; “it is time for flying electric cars, the future is here”, to which a colleague beat me to comment; “a flying car, do you mean an airplane?”. The discussion went on to claim the difference was that it was a “bad airplane” or “more like a helicopter”, which I fail to see clarifies anything (Fieldnotes). Maybe the consequence here is not that drastic but when multiple actors attempt to solve a complex problem such misalignment of terms can be devastating. Mutual understanding is an important aspect of multidisciplinary collaboration. This was agreed by the Head of DTUM; “it is important that what you are doing is clearly defined and communicated” (35:33 S. Hansen). To illustrate I will use the term, or buzzword *autonomy* as a case.

6.3.1.1 - Autonomy as a Case

As I entered the land-based, I have heard a lot about autonomy. I have by now attended multiple presentations on *autonomous*, unmanned navigation, see Appendix 4 - Events and Other. To be blunt, some of them have left me speechless as the absence of appreciating navigational practices becomes so noticeable that their *products* are difficult to see applied to the real world[13]. Well aware of what stage the project was at. Simply because it is based on a wrong assumption of how navigation is conducted. It leaves one to wonder how funding was ever acquired in conjunction with the climate crisis as it appears inapplicable and only conducted as a science experiment of sorts. I will say, I assess this from what I have heard and seen, I could be mistaken. Nevertheless, as I said to a colleague, “if I do not understand it, I am

[13] Developers are trying to build an autonomous vessel based on the rules of Collision Regulations (COLREG). Current COLREGs depend on the rule of good seamanship. I.e. It is completely dependent on the human operator to act with human adaptability to interpret a given situation. Simply because it has not been possible to write the rules of the sea, without the human mind interpreting a complex situation of conflicting rules. And now they are trying to build an autonomous system on the basis of a set of rules, completely dependent on human intervention.

confident that someone at sea does not either" (Fieldnotes). But enough with authentic observations and on with some facts.

In 10 years, Danish Shipping expects a crew reduction of 10-20% due to the rise of autonomous shipping, causing more crew to become onshore operators. They further state that *they think* autonomous ships can perform better concerning safety and carbon footprint (RINA 2018). Not something that has reached a consensus, as S. Hansen disagrees; "[...] I do not think you can remove the crew, it is not realistic for us, maybe in the distant future" (19:34 S. Hansen). Moving the operators ashore, in itself, has many challenges (Man et al. 2018). Furthermore, where many see autonomy as a force to replace humans it is mostly the case that autonomous systems (not ships) are developed to support humans in making decisions, as she discusses; "[...] you should not do autonomy just because, it should be to enhance safety and efficiency [...] so autonomy is more like a support function than a system to take over" (19:03 S. Hansen). The frustration when a buzzword emerges with multiple or unclear meanings can be elaborated through an article by Eriksen where he writes; "the problem arises when the new use of the word is not clearly defined or if there are conflicting definitions, perceptions, and uses" (S. Eriksen 2019, 33). The problematics may be magnified by an experience I had last year;

> "To illustrate this we can look at a peculiar experience I had with a company presenting their 'autonomous boat' at Svendborg harbor in late August. Amongst the spectators, I overheard people debating whether or not we could assume that the unmanned ship can be realized. Many believed that it would never happen or at least not in a very long time. Some argued that the company was not at all capable of producing the technology needed for an unmanned ship. But, the company never claimed to be able to do so. They acknowledged that their system cannot operate without human supervision but it can function as an aid to the navigator. People were trying to debunk a statement never made by the company. We were watching a demonstration of a system that should aid the navigator while spectators were arguing that the ship would not be able to navigate by itself. But! But is a vessel carrying such a navigational aid autonomous or unmanned? Well, certainly not unmanned as there still needs to be a human navigator present. But then, another company had an article in the paper, Søfart, in October about having ordered a fully remote-controlled vessel. And then you might ask, is that vessel autonomous? Well, it is certainly unmanned as the navigator now remotely operates it. Autonomy is frequently used but is not defined in any way that will make sense for stakeholders" (Kristensen 2022, 19)

Eriksen continues that the consequences lie in; "an unclear definition is problematic since a statement or projection may lead to unrealistic expectations if the reader's [receiver] understanding of the term does not match that of the author" (S. Eriksen 2019, 33). Autonomy is defined in a dictionary as; "the ability to act and make decisions without being controlled by anyone else" (Oxford University Press 2021) i.e. the variety of *what* actors can be talking about is truly significant. Like in the above-stated example, the different actors are addressing widely different types of vessels. Also, the presentation from ShippingLab at the event, IDA Maritime an update on autonomy (IDAMAN), did not acknowledge the difference in the assessment of; how plausible it is that a vessel can *crewless* cross the fjord of Aalborg (Fieldnotes,

IDAMAN) against crossing the Atlantic or passing through the strait of Singapore[14]. Apart from the fact that they both float, is a non-relatable issue. Unclarity in *what* is being addressed can further cause a receiver of an argument to prepare counterclaims to something that was never actually in the sender's intention, as written by Eriksen; "ambiguity in the term also makes it hard to challenge statements made by authors if exact definitions are not stated in every case" (S. Eriksen 2019, 33–34).

Similar predicaments can be found in the discourse of digitalization. Inspired by digital logistic successes such as Amazon and Alibaba, Danish Shipping wants to transform the sector from analog to digital (RINA 2018). For this to become reality, the report points to autonomy as paramount for what should be Denmark's priority going forward. As the report states that 40 million USD has been earmarked for this transition (Gyldensten 2017), something is to happen for sure.

One of the benefits of digitalization is the enhanced and eased processing and collecting of data. Such data can provide ship operators with valuable insights into ship operation e.g. engine, system, and crew performance. This has been addressed many times, including the Digital Harbor (DH) event in Esbjerg and at the latest at the AI Regulation (AIR) event both hosted by MARLOG. Such quantifiable data is important for the further development of technology. Digital methods can easily map, visualize, and display huge amounts of data (Fieldnotes, AIR). However, these fruits are not easily harvested and it is not all that modest. STS Professor Jensen says; "I mean now you hear one story after another about AI, how it has solved something spectacular. If there is one thing AI did not do, then it is solving anything" (09:19 Jensen). Furthermore, it has been addressed before by DMAIB that; "there is a lot of data, that is not the problem, the problem is we do not know what to do with it [...] there are no models to support analyzing the data [...]" (Hilduberg 37:04). A study by the digital newspaper EMC found that less than 1% of the world's data is analyzed and 80% of the data is unstructured (EMC 2012). AI is extremely resource-demanding and dependent on human work such as setting the framework, sorting the data, and maintaining it. Granted, quantification is next to impossible for a human to do, the Professor further explains; "[...] at the end of all that work, indeed, you can say, AI did it. It is like saying it was the nuclear physicists that won World War 2" (09:49 Jensen). Lastly, there are currently huge challenges regarding the legislative aspects and ethics (Fieldnotes, AIR).

We can look to the highly attractive Energy Efficiency (EE) systems as an example. Even though there are low-budget and available measures to gain EE improvements that are not utilized, cf. 6.3.2.1. If some actors are incapable of utilizing such non-radical improvements they are not likely to adapt to futuristic complex digital solutions (Viktorelius, Varvne, and von Knorring 2022, 2). In a study by Man, Lundh, and MacKinnon on the effectiveness of an EE system, it was found that fuel consumption data were displayed complexly and not easily understood. One reason is that the data displayed had little relevance to the practice undertaken by the crew (Man, Lundh, and MacKinnon 2019, 3–5). In a previous semester project, we investigated how failing to understand new systems can lead the user to avoid newly implemented solutions and pick up familiar methods instead (Thorsteinsson et al. 2021). The same can be the case at sea, cf. 6.1.2. Going back to the study, the EE system failed or at least did not induce EE practices. Collected data would further become useless for the earlier started benefits of initialization as

[14] The strait of Singapore is known for being heavily congested.

it would provide land-based analysts with flawed data. Inevitably such malnourished data leaves analytical outcomes quite out of touch with reality (Man, Lundh, and MacKinnon 2019, 4).

Digital data extracted from the vessel can be difficult for land-based actors to interpret for different reasons e.g. the intention of how and why it was created, how the intention changed, and the various factors and input that formed it. This means that data does not necessarily bring the viewer any closer to understanding the context from which it came. The value of quantifying data is undiscussable *if* it is supported by qualitative accounts. Therefore, it is not a solution in itself, this was agreed by S. Hansen who argues that; "the human brain can do things a computer cannot, but a computer can calculate never-ending amounts of numbers, and fast" (20:01 S. Hansen). Shipping operators already possess a lot of data but they cannot administer or get contextualized meaning from it because they lack insight into seafaring practices (Man, Lundh, and MacKinnon 2018, 803). The challenges of contextualizing such data in the social setting it occurs in and the context under which it is to be interpreted, persist. Such a *gap* should be acknowledged and bridged by qualitative accounts (Munk 2019, 160–61).

Through my fieldwork, it is easy to feel that digitalization appears to be a prominent feature of the future (Fieldnotes). At the movement, technophiles experience an increasing interest in modern digital solutions (LaBerge et al. 2022) while many parts of shipping struggle with simple connectivity, cf. 6.2. While the use of digital methods in society may have been aided by habits contracted from the COVID era, there still is a way to go. Interestingly, although given its apparent godlike status among actors, a mere 30% of shipping companies have implemented or have a strategy for digitalization (Man, Lundh, and MacKinnon 2018, 796).

> I was in April 2022 invited onboard a brand-new vessel berthing in Copenhagen. I could not help myself from snapping a picture, see picture 15. In the picture are some folders. These folders are very *peculiar* to see, especially on a brand new 2022-built vessel. And I will tell you why. The three binders from the right labeled 1, 2, and 3, are *old* maintenance filing folders. Before vessels had a digital Planned Maintenance System (PMS). These folders were used to document scheduled maintenance. This is how far digitalization has come in some places. If my memory serves me right, these were published in 1981. They are only still on board because legislation, still, does not accept some digital systems. I thought they were gone (ae)

Picture 15 - picture of the folders.

The discourse on where we collectively stand with digitalization is hurting our unified progress. By attending a series of webinars hosted by Aalborg Maritime Network (AMN) on Marine Sustainability by Digitalization (MSD) I have observed many businesses discuss digitalization. It was stated on more occasions that the data is available there but they need to know how to make sense of the data. While many land-based actors appear very optimistic about the progress, the story is different at sea. If you ask the seafarers, they will say there is less and less collaboration. If you ask the land-based people, they will say there are more and more. Perhaps since they can extract data from the vessel at will (Fieldnotes, MSD).

To sum up, there exists a discourse on technology and other *buzzwords*. Therefore, increasing mutual understanding and unified direction of what is trying to be achieved is key. The social perspective is important, autonomous ships relay a notion of poorer employability as others (technology) can perform better (Poulsen et al. 2022). Understanding the need for socio-technical equilibrium is vital for constructing automated solutions (Bainbridge 1983). Developing automated digital technology holds huge potential to make ship operations more effective and emancipate humans. Technology and digitalization bring valuable and interesting opportunities along with them, but also challenges. It is important to be critical of claims of what is technologically possible and remain skeptical of data that has not been contextualized. Therefore it appears valuable to further explore where the technology gets its social context and status from.

6.3.2 - Societal & Social Context

Blue Denmark is arguably affected by tech utopias. However, one thing is how Blue Denmark addresses technology but then what influences Blue Denmark? What about the faith and meaning we as a society ascribe to technology? To address this question I draw a lot on my interview with STS Professor Torben Elgaard Jensen and my studies as a TAN.

Contemporary technology is often synonymous with innovation and new technology must be Hi-Tech such as AI and autonomy. The thought to digitalize everything may be traced back to utopian accounts from Silicon Valley on technological determination (Protin, Stuart, and Weinberger 2020). That means technology and digitalization have been deemed a savior for some time now. This was heard from a former seafarer at WMTC 22; “already back then [2007], they said, now let us digitalize everything, problem solved” (Fieldnotes, WMTC). To which there might be mixed opinions. However, from the perspective of STS, this is far from reality, Jensen argues that; “[...] there are many ways to be innovative, you can be innovative as a worker at a governmental organ in the middle of 8000 other employers, innovation is everywhere” (20:53 Jensen). The field of medicine may be equally disproportionate to what technical experts claim to achieve while neglecting what social structures allow them to achieve. Like during COVID, he argues; “you can say that it is the vaccines that saved the world, but looking at Denmark and Romania, both countries had the same vaccines, but since none of the citizens in Romania wanted them, as they had a distrust of the government, it had no effect” (10:19 Jensen). The two countries have relatively different levels of trust in the government which should be considered when evaluating the success of the vaccines, he evaluates that; “arguably it is a summation of trust in the health system in Denmark together with experts' vaccines. Clearly, some say that in the end, it is the vaccines, it depends on how you tell the story [...]” (10:53 Jensen). The tech industry has gained an enormous amount of power, some of it justified. But from a democratic point of view it is not all positive, as he expresses; “[...] no doubt, the tech industry, and lobby are very good at claiming credits and then argue for more money to further development” (10:53 Jensen).

A problem when *evolution* occurs too fast is that no bestowed methods are in place for regulating the new and unknown, a problem noticed by the Professor; “as a society, we are maybe a little defenseless to these claims as we are worried that the USA and China will get it all [technological achievements], so definitely, we need some serious tools to evaluate technology, because as a whole, it is hard to do” (11:50 Jensen). As nicely put by the Professor in an interview with Techmediet Radar; “technology is far too important to leave to the engineers” (Techmediet Radar 2022).

Milestones reached by technological advancement are indisputable. However, it has arguably affected society towards a blind faith in what can be solved with technology, and when. In a discussion at MRA’s workshop at WMTC, circular economics in the Netherlands came up. The Netherlands was striving for a circular economy for 2050. However, it has supposedly already been abandoned as it is simply not possible. As *we* want millions of different products available all the time, the newest phone and strawberries in winter, a local circular economy just seems impossible. Changing habits and patterns of consumables are not something that happens overnight, sadly it was observed at the workshop that; “we are just not ready for change” (Fieldnotes, MRA WMTC).

It has become clearer and ever more important, change is necessary. An unprovoked war on Ukraine has propelled the rest of Europe into an energy war with Putin (Vaughan 2022). Once again politicians react only as they are faced with unignorable facts and consequences. They have been warned in ample time to deal with the problems and change direction (Scavenius 2022b; 2022c; 2022a). As the energy, climate crisis, and actual war, now include imminent graspable consequences, action can be seen taken further at a political level, as the Danish Prime minister says; "it has been said before, energy politics are not just energy politics. It is also about security politics. That is why we [the government] have decided that Denmark is to be independent of Russian gas" (Borre 2022). Which is proposed to be both very expensive and very difficult (Kehlet 2022; KEFM 2022). Technology is now not only supposed to solve the climate crisis but also geopolitical mishaps with Putin. This suggests that technology has been given a substantial responsibility by society.

6.3.2.1 - Alternatives to Technology

Placing this unrealistic responsibility on future technology seems odd as there are applicable possibilities with current technology. Not to mention non-radical organizational changes, cf. 6.3.1.1. Cf. 6.1.2 time and resources are spent on solutions with no apparent possible or immediate contribution to the green transition. Low-cost simple EE measures in the maritime sector can cut up to 75% of CO_2 emissions, while also reducing the cost of operations (Johnson and Andersson 2016, 79–80; Viktorelius, Varvne, and von Knorring 2022, 2). However, this proves difficult (Poulsen and Johnson 2016). An example of this is the Ship Energy Efficiency Management Plan (SEEMP) which was introduced in the early 10s to ensure the ship crew acted and planned for reducing the energy consumption of their vessel (IMO 2011). Unfortunately, the effect of such initiatives proved insufficient (Johnson and Andersson 2016, 80). The initiative was scrutinized as social structures were neglected. Such a system should be deeply rooted in both social and technical aspects, in a socio-technical setting (Kataria et al. 2015, 170).

> I remember well when at a ship meeting we were introduced to SEEMP. It was presented as an extra burden for us from the office. I recall the first draft including demonstrative points such as remembering to switch off the coffee maker. Likewise leaving the lights on when leaving rooms, garbage handling, and so on. Minor things that perhaps were commonsense back home, where you paid the electrical bill yourself (ae)

EE practices such as the SEEMP leave it uncontextualized up to the personalities onboard at the time of drafting. The rotating crew[15] then have to make sense of that. If a crew has a low interest in or awareness of EE it will be reflected in the SEEMP. Contrary, if the crew possesses a high concern or even healthy competition for EE that too will be reflected (Man, Lundh, and MacKinnon 2019, 6). In my later days as a Chief Officer, I would encourage the bridge team[16] and so we would often compete on who could maintain the lowest fuel consumption throughout a watch (ae).

[15] The crew on board does not stay the same. Once the crew has stayed their contract, they will be relieved. Crew change can be one, more, or the entire crew changed. Which requires the *handover* between positions to be very elaborative.
[16] The bridge team are the navigators on board.

Picture 16 - a picture of the telegraph[17] on a large tanker set to full ahead

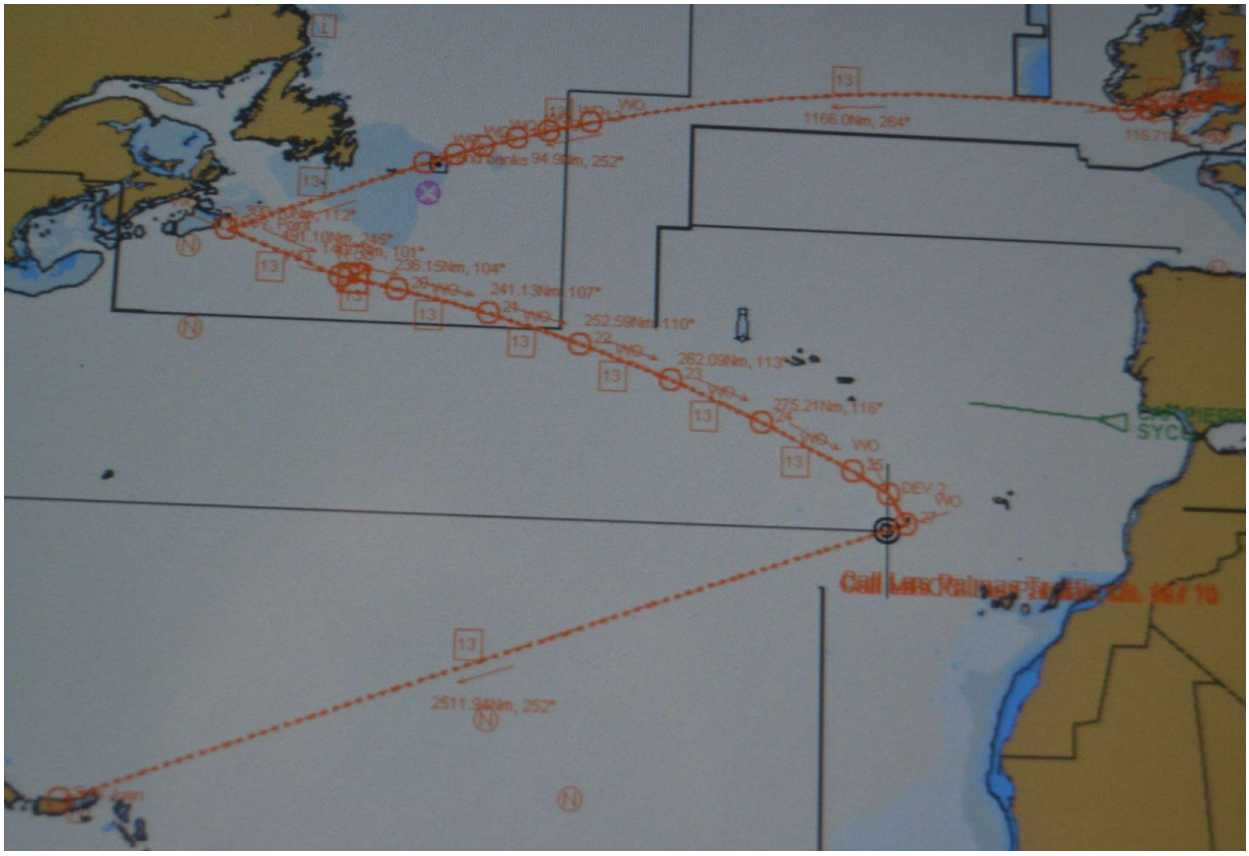
At a presentation at WMTC 22, a revised edition of the SEEMP was proposed as one of the keystones in ensuring the International Maritime Organization's (IMO) 2030 and 2050 Goals (IMO 2022). The argument was that enhanced monitoring of fuel consumption would induce positive change. To which I agree but fail to see it as an ultimate solution. In the presentation, only two aspects of the operation itself were mentioned. Even though it has been demonstrated through the last decade that such change does not happen without managerial guidance and policy-making. I asked the presenter why only two operational factors were included. He acknowledged that there were others but had chosen not to include more (Fieldnotes, WMTC). These revisions do not change the fact that when such responsibilities are handed down as a, *here fix this*, then traditions, personal interests, and knowledge will be reflected in the result. Ultimately providing low cause for effective change. Furthermore, such SEEMP would still be individual for every ship with no mutual learning system between ships. That leaves one to wonder how many SEEMPs include turning off the coffee maker when not in use. While that is a good move it is still somewhat futile in the bigger picture and for everyone to conclude that independently, is a waste of time. EE systems should not be developed in silos/vessels around the oceans but in mutual forums engaged with by both sea and land (Man, Lundh, and MacKinnon 2019, 6). Imagine a healthy competition across a fleet on the lowest fuel consumption and the effect it could have on traditions in shipping. It is EE changes like this that appear to be *easily* applicable and inexpensive, yet fail.

Why is that? There is most likely not a simple answer. But in bringing up the darkest side of shipping there is an element of motivation for seafarers to deploy EE too. There are impenetrable motivational

[17] The telegraph is the *gas throttle to the main engine.*

barriers for the crew to conform to *meaningless* EE initiatives. Motivational barriers such as the trading of natural resources as commodities. The ugly side of capitalism shows itself to me firsthand;

> Imagine this situation, a tanker with a cargo of 50.000 tons of diesel. Loading port Northern Europe, cargo sold to New York City, USA. During the voyage, 2 days before arrival in New York City the cargo was sold again to Lagos, West Africa. Again during the voyage, just off the Canary Islands, the cargo was sold to San Juan, Puerto Rico, see picture 17. This will end up being the actual unloading port. Distance traveled with the *same* cargo, approximately 11.112 nm on a voyage spanning 5042 nm if traveled directly. A vessel that travels at 12 knots service speed, consuming about 125 tons of heavy fuel a day, i.e. burning 4800 tons *more* on such a voyage. A vessel operated by some 20 seafarers who are then told to switch off their coffee maker while not in use (ae)



Picture 17 - a picture of the route in the example above.

How much fuel would have been saved on this journey if the vessel were equipped with a digital route optimization or EE system as opposed to how much fuel would have been saved by not trading oil as a commodity? While this goes on often (Bockmann 2022), we ask ourselves how technology can save x% fuel on operations. Not a scenario boosting morale and willingness to change. Of course, everyone should be ready for change. But it is expressing a serious problem in retaining some capitalist freedoms while we (through technology) frantically search for solutions to attain a future that includes us.

A vessel crossing the Atlantic Ocean no less than three times with a cargo of 50.000 tons of diesel, trading it like it was a stock for-profit while dispersing negative impacts is currently acceptable in our society. Choosing my words very carefully, there appears to be a *blind belief* that technology will save us, that capitalism is the one true system, and that societal growth can only be obtained through growing revenue. Although the aspect of financial value can be detected to have many motivational traits (Herzberg, Mausner, and Snyderman 1993). I truly believe that similar motivation can be found in playing a part in the green transition thus ensuring a sustainable world. Theory on such motivation can be found in the studies of Harry Harlow and Edward Deci (Pink 2012). But switching off a thousand coffee makers while an elite becomes billionaires from unnecessarily burning tons of fuel, is not going to motivate a person for a change. Nevertheless; “seeing as we are fighting for our collective survival, maybe the strategy should be revised from the legislator's perspective” (Kristensen 2022, 24).

Picture 18 - a picture I took at the anchorage of Fujairah, hundreds of tankers waiting to sell their cargo of *black gold*.

As the reader might slightly feel this project is getting off-topic. I assure you that it is not. The social context and how it has affected trends in the development of technology is of great significance. Having said that, turning back now to the question of what technology *is* and how technology can benefit here and now.

6.3.3 - Technology, Preferred

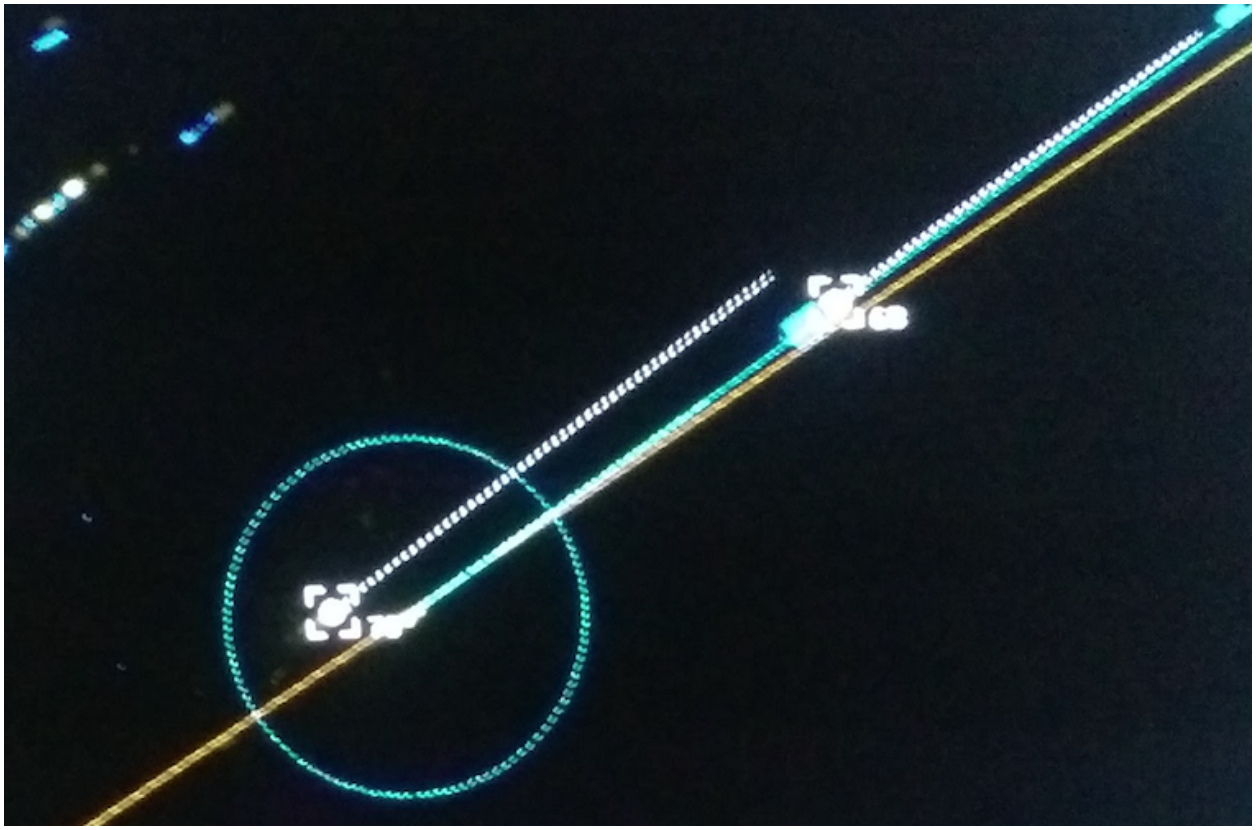
To recapture, at the beginning of this project the technology of interest was described as an exploitative interactional automated digital system, such as the forenamed EE systems. Exploitative and interactional have been formulated to be somewhat applicable and dependent on user interaction, cf. 3.0. To briefly address automation and digitalization and how they can enhance shipping operations can be understood in the example of the ECDIS;

Picture 19 - picture of me doing manual work on a paper-based navigational chart

The ECDIS revolutionized the practices of the navigator by; digitally automating manual position-fixing to show ship location in real-time, enabling the use of a single navigational chart (screen) by introducing zooming, easier iteration in passage planning, and easier iteration in dynamic ship data and safety parameters. All these manual and time-consuming tasks are now executed at a moment's notice (Krause-Jensen, Hansen, and Skårup 2020, 35). Defining automation from a dictionary; “automation is the use of machines or computers instead of people to do a job” (Cambridge University Press 2021). Like the features inaugurated with ECDIS that free the operator to care for other tasks.

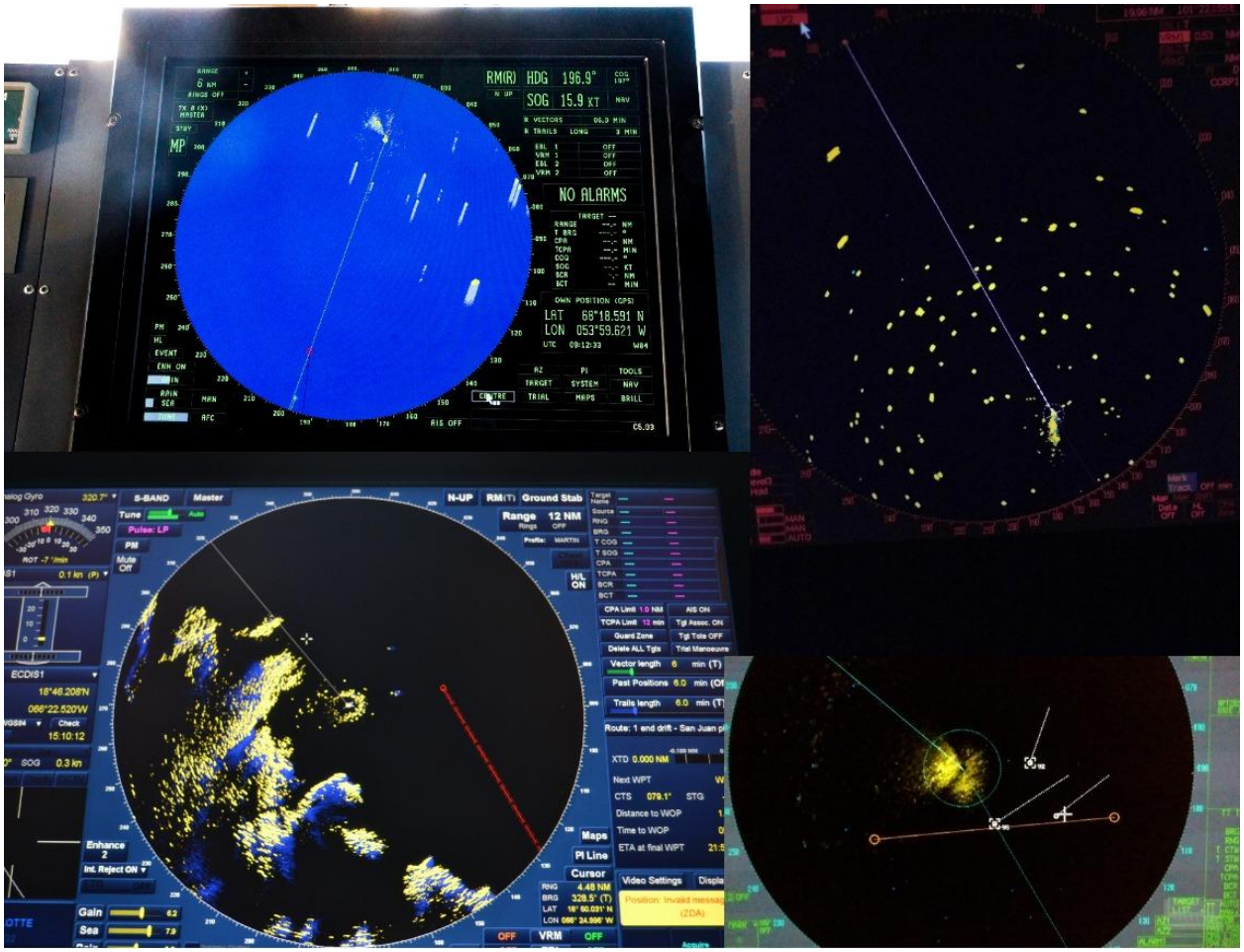
> Recalling a feature of the ECDIS system called the *Predictable Vector*. The predictable vector feature would enable me as a navigator to *fast-forward* a current situation for up to 60 min to visualize what would happen in the future if targets[18] would keep their course and speed at that specific moment. Although it did not account for the dynamics and potential individual decisions of all other targets present, it provided me with a valuable visualization of how things would develop in front of me. This computation of data would take me many moments to calculate, which the system provides as fast as I can move the minutes' slider (ae)

[18] A target is a term used for the echoes a RADAR registers and calculates movement of.



Picture 20 - a picture showing the dotted line that is the vector, it can be set to relative and the time can be adjusted, providing a visual of a future scenario

Such instant data visualization enhanced my decision-making abilities and cut down consideration time significantly, illustrating how data displayed correctly and in tune with the given practices can optimize tasks. The same would apply to EE systems e.g. a relative vector is created instantly as the navigator increases or decreases the engine power. Then, possibly even considering external factors, immediate results of the navigator's action would be easily readable at a moment's notice allowing instant reconsideration. Such predictive insights would enhance EE and even facilitate better inter-ship collaboration (Man, Lundh, and MacKinnon 2019, 5–6).



Picture 21 - pictures of a RADAR computing and displaying in real-time, something that would be impossible for a human to do. From top-left and clockwise; the relative motion of icebergs; several fishing vessels in the South China Sea; other vessels' relative courses and speeds; showers and their movement.

It is utilizing these current technologies and the interoperability between them that I argue holds relatively effortless achievable potential. And as the position of the seafarers and the purpose of technology along with its context have been addressed, it is time to enter the sites of the system.

6.4 - The System of Blue Denmark

In the 4th and last part of the analysis, we look at the system itself, what constitutes the system, what are the different actors' perspectives on technology, and how the actors juxtapose. The informants have been presented cf. 4.4. This section will follow different themes through the sites of the system analyzing how they are positioned, their perspectives on each other, and why they fail to recognize the user. The idea is that the data will be presented in the same way that I uncovered it. So as this site-to-site *conversation-style* presentation of data will begin, I kindly remind the reader to consult Appendix 4 for an overview of informants and events. Cf. 4.4, the sites were described as;

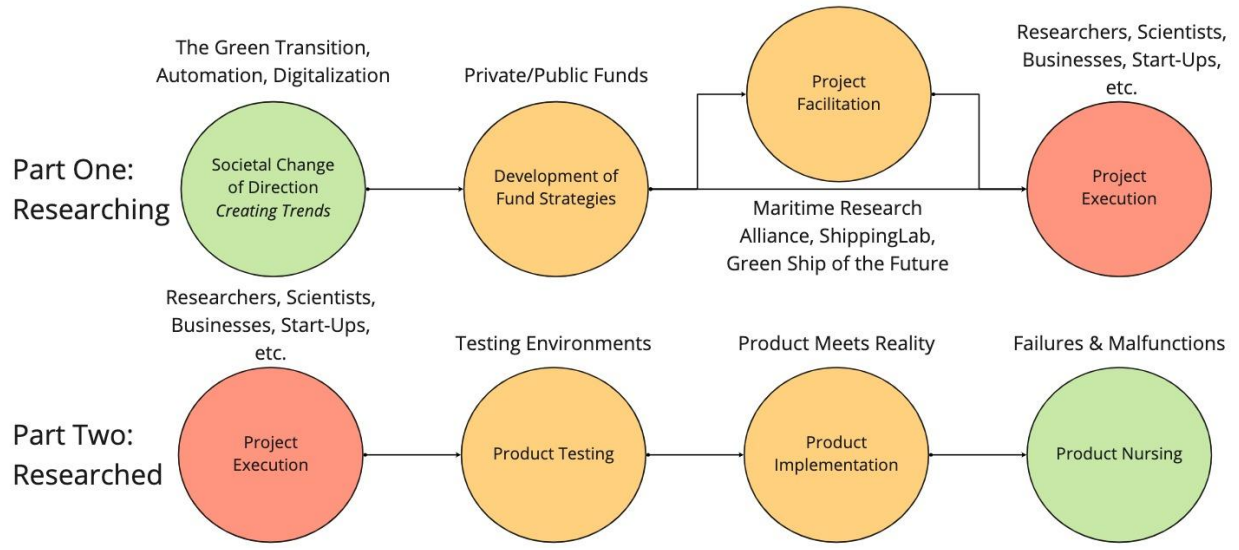


Figure 7 - cf. 4.4.1, the sites of the system visualized

6.4.1 - Actors of the System

Cf. 6.1, 6.2, and 6.3 the disconnect between land and sea along with the constitution of the world of shipping often results in sub-optimal conditions for solutions of change. Arguably, many of the challenges addressed earlier in the analysis could be solved by collaborating and involving the user much earlier. So why is it not done? To find the culprit obstructing collaboration I initially went to the project facilitators as they are branded as impartial collaborative spaces. The project facilitators have an exceptionally significant position in coordinating the development of technology. However, the Project Director of ShippigLab, Gary, tells me; “we are driven by the industry’s interest as they are our core stakeholders. The companies in Blue Denmark both the shipping companies and manufacturers, everything we do has to have a positive effect on them [...]” (09:41 Gary). He also says that they are; “[...] funded by the Innovationfund it is yours and my money” (08:47 Gary) which further implies keeping the interest of certain organs. The shipping companies also have customers to please, the Head of Business Development at Esvagt told me; “it is the big ones, the big energy, and oil companies, they are our customers” (13:05 Overgaard). So, there are many different stakeholders for the system to please which can mean the focus on the user fades. Even though the project facilitators are meant to act as bridges between actors there are rules for their work and they too, face the challenge of including the user. Gary informed me; “I think it is one of the greatest challenges of what we do, to bring in the navigators, the ones with the practical experience, I do not how you could do that” (18:53 Gary). They often turn to maritime academies for knowledge on seafaring practices, Gary says; “we depend on the maritime academies, SIMAC e.g. and their facilities, not the same as the real deal but we try to get practical experience from them” (19:31 Gary). The Head of DTUM also said; “often the educational institutes act as the source to domain knowledge” (10:00 S. Hansen). The universities are also implicated by user involvement as it is difficult to see a clear line between when research stops, and development begins. Therefore, it is also difficult to assess when user involvement will commence, which was identified by the Head of DTUM; “as to whether or not something is implemented, that is the next step,

after research, it is not often research projects are involved with implementation" (04:52 S. Hansen). Research is often handled pre-concern of development and implementation, as she further elaborates; "research Projects for us is almost always conducted in collaboration with the companies, and you know, implementation is after such a project" (12:13 S. Hansen). Granted, there is a stage where it is completely on a conceptual level and the user cannot be involved. Recalling the reply I got in an email from the Orients Fund on how they ensure user involvement and redirected me to DTUM, cf. 4.4.1. The Fund told me that they ensure user involvement through applied science which DTUM was responsible for. However, DTUM's S. Hansen tells me; "I think it is highly relevant to address this. Applied research is one thing, but that is together with the companies, so a next dimension is getting a finger on the pulse of the user, to understand how it is to be implemented" (12:31 S. Hansen). When asked about the issue of user involvement many actors point to the shipping companies as gatekeepers. If the shipping companies are gatekeepers to end-users i.e. the navigators, then they have a responsibility for their availability, to which Esvagt's Overgaard mentions; "it should be as easy as inviting the seafarers to participate in projects, it is extremely valuable, for sure it is something we have to get better at [...]" (19:13 Overgaard). When asked about the project facilitators, he replied; "I know of them but have not worked with them" (07:07 Overgaard). The project facilitators are here seen as more of a research initiative which is not the main interest of the shipping company, as he elaborates; "we look at the projects that come to attention, but if we are to invest in a project, we have to be able to see how that reflects positively back on us, we are not in on heavy research [...]" (10:55 Overgaard). Understandably, given the fierce competition in the industry and the lack of international regulation, this was acknowledged by the Head of the DMF; "[...] they [shipping companies] are concerned with what provides positive revenue" (50:33 Lundberg). Although this is a sound argument it is seen as a problem, as Gary tells me; "[...] when approaching the shipping companies in the development phase, they very quickly become *operational* in the sense of what they can use here and now" (24:45 Gary). So there is a conflict in actors' agendas. This is a problem since it means paying more, as I was told by the Head of DTUM; "first of all it is going to be more expensive, and the company needs to take more responsibility, so eyes need to be set on the long-term investment" (12:46 S. Hansen). This reminds me of an amusing anecdote heard at WMTC 22; "in 2008 the shipping companies had no money to change, now they are too busy making money to change" (Fieldnotes, MRA WMTC). There are challenges in handing out responsibilities, therefore MRA's Olesen proposes that; "instead of the shipping company making promises, then maybe the team [developers] should be more multidisciplinary, e.g. the engineer looks into the technical aspects and the anthropologist researches the users and their practices" (48:22 Olesen).

Among the land-based actors, it is often Danish Shipping that acts as the voice of the many shipping companies, Project Manager at MRA said; "when talking about the shipping companies, it is often Danish Shipping that is the main actor [...] (14:29 Olesen). This pushes the seafarers even further away which is probably why they are rarely consulted. This was also recognized by the Head of GSF; "[...] it is rarely the case that the end-users are participating in developing and purchasing these different systems [...]" (25:31 Riis). But when we have today's digital methods there should be no excuse, as argued by Overgaard; "something as simple as Teams meeting, I mean you cannot argue that there is not a way to connect to them" (20:00 Overgaard). It is worth mentioning that Esvagt's vessels are based mainly in the

North Sea where the digital infrastructure is significantly better than in other waters. Therefore, such a solution may not be universal, yet, as Overgaard continues; “it is like there is a permanent drag in this business to catch up, it is somewhat conservative, it will get there, just not as fast” (27:30 Overgaard).

When discussing where the occurrence of user involvement could take place, Olesen suggests; “it could be the fund managers, e.g. they could be more explicit in what is required, a plan for involvement [...]” (43:26 Olesen). Again, handing out responsibility is a risky task, as he acknowledges that; “it is difficult to say it is the Funds’ responsibility to make sure that whoever gets a bright idea can get it to the shipping companies [...]” (45:01 Olesen). Alternatively, it could be the, as S. Hansen suggests; “[...] researchers themselves, could be responsible” (36:55 S. Hansen). An answer from GSF even addressed the entire process; “I do not know what to tell you, but I would hope that they contemplate on this [to include user practice] in fund management, so through the whole process [...] (43:42 Riis). As to whether the Fund would be aware of this is unclear as only DMF was interviewed. However Gary tells me; “just off my tongue, I believe they [the Funds] have a plan for the implementation, but that is very general, not a specific way of how it is done during development” (31:25 Gary). When asked if there were any standardized procedures in place DMF’s Lundberg answered; “do we ask if they [start-ups] intend to involve users? No, if it is a start-up it should be included as an important element of their project” (11:22 Lundberg). Some justification must be given to DMF as they are a small Fund and branded as being *high risk*. Nevertheless, it does leave some wondering if fund management should be held accountable for project managers not being guided to include the practices of the user. When talking to the shipping company, it was very clear that a full plan was needed for a project, as Overgaard states; “without a doubt, you do not get money if you cannot describe how and where it is to be implemented” (16:13 Overgaard). This might have something to do with the fact that they are, mostly, engaged with private Funds (15:36 Overgaard). However, as S. Hansen rightfully argues; “in the end, it is everybody’s responsibility, if you can call it responsibility, but if the problem is that technology does not work due to lack of user involvement, then everyone should aim to achieve that” (37:00 S. Hansen). And as she continues, regardless of who should have responsibility; “[...] user involvement should be addressed in the beginning because it heightens the chance for project success” (38:43 S. Hansen).

6.4.1.1 - Funding

Initiatives like MRA have been wanted. The universities are important actors in getting the knowledge to the right people i.e. addressing the problems cf. 6.1 and 6.3. Researchers must acknowledge the need for multidisciplinary collaboration and include as many perspectives as possible. Hard science and quantitative data, as have mainly been the focus, are not enough (Viktorelius, Varvne, and von Knorring 2022). However, what research gets prioritized appears affected by funding structures while also introducing a competitive factor to get funds as actors are to apply and the best application is granted funds. Where the idea stems from is not certain but Jensen mentions that; “we see the same logic in many other places in society” (17:18 Jensen). This can mean that research and project funding can be influenced by trending topics, cf. 6.3. An assumption that technology is attracting funding seems correct, as Olesen tells me; “it is my opinion that it is easier to get funding for technical research in place of social sciences, I do not carry in statistics, but it is my opinion, the technical is the big trend right now” (20:12

Olesen). And he recognizes that it is not uncommon to; “assume that having a more humanistic instead of purely technical approach would enable a higher applicability” (51:06 Olesen).

When discussing what impacts the operation of project facilitators it seems plausible that they are influenced by more powerful actors, GSF’s Riis tells me; “it is about creating jobs, and promoting the Danish maritime industry, if you cannot do that, then it is not a Fund’s project [depending on the Fund]” (12:44 Riis). Especially those with public funding. Cf. 6.3.1.1, autonomy has been described as a pinnacle for bringing down emissions from the shipping industry (by Danish Shipping). Looking at ShippingLab’s autonomy project, half of the budget for ShippingLab (mainly public) is earmarked for autonomy research and development (ShippingLab 2022b).

Initially, I assumed being granted money for a specific project could have a restrictive impact on a given project. However, when I asked if project facilitators felt restricted by their application it was quickly deserted, Riis mentions; “the agenda is generally set from a fund application [...] but if there is sound argumentation that the method will not work, then it is possible to change that” (11:54 Riis). There might be a notion that actors are bound by their initial application but that does not seem to be the case, Gary tells me; “we are not bound by the application, some of the partners may feel like it. We do things as long as it makes sense if it does not then we intervene [...]” (35:22 Gary). When asking MRA it was found to be; “more important to agree on what we are supposed to learn from a given project [...]” (32:26 Olesen).

Whether true or not, there are peculiar similarities to global social trends, something that Riis concurs with; “if we take society as a whole I think we can establish that there is an overexcitement towards technology [...] that technology will come and fix all the problems of the world” (36:08 Riis). Arguably this trend has gotten a foothold within Blue Denmark, as Riis continues; “like the rest of society, there is overweight of focus on the technology but I do not think it is with bad intentions, it is just following society where fancy exponential technologies are mentioned everywhere, so naturally, that is what attracts funding” (37:10 Riis).

Getting funds arguably becomes a sport or practice where significant amounts of time and resources are deposited. It can also be a contributing factor to the substantial focus on technical experts and the minor focus on the practice. The structures of funding sometimes remove the true context from innovation as it becomes a goal in itself to secure funds. ShippingLab’s Gary tells me; “[...] sometimes it is very easy to see in the application that they are trying to appease us with what they *think* we want” (32:39 Gary). It can be traced to trends like the use of certain terminologies that are used simply because of their *power* in society, as Gary continues; “sometimes it is more the fact that there is an argument, than the quality of that argument, that means something [...] like it does not matter what you answer as long as you answer” (33:33 Gary). Such projects are doomed at once, as he states; “in those cases, for sure it will not get implemented, because it does not matter to them” (34:17 Gary).

Looking up from below, trends can appear to inhibit applicable solutions. As I will elaborate on in chapter 8.0 I can see how SearchMaster’s product, especially combined with LifeFinder’s, can innovate a *dumb* thing. The inventor SearchMaster himself felt frustrated about this; “it needs to be called something

green, ours are not so there is no interest" (14:42 Mogensen). Hence, trends can prohibit applicable ideas that are innovative and make operations more efficient to be discarded, as he mentions; "we gave it the wrong name, we should have called it Green SearchLight" (19:54 Mogensen).

> During my time at the incubator at AAU, I have been taken aback by how the scene is constructed. Starting a company is not having a good idea with a product you think can better the world. It is purely about *pitching* and *funding*. So much so that most of the workshops in the incubator are practicing pitches (ae). And even more, AAU has a person filling out the position of *Innovation Officer* to conduct webinars on *how to fund*. A rather relaxed informal setup where they elaborate on how to best get funding, ending with; "just apply for more next year" (Fieldnotes, IF/IB)

Possibly we as a society do not have unlimited time therefore it is a harmful way of looking at progress, as Jensen observes; "there are seemingly no consequences from exaggerating what a project is capable of achieving, they just get another try" (12:12 Jensen). As introduced at the InnoFouder/InnoBooster (IF/IB) presentation, InnoBooster has an annual budget of 300 million DKK and a success rate of 30-35% (Fieldnotes, IF/IB). Depending on the individual, one might think positively or negatively of 30-35%. But considering the amount, and that there is a *non-innovative* solution applicable for reducing emissions, I do not take it positively. Granted this specific Fund is not maritime and aimed at the green transition specifically.

In summary, Start-Ups are small-time players and can at times happen to oversell a product. This should not fool big players such as funds, shipping companies, or project facilitators. Arguably, by the level of activity in the start-up environment, it can appear problematic as it can be interpreted as *how* society plans to deal with today's problems, i.e. through incentivizing the mass development of technological artifacts. The setting at the Incubator was also observed at Digital Tech Summit (DTS) 2021 and TechBBQ 2021. An observation I share with the incubator board member, Jensen;

> "I am on the board of this *incubator,* there are other members from a more financial-oriented background, very talented people. But it is very peculiar to me. I thought, to create a company, you just needed a good idea. For them it is not the case, you need to be able to tell a spectacular story of what you are doing. Because without a story, nobody wants to invest in your company, and without money, you end up wasting your time" (17:54 Jensen)

> The Start-Up scene is unique. It is a sort of mayhem where everyone is out for theirs and does not mind exaggerating the capabilities of their product. It is almost as if you are taught to speak in a certain way with certain words that attract the attention of those with money and power. Something I suspect autonomy, digitalization, sustainability, AI, Big Data, etc, are being subjugated to (ae)

Through interviews with the Start-Ups SearchMaster, LifeFinder, and Aprendio it appeared that new and small start-ups benefit a lot from these initiatives. Either to collect knowledge, collaboration, or funding. It was expressed as a very essential and valuable tool to develop initiatives and become established in a competitive world. However, it was also mentioned that it can be a hazard to become too dependent on

such support (M. Hansen). Even though receiving funds can be a very valuable thing it has a downside. The system is rather complex and inhibits the freedom of the innovator in many ways. Many of the start-ups from the start-up program *Maritime Stars* fail and never develop a finished product. This may be because many feel that once funding is secured and a prototype is finished, that is the job done. But the marketing aspect is where many fail and desert their idea. Even though SearchMaster has received support from some of the relevant initiatives, support in finding shipping companies to adopt and test their product is still missing (Mogensen).

The current constellation of funding appeared to require a level of self-maintenance (Fieldnotes). Furthermore, technical experts can seem to try and keep their current societal validation, as Jensen talks about the power of technical experts; "[...] they hold on to the idea that technology is fantastic, so when they tell the story they make it seem like it was technology in itself that did it" (09:10 Jensen). After which he addresses that it is; "[...] the same as every other sector, not because the tech industry is worse than others, they are simply extremely privileged at the moment. A sort of unjustified power that lets them dominate the narrative" (12:23 Jensen). Unfortunately, this upholds the assumption that technological greatness is a *technical expert thing*. Campaigning and lobbying are not free services, as the board member tells me; "researching technology is big business so there is an ongoing quest of justifying continued research" (07:01 Jensen). Arguably, when such systems are driven by what is trending it further adds a layer of ineffectiveness to positive change. Maybe, the current funding structure could be more effective. When I expressed my frustration as I was unable to understand the current set-up to Jensen, I was told;

> "Many are critical to the current system of funding. But it is like there is this almost religious belief that competition is good. Competition is healthy but is the current way the best [...] if the Fund granted the money through lottery. The winner might not be the best on paper, but if there are ten applicants, then 9 people did not waste their time" (29:46 Jensen).

To sum up, the funding system appears to influence how Blue Denmark seemingly chooses to focus on technical experts and their artifacts more than the users and their practices. It also seems to have a certain amount of waste as many actors compete, with only one winner. Lastly, there are several resources required to uphold the system. It might be beneficial for the overall goal to evaluate alternative methods of channeling funds to the most valuable projects although it might be difficult to see viable alternatives, as MRA's Olesen questions alternatives; "[...] I am struggling to see any alternatives but I acknowledge that there is a lot of time spent on fund applications" (40:03 Olesen). But as Jensen tells me; "often, the people who are applying for funds are paid for from public funds, so the ones who do not get a grant, to some extent, waste public funds" (28:21 Jensen). There are other ways, however, as recognized by Olesen; "[...] I will say that just because your specific application did not get the grant then it does not mean that your time was wasted, there are other methods to get your project through and of course, you reflect a lot on that specific project" (38:40 Olesen).

6.4.2 - The Truth, the User Matters

To complete the nexus of technology the focus needs to be readjusted from the artifact to the practice. Allegedly technology cannot succeed without both, as the STS Professor states; “if you think all you need to develop technology is technical insight, or to just get it to work according to some criteria of functionality, then you have not understood what technology is” (00:03:35 Jensen).

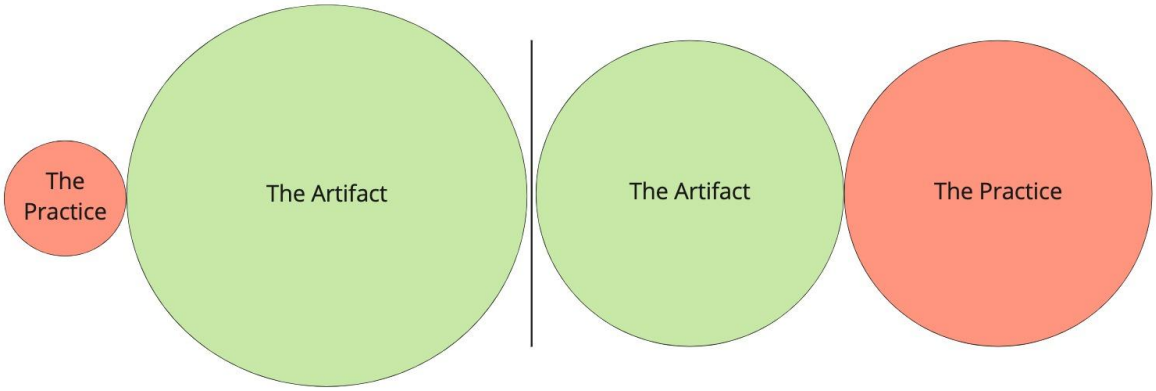


Figure 8 - an illustration of the spread of focus given to technology.

Still, when developing any intended solution it is difficult for the creator to understand the various ways in which it can be used. When it strives to be very Hi-Tech and advanced there is added additional complexity. We see this in the maritime sphere regardless of the progress made in optimizing systems, cf. 6.3.1.1. Such systems are not functioning optimally because the end-user has not been considered in the development of the system (Grech and Lemon 2015, 2). Actors have acknowledged the problem illustrated in figure 8. The Head of GSF, Riis, agrees that; “there has been an exaggerated focus on the technology [artifact]” (36:08 Riis). This could be caused by the current socio-cultural setting where technical experts are thought of as the only remedy to the world’s problems, cf. 6.3.2. Even though actors agree that user involvement is important it is debatable as to what extent it is standard practice, as Riis tells me; “I am not sure, but I think it has always been the intention to incorporate end-users [...] regarding exploitative technology, I think it is extremely important to incorporate them, otherwise it will not work” (39:46 Riis). It should be noted that while preferable to the exploitative and applicable technology might be less relevant on a conceptual level, as he further argues; “with explorative technology, I do not think it is that important at the first stage that is about understanding the potential but to apply the technology to solve a problem, involvement is vital” (40:18 Riis). Actors recognize the importance of user input for a successful implementation, as Riis concedes; “if it [technology] is not adopted, the other half of the calculus is missing, and that is the end-user” (26:51 Riis). Much research has gone into bridging the gap between the designer and the user. Areas such as human-computer interaction, different methods of user involvement, participatory design, user ethnography, and more (Hyysalo, Jensen, and Oudshoorn 2016; Oudshoorn and Pinch 2003; Woolgar 1990; Sunderland and Denny 2007; Børsen and Botin 2013; Büscher et al. 2009). Keeping the user in focus has met criticism, arguing that such methods will inhibit innovation. The user will only describe *known* problems (Wahlström et al. 2017, 220). Tacit knowledge restricts the idea that the practitioner can describe *what* and *why* they do what they do and what they would like to be able to do. Furthermore, the repetitiveness of processes that accumulates to the practitioner being an expert can also blunt the

sharpness of the creative mind to see alternative ways and solutions (Kristensen 2022). Regarding user inputs, the Project Director of ShippingLab tells me;

> "[...] to understand what we would include on the screen, the end-user was to construct the screen as they pleased. But when we would design it, in the beginning, we would not ask them, because we would be limited by their inputs. We wanted their opinions and their knowledge, but not on the system's other possibilities" (26:20 Gary)

I will argue that is exactly the knowledge that developers need. Seafarers are often left in the unknown from early design phases until the artifact is dropped off for them to adapt to (Kristensen 2022). By listening to inputs seafarers feel included. And the inputs can illuminate problems that developers could never foresee. Despite the recognition, seafarers are mainly exposed to a top-down implementation system. Seafarers seem too far down in the hierarchy to be included in the complex system's development and implementation phase (Man, Lundh, and MacKinnon 2019, 4). Even though some actors appear to want to involve users it is often obstructed by the structures of shipping (Krause-Jensen, Hansen, and Skårup 2020, 25).

6.4.2.1 - Diversity & Patent on Knowledge

A suspicion that occurred throughout this project is that user involvement is not just involving *users*. There seems to be ambiguity as to what a user is. There seems to be a gap relating to who the user is. Users may be the ones who pay for the product, but not the ones who use it. In exploring the system it appears different sites have different ideas of who the users are. However, it was quickly agreed that end-users are not the industry, shipping companies, or what you can call customers, but the seafarers who are the end-station for the product, as Riis assesses; "I would say it should be the end-users, as the customers are constructed by a financial relation" (25:01 Riis). When discussing the level of user involvement it appears to sometimes be misunderstood and instead referred to as a customer, as explained by Gary; "you could say that our end-users are the manufacturers and the shipping companies" (17:04 Gary). It must be understood who customers are and who end-users are. This could be a barrier to real end-users involvement as exclusive actors can be under the illusion that end-user involvement takes place, as can appear to be the case with the Orient Fund cf. 6.4.1.

Furthermore, instead of end-users with the needed contemporary expertise, there have been referred to ex-users (seafarers) as *users*. Former seafarer M. Hansen of Aprendio explained; "from what I have observed, there are many [ex-seafarers] *know-it-alls* with the solution for all the world's problems" (10:52 M. Hansen). This is problematic because there is a risk that extracted knowledge is not grounded in contemporary seafaring practices, as affirmed by Riis; "[...] the end-users are often represented by former seafarers [...]" (28:09 Riis). Domain-specific knowledge is valuable but it must not be a dominant determining factor, as M. Hansen elaborates; "then we spend time on half-hearted solutions with a former navigator or marine engineer with old knowledge" (11:03 M. Hansen). It can be detected as an ever-continuing loop where new generations have the required skills but when they leave the sea and become a part of the land-based they lose this status as a new generation then claims this it. This was expressed by Esvagt's Overgaard; "the young generation has a high level of technological competence"

(12:14 Overgaard). When former seafarers affect what should be in the future setting with a foothold in an old setting it can create a problematic offset this problem was elaborated by Gary; “a problem with bringing in people with a high level of practical understanding is, that there will be an enhanced risk as they are limited to their *known* environment, from when they were at sea” (24:45 Gary). Furthermore, often when user involvement takes place it is a selected few. The Head of DMF told me about the time she was situated in shipping operations and she observed; “[...] there were the darling captains who always were brought in on the projects [...]” (10:01 Lundberg).

> From my experience, the captain is *often* the one least in touch with newer systems onboard. Once, I was *headhunted* by a captain to return to their ship simply because I knew how the new Safety Management System (SMS) worked, they did not even like me. I have experienced many times since last August that people have an interest in how things work at sea. They will say “Rasmus, you were at sea can you tell me how that works”. I realized this when I was asked about some specifics about a tanker vessel. I thought; “it is 6 years since I was on a tanker, I have no idea how it is *now*” (ae)

This could be an explanation for why the industry often is addressed as conservative, as Overgaard states; “it is like there is just a delay in this industry, it is somewhat conservative” (27:30 Overgaard). It might be relevant to discuss how seafarers are drawn onto the land-based i.e. to make sure that former seafarers do not get a patent on knowledge. It is however not always an easy task recruiting the right competencies, as Overgard tells me; “I think we have a great level of competencies, but Esvagt is in Esbjerg, which is far away from the center, so it is difficult getting seafarers to come here, you know right? [with a smile]” (10:01 Overgaard). So location plays a role as well in reaching gender equality in a male-dominated industry, an observation from Gary; “I think it is a somewhat homogeneous group [...] I think the diversity is narrow, and in more ways, also gender-wise [...]” (24:01 Gary). Arguably Blue Denmark needs fresh air, M. Hansen tells me; “I have earlier criticized that there is too much maritime knowledge and we need new knowledge” (10:44 M. Hansen). Blue Denmark needs to recognize the value of other disciplines, some Riis experienced; “I am not *maritime*, I have not been out there [at sea] but perhaps I have some other tool, another way of doing things that can benefit” (05:57 Riis). At the same time Riis also acknowledges domain-specific knowledge; “[...] of course domain-specific knowledge is extremely valuable” (32:40 Riis).

To sum up, there are benefits in having a consortium of different disciplines working together such as a more creative and reality-bound approach. Something that is needed in Blue Denmark, as put by Gary; “some of the projects we have are very technical and very engineer savvy, but there are no marine engineers connected [...]” (22:30 Gary). It is indisputable that domain-specific knowledge can help verify potential in development. But it must not overturn other inputs as they are equally needed, as nicely put by M. Hansen; “it is important to be observant of the diversity of knowledge [...] also within maritime knowledge, that you are aware that there is a seafarer from China and India who also are end-users of the product” (13:42 M. Hansen).

And such concludes the main analysis.

7.0 - Summarizing the Analysis

I did not uncover the user in the system. I found many interesting things, but not the user. I found that mainly everything actors of the system do, they do with the best of intentions. Even though collaboration is sought after, Blue Denmark appears divided and work happens in silos. Not only when looking at different areas but also within the same area. The part that unites Blue Denmark the most is on a meta-level, the green transition. The substance of the transition, however, appears weak and very determined by trends. As collaboration mainly exists on this conceptual level it could be what results in the seafarer being left out of decision-making roles, see figure 9.

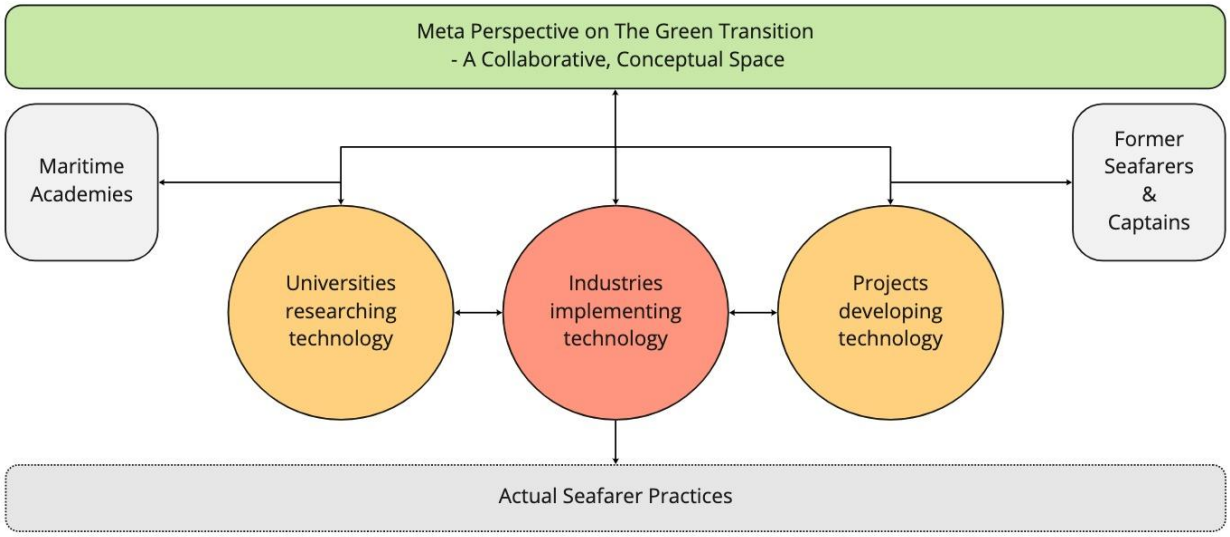


Figure 9 - illustration of collaborative paths in Blue Denmark and barriers to seafaring practices

The responsibility of who ensures user involvement takes place is unclear e.g. GSF does not interact with the end-user but leaves it up to the shipping company to take care of that part. This leaves the shipping company in charge of something they perhaps will not keep to, as told by the Head of GSF; “no, we do not have that much focus on the end-users on the ship, but we ensure to collect as many perspectives as possible when discussing these technologies” (30:08 Riis). Shipping companies can appear to act as a gatekeeper and designated user facilitators by other actors. Actors seem aware of the value user involvement has, as Riis continues; “gaining mutual understanding can help avoid many of the traps of inducing change with unwanted consequences that affect others negatively, just because you just did not see it from that perspective” (31:22 Riis). But understanding users' practices has been revealed to be more problematic as ex-seafarers and academies often represent actual users. In some cases, actual seafarers are consulted but typically only Captains. Actors have to make sure that the people who get to represent the seafarers' practices represent actual practices, not the academy’s, not the captain’s, and not former seafarers’, but the real deal. When it comes to the aspect of why such involvement is lacking the true complexity of the system may be the answer, especially the red dot in figure 9, as acknowledged by the Project Manager of MRA;

> "I think you need to look at how the maritime sector is organized. There are ship owners who decide what equipment is on the vessel, ship operators then charter it and do not own the equipment, then they charter in the crew from a third-party ship management company that is trained in other equipment, it is a very complex system with a lot of different actors who are in no way connected" (28:50 Olesen)

The simple answer is that Blue Denmark is too big an entity for anyone to be held responsible. The system is a mesh of so many different actors with completely different agendas that it is impossible to point to one and say "here, you are responsible". It is truly a microcosmos. The previously mentioned *red dot* can appear to act as a *black hole* for collaboration. Arguably, the technology developed in Blue Denmark is undemocratic as seafarers are not included in the decision-making of the microcosmos. Therefore, there is a risk that coming technological solutions will oppress seafarers, thereby reducing the chance of adoption. Which in turn, means technologification is postponed.

At a land-based inter-organizational level, GSF tells me that project facilitators are connected and collaborate only competing on funding and stakeholders' time (20:20 Riis). They ensure that other companies have a collaborative space and this is something that is constantly under development, Gary notifies me; "we have, in what we call ShippingLab 2.0, creators who focus on action-based research and bring more disciplines in [...] and through that evolve some methodologies that can help in future development" (20:00 Gary). This appears to have a positive effect on the system. However, it is only a place for ideas to grow and nothing will change without the businesses' support. When moving from the initiatives such as MRA, ShippingLab, and GSF to the hardcore business world of shipping (the red dot) their visions are not shared to the same extent. There is a clear gap in what different actors aim to achieve. One could say their objectives may cross but they are not the same, as expressed by Olesen; "fundamentally when we talk about collaboration, the different actors have very different approaches and agendas [...] us at the universities are measured a lot on how much we publicize, not something the businesses are very interested in" (22:20 Olesen). Even though these initiatives may be trying to do what they can it is an impossible task for them to do alone, a concern from GSF; "[...] we try to incorporate as many actors as possible, not just those in the shipping company, we cannot achieve anything if the manufacturer and harbors are not on board" (29:36 Riis). And while these actors are aware of what is going on it still seems to lack significant progress. ShippingLab even tells me; "our steering committee consists of actors from Blue Denmark so when an actor presents an idea, it will be seen in the larger perspective of Blue Denmark" (08:10 Gary). In the end, common goals are inhibited by the motive for profits, as MRA adds; "[...] the aspect of whether or not a project can be profitable, commercially, is somewhat a barrier because we have these different approaches" (23:26 Olesen).

When zooming in on an individual level, there are networks in Blue Denmark that can appear somewhat exclusive. It was observed that *high-up* personalities do engage, according to the Head of DMF; "they do share information, recently at the innovation committee meeting, CTOs from all the shipping companies were there and they did talk and share their experiences" (48:20 Lundberg). Blue Denmark appears to have a confined elite that is seen positioned throughout multiple powerful positions. As I was told in a private meeting; "it does not take long to follow the web and see that it is the same people who share the different boards around Blue Denmark, they are all involved with what goes on that might affect

them, especially funding there is a lot of who knows who". In the same meeting, I was told; "I have spent time nursing relations due to internal mishaps, mishaps on a person-to-person level" (Fieldnotes). There are, however, benefits to similar networks among the facilitators, expressed by Olesen; "I would say, there is a lot of collaboration across our networks and acquaintances, it is always easier to reach out to the one you know [...]" (18:31 Olesen). Something that GSF utilized; "I have used MRA's huge network to find a researcher within a specific field, so that is also a good level of collaboration [...]" (19:15 Riis). GSF also mentions ShippingLab; "I feel that I and ShippingLab can support each other and we have a very healthy dialogue" (17:43 Riis). It should however not only be confined to those enrolled in the network.

Collaboration can be seen depending on from what angle the system is observed. The green transition is a topic everyone knows, and this is a subject to agree on and collaborate on. What this means, however, is somewhat distorted. And here the disconnect to real-life practices enters. It is the impression that actors are mainly concerned with the artifact of technology, influenced by trends and funding practices. User involvement is not an alien thing to any of the actors but it is not a normal, standardized practice either. It can easily be avoided or excused for several reasons. Mostly, it is not what attracts money. Along with themes such as changing behavior and organizational practices, it is much less attractive than hardcore tech projects. In general, it seems that the utopian story of technological achievements from around the world has given a motive for slacking significantly on user involvement when developing technology. Iteration is not the go-to method as we see a more linear approach applied. From a problem to a solution and then press go. Expecting to reach the exponential curve of the *hockey stick*. Actors agree that users should be consulted and that it is a problem that such consultation is lacking, something that concerns Gary; "[...] it is a hole in the process that is being dug with open eyes, which is paradoxical since one assume that one has the interest [to implement technology] at heart" (21:08 Gary). While there seems to be a consensus on the importance of user involvement in the system there are uncertainties as to how it can be achieved, a challenge noticed by Riis; "the end-user cannot be a technology expert, of course, it is not their job, they have a ship to navigate. So naturally, there is a difficult task incorporating them in a workshop, etc." (40:55 Riis). Furthermore, it can be a practical challenge to test the technology on a vessel, as Olesen assesses; "I think it will be difficult to establish procedures for testing the technology on vessels due to their trade and the complexity of ship operations [...]" (45:27 Olesen). Naturally, it is a question of capital, pointed out by Gary; "[...] I think it also depends on what resources are available and what you are developing" (26:01 Gary).

While this might be speculative, something that is not. Shelved technology caused by seafarers and land-based actors not being able to understand each other, resulting in technology holding no ground in reality, does not solve anything. It does not make the operator or their ship any safer, more effective, or better in any way. It is a waste of time, money, and resources. Therefore, what can be done in the early stages of developing technology, should be done. The true purpose of technology should be known and appreciated by all actors. It is damaging to technological advancement and the green transition if seafarers *understand* technology as an enemy and not as a digital colleague. Likewise, if land-based actors do not understand life at sea and seafarers' practices.

Being on the topic of technologification, whether or not one *believes* in total *digitalization* and *autonomy*. It does seem peculiar to address self-sailing crewless vessels as a solution when global

connectivity infrastructure is unable to sustain usable connections for daily operation. Zooming out from Blue Denmark the umbrella organization IALA[19] contains *many* initiatives on anything e-navigation[20] (IALA 2022) including a project I have been connected to previously, VDES (IALA 2021). Sunbae Hong from the Korean Ministry of Oceans and Fisheries, in a presentation at Digtal@Sea 2021, calls for addressing the challenges in global maritime digitalization by creating global harmonization and interoperability within this *endless* list of initiatives. Furthermore, he calls for collaboration between stakeholders to reach a level of digitalization capable of sustaining global digital shipping. Such challenges require facilitation by national and international organizations (Hong 2021). Going back to Blue Denmark it leaves some just wondering about the actions of choice when autonomy becomes a top priority when, simultaneously, the world's maritime stage is trying to figure out how to ensure connectivity to the world's oceans. Are we simply selecting the trending *hot* and *sexy* topics with huge potential while leaving more *boring* yet necessary-for-us-as-all projects for other countries? It poses a problem when Denmark sets its eyes on individual success as a maritime super hub for maritime digital solutions and not the progress of the whole world, as declared by Hong; "focus on progress, not perfection, one step made together is more powerful than 10 steps made by one country" (Hong 2021).

[19] IALA or the International Association of Marine Aids to Navigation and Lighthouse Authorities is an umbrella organization for international collaboration of maritime solutions and streamlining.

[20] E-navigation is a term by IMO trying to prescribe guidelines for electronic initiatives to enhance global harmonization and safety.

8.0 - Reflective Phase

Blue Denmark is big. If I did not know before, I do now. I have learned a lot. By that, I mean that there are more actors and sites than anticipated. The network that affects the system keeps extending into new areas. Energy and oil companies, manufacturers, and legislators add to the seemingly endless list of sites that also play an influential role in the system. However, this is where I draw the line and end my research. Luckily, I have plenty to reflect on with what I have.

Arguably, collaboration in the system appears at three levels; 1) Societal, the sphere where delegates meet to address the green agenda across the value chain on a conceptual level planning towards the future; 2) Institutional or the businesses of Blue Denmark i.e. inter-organizational, often represented by an elite that exists throughout high-powered positions e.g. in boards of directors; 3) individuals, or person-to-person i.e. reaching out for help and ideas. They can thus be labeled as; 1) meta-level, 2) macro-level, and 3) micro-level. Recalling the critical view on technology suggested by Feenberg and the TAN triangle of relations needed for the success of technology suggested by Børsen cf. 5.0, the findings from this project suggest that relations need to be found across each level, see figure 10. If the relations only appear at one of these levels it proves insufficient to democratize the system. Participatory design, technological interventions, anthropology-driven design, interactional expertise, responsible innovation, etc. Such initiatives might help to include the user but if it is not acknowledged through the levels an attempt at change can be ineffective.

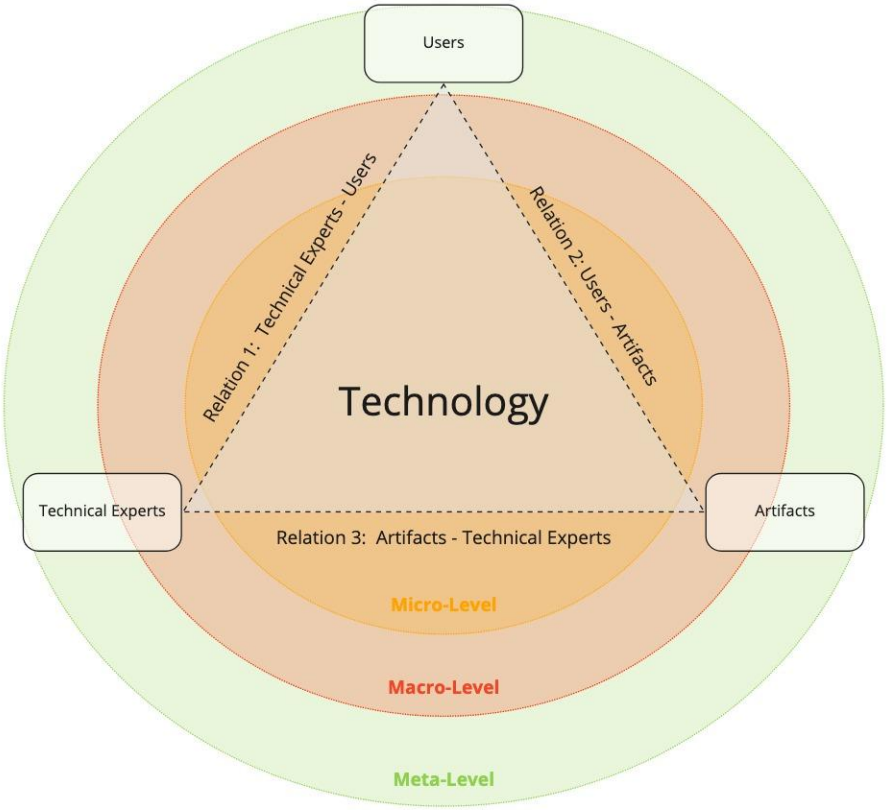


Figure 10 - the three levels of collaboration visualized on top of the TAN triangle that constitutes the three relations needed for technology's success, inspired by (Børsen 2020, 222).

When challenged with evolving Blue Denmark and its actors into a technological digital beast it is dealing with a complex socio-technical setting already heavily challenged in adapting to new technology. Therefore, multidisciplinary facilitation appears necessary for the likelihood of technological success. It has been difficult up until now so amplifying pressure is not going to make things any easier for the proud business of the maritime industry. As heard in a keynote speech on future green fuels at the WMTC 2022 by Knut Ørbeck-Nillsen CEO of DNV Maritime[21]; "I know what the fuel of the future is, I assure you, it is collaboration" (Fieldnotes, WMTC). Unfortunately, collaboration is not enough, as it can *simply* mean two actors collaborating on developing an artifact. To clarify the needed collaboration, I will turn to transdisciplinarity. In this context, transdisciplinarity refers to how multiple academic and non-academic disciplines should come together to function more seamlessly and agree on discourse. As a result, transdisciplinary research and practice are emerging as an important strategy for dealing with the complex challenges of the 21st century (Renn 2021, 1–2).

Picture X - a picture of a ship-to-ship transfer. A truly remarkable operation where two vessels and the two crews work together to attach while at sea.

Reflecting on my time as a *mediator* between start-ups and shipping companies and inspired by transdisciplinarity literature I will propose a method to ensure collaboration on multiple levels, see figure 11. Instead of every inventor working alone in different *incubators* or similar, bring them together. If developers can work together to promote interoperability and standardize systems based on real-life practices, user adaptability would arguably be much better e.g. the potential synergy from a SearchMaster/LifeFinder collaboration. Such synergy appears to be prohibited, or unnoticed by current systems.

[21] DNV or Det Norske Veritas, is a world-leading classification society. Classification societies are highly influential and powerful as they provide vessels with a classification certificate, which essentially is the vessel's driver license.

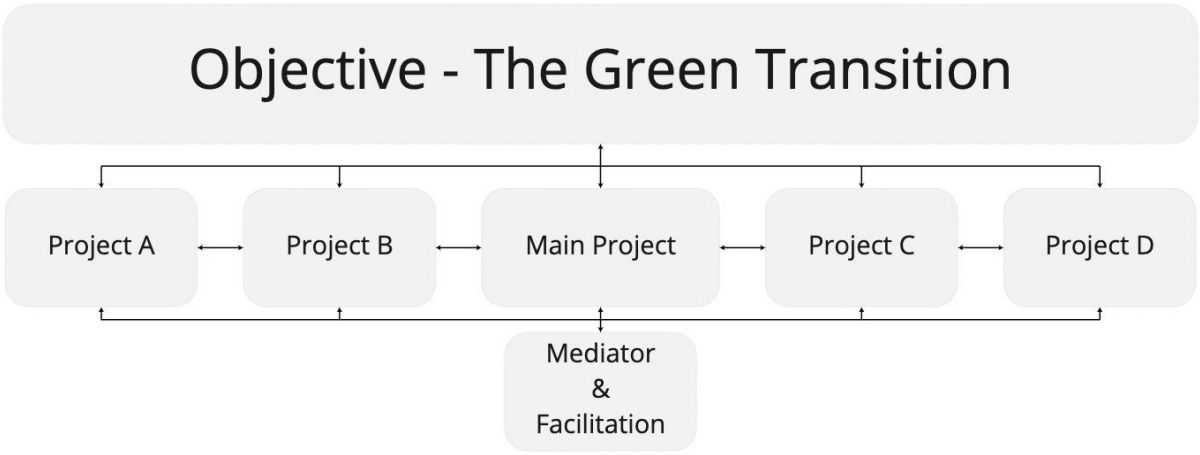


Figure 11 - an illustration of how multiple projects can collaborate towards the main objective e.g. reducing emissions from ship operations. Different projects are included in a consortium facilitated by a competent mediator, preferably with enough domain-specific knowledge to spot potential synergies in the consortium. Project A and B could as an example be LifeFinder and SearchMaster.

LifeFinder was the first start-up I made an acquaintance with as we were both a part of the *connected ship* project, see Appendix 4 - Events and Other. In early 2022 we discussed the possibilities of conducting participatory workshops to refine their product. In the meantime, I had gotten familiar with SearchMaster. With my offshore experience from Esvagt, I saw there was value in bringing the two ideas together, as did they. Their technology would complement each other. SearchMaster's technology not only was a *better* searchlight but also added automation to the operation of the searchlight. A ship's searchlight is used to locate persons or objects in the water. This is done by manually moving the light around with a handle. SearchMaster's searchlight can with the help of various inputs keep its light beam steady at a certain object e.g. a transmitting beacon. A problem however is that people who fall overboard rarely carry a transmitting beacon because current ones are large and bulky. Something LifeFinder had a solution for. Their very small and durable beacon could be placed on all crew and personnel operating in the north sea's offshore industry. Virtually, if crew and personnel were equipped with a LifeFinder beacon and all vessels were equipped with SearchMaster's searchlight, it would be impossible to lose people at sea. As the beacon alerts the searchlight and other equipment of the standby vessel immediately.

Therefore, proposing a model where innovative solutions are created in a mutual environment to secure future interoperability of systems with all actors. Furthermore, adding a consortium facilitator that can ensure access to different actors, disciplines, and users.

Applying the concept to a wider context. In Blue Denmark, it would include *all* required disciplines to come together in a structured collaboration, see figure 12. This would help to perform more efficiently and effectively, such as through consensus building, sharing knowledge, securing the next generation of seafarers, and benefiting from resources and expertise across boundaries, including the seafarers.

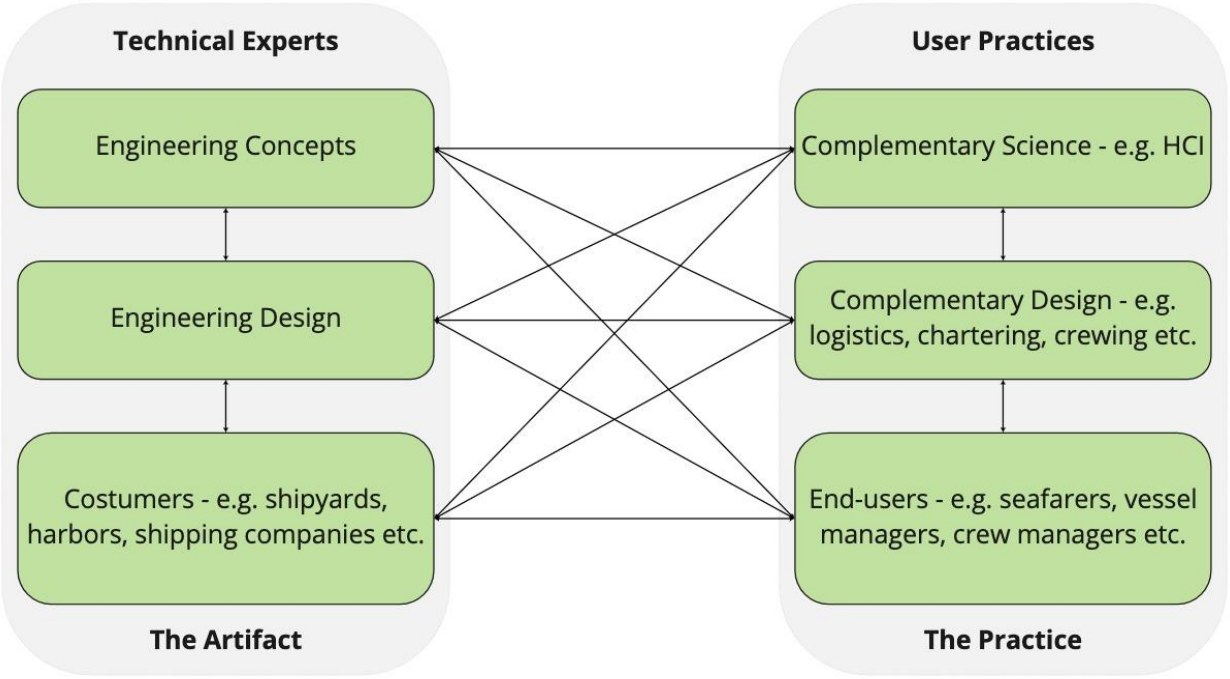


Figure 12 - a model of maritime transdisciplinary collaboration inspired by (Vegte and Vroom 2013)

The transdisciplinary method also honors mutual understanding regarding societal change e.g. the green transition and the many loosely defined terminologies it has brought. As written in transdisciplinary literature; “the key to transformation is to create a discourse structure for mutual learning that provides the foundation for dealing with *wicked* problems with long-term implications” (Renn 2021, 1–2). Lastly, to address how users practically can be included. Strategies such as Co-Production (Bremer and Meisch 2017) offer ways to break down barriers between technical experts and *laypeople* and engage with practitioners to include inputs even before development begins. Extending to direct tools I find Design Propes and Design Games applicable for the maritime setting. Tools that are built on; “a belief that all people are creative and can contribute to design if provided with an appropriate setting and tools” (Mattelmäki 2008; Vaajakallio and Mattelmäki 2014).

By combining the project consortium facilitator and the discipline mediator a total system can be proposed, see figure 13.

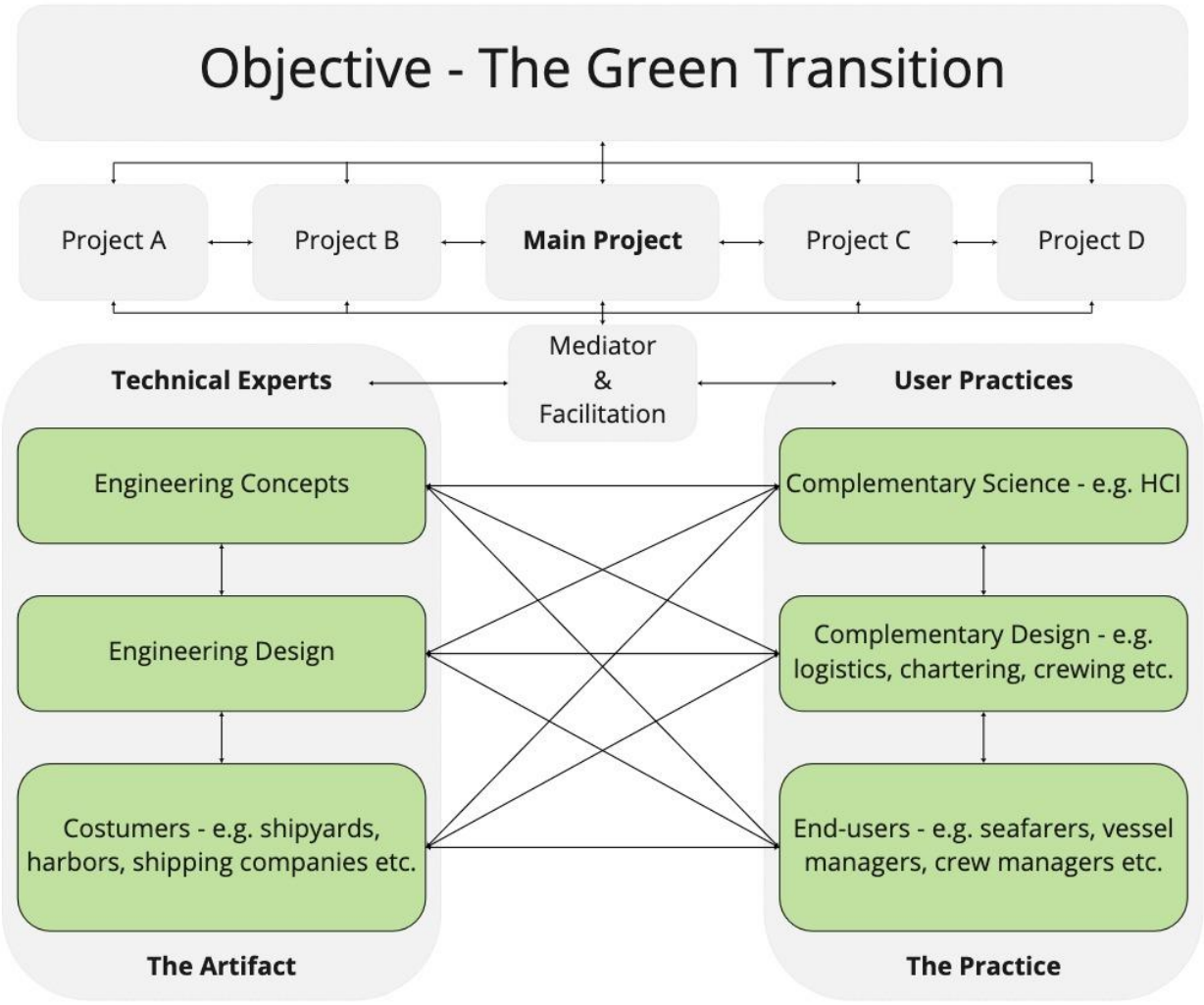


Figure 13 - illustration of a proposed new system structure of developing technology for Blue Denmark. By combining the two systems seen in figures 11 and 12, important aspects of technological development that the current system neglects are included. It is important to underline that a mediator role should not be understood as a bottleneck for the system but as a consultant and a facilitator.

Technology remains open for interpretation as it can liberate and oppress us. There are two sides like the Yin and the Yang - the light and dark. This creates a controversial sense to it and it is why interdisciplinary mediators should be consulted to contextualize it in this complex world. Do we all agree on what autonomy means? When the various disciplines' claims are expanded then maybe we do. To avoid misalignment in expectations from claims, they should be contextualized and mediated meaningfully. To be an effective mediator one must be able to socialize within the network and among its people and non-human actors (Broberg and Hermund 2004, 318). Early in this research, I was told by an anthropologist, "I think you will have an easier task in this role than me. You are more *readable* for the industry". Being a seafarer and a TAN while additionally building confidence from such adorning remarks, I have undertaken this voyage and ventured on with this thesis. First, merely to understand the network of Blue Denmark. Now I will strive to induce positive change. And with this final epiphany, I will end this project;

During a supervision session, I was asked what the abbreviation *nm* in my text meant. I was not sure what to make of the question but as a guess, that it was in place of nano millimeters ensued, I understood it was non-rhetorical. As I explained that it was nautical miles, the distance unit used in navigation, I reflected on the reality of expectations and how difficult it is to know what one can assume other actors take as general and common knowledge. From the perspective of Blue Denmark, it is probably safe to expect that most actors understand the abbreviation nm. However, in calling for multidisciplinary understanding and collaboration, I was bluntly reminded that mutual understanding and aligning expectations *must never* be underestimated or taken for granted (ae)

9.0 - Conclusion

Concerns about our future are growing rapidly and the green agenda is being enforced to combat the negative effects of climate change. Established organizations are pressured to develop and implement faster than ever leaving little time to meet the user. There have been found no formal standardized methods for ensuring user involvement in the first part of the system. Juxtaposed to pre-project findings, user involvement first emerges when technology is implemented and operational malfunctions manifest themselves. Much like the well-known example of *Sundhedsplatformen*. Everything is grand on a conceptual level, however, it has no place in the real world. Often, such solutions are top-down implemented and alien to their users thus assessing the system as rather undemocratic. The system is very complex which makes it difficult to determine who should be responsible for keeping in touch with the seafarers. Affected by a social belief in technology as our savior and funding structures that accommodate a system where human perspectives are less interesting than the artifacts, activities in understanding social contexts are low. Though there might be a unified desire to construct technology to conform to the criteria of the green transition, this important perspective is absent. The consensus mainly revolves around working towards futuristic technology that the world cannot use *now*. The focus must be moved toward building reliable and applicable technologies in a system of total collaboration to ensure positive outcomes. Furthermore, the focus must be moved towards international harmonization while muffling some capitalistic liberties.

Technologies *are* becoming more advanced, and they *are* learning but the level of adaptability that humans possess, needed in contemporary navigation, is not around the corner. Therefore, futuristic conceptual technology should not be regarded as a solution to the climate crisis. It has been stated time and time again that technology cannot to a satisfactory and reliable degree make the right decisions in the dynamic and unpredictable world at sea, alone.

Ultimately user involvement in the system fails because it generally focuses on the artifact and the claims of technical experts while the constellation is hostile to changing structures. It appears that there is a need for a democratic intervention in Blue Denmark to support further technological advancement. Actors of the system mean well and strive for a better world. However, becoming lost in the complexity of the shipping world, visionary work has little effect. Transdisciplinary methods could be a positive way to structure and facilitate further technologification of Blue Denmark. By bridging the many different sites of the system, a holistic view of how technology should be developed can be acquired. The definition of technology must become more inclusive referring not only to the technical artifact but also to the practices of people.

In the end, regardless of the success of any given technology is it not worth considering what will happen to the seafarers and their practices, even in the event of *sailors* entering an existence only found in the history books?

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Appendix 1 - Literature Search

Using the five W's for a planned and structured, yet iterative literature search. It is structured to facilitate online literature search, using search engines (Zins 2000, 1231). It forces me to approach the search systematically through five phases (Zins 2000, 1242). The phases are the five W's; first, *what*, defining the search assignment, second, *where*, locating and assigning resources, third, *words*, finding and selecting search words, fourth, *work*, defining the methods and parameters, fifth, *wow*, evaluating findings and iteration. The search strategy remains open for the searcher to iterate wherever the need is (Zins 2000, 1236–37). In the following, it will be possible for the reader to follow the process.

The *what*. Here one can wonder and reflect on the general agenda of the search and start to define questions. This helps the search gain direction (Zins 2000, 1238). As I had made my storyboards I already had the answer to the *what*. To learn what research exists in the area of technology and humans, the human-centered design caught my attention. Therefore the assignment starts as such:

> How can Human-Centered Design/Human-Computer Interaction be used as a backing concept? How can actors in Blue Denmark collaborate more and understand the perspective of the seafarer and include them in technological advancement?

The *where*. There are multiple search engines available and they all have unique traits (Zins 2000, 1238–39). Since I had the desire to gain a wide and diverse set of literature on a specific topic, within the maritime field, the search was carried out on the umbrella database, Google Scholar.

The *words*. Now it is time to start finding the words that will provide the most valuable and relevant results. Work here will ultimately save work later. Naturally, this means that the searcher must have a basic knowledge of the thing searching for. The iteration of the search strategy may allow the searcher to become aware of new terminology that eventually will lead the searcher to a much different, but much more effective search word (Zins 2000, 1239–40). 24 of January, I started adding words. In the first block, I added words about human and computer interaction, such as HCI OR human-centered interface OR human-centered design OR HCD or Anthropology driven design OR user-driven design. In the second block, I specified the maritime by adding Maritime OR seafarer* OR sailor* OR navigator OR navigation OR ship OR vessel. I added the words into two main groups of themes called co-creation and maritime. The first set of words then looked like this:

- Co-creation: HCI OR human-centered interface OR human-centered design OR HCD or Anthropology driven design OR user-driven design
- Maritime: Maritime OR seafarer* OR sailor* OR navigator OR navigation OR ship OR vessel

The *work*. Executing the search itself. There are some features in the search engines to consider when constructing the search string (Zins 2000, 1240–41). First of all, we can combine the words from the two themes into one complete string:

- (HCI OR human-centered interface OR human-centered design OR HCD or Anthropology driven design OR user-driven design) AND (Maritime OR seafarer* OR sailor* OR navigator OR navigation OR ship OR vessel)

Notice the use of *or* instead of *and* not limit the search to literature including more than one word from each theme. Between the two themes though is an *and* to make sure the literature will include at least a combination of one from each theme. Also, notice the use of * to enable more than one version of the word. Thereby constructing the first search string for the first search. General criteria for literature: English/Danish and peer-reviewed/scholarly. Now the two themes are transformed into a search string and the search can commence. It is worth noticing that iteration and epiphanies are to be expected along with the search as it unfolds (Zins 2000, 1240). On the 27th of January, I applied the search string on google scholar. I got 22.600 results. In the following, the three searches are described along with their iterations and results.

#1 27/01-2022
Search Engine: Google Scholar
Search String: (HCI OR human-centered interface OR human-centered design OR HCD or Anthropology driven design OR user-driven design) AND (Maritime OR seafarer* OR sailor* OR navigator OR navigation OR ship OR vessel)
Results: 22.600

After the first search, I noticed that the string was flawed when searching for more words as a term e.g. human-centered interface. Therefore I added the "x" to tell the search engine to search for more words as a whole as a "human-centered interface".

#2 27/01-2022
Iteration: Add ("") to terminologies
Search Engine: Google Scholar
Search String: (HCI OR "human-centered interface" OR "human-centered design" OR HCD or Anthropology driven design OR user-driven design) AND (Maritime OR seafarer* OR sailor* OR navigator OR navigation OR ship OR vessel)
Results: 478

After the second search, the result started looking manageable. I then noticed a quick fix to make it even more so, excluding literature older than 2018.

#3 27/01-2022
Iteration: Add >2018
Search Engine: Google Scholar
Search String: (HCI OR "human-centered interface" OR "human-centered design" OR HCD or Anthropology driven design OR user-driven design) AND (Maritime OR seafarer* OR sailor* OR navigator OR navigation OR ship OR vessel)
Results: 158

The *Wow*. The last step is to evaluate if the results cover the desired outcome (Zins 2000, 1242). As I was satisfied I ended the structured search on January 31st.

I searched through the relevant articles' references which provided *good* literature. I collected relevant literature and grouped it into themes related to the prescribed storyboards. Then, I started reading. The reading progressed satisfactorily. Through reading, I found more literature. However, on the 6th of February, I got infected with covid-19 which slowed down my progress significantly. On February 14th, I was ready to continue. After sorting the literature from citation jumping, I kept 67 subjects. Although some were older than 2018, I included them. I continued reading, and ideas occurred that I jotted down in a separate document. These ideas proved valuable in the form of interesting perspectives. After sorting again, I ended with 73 subjects. On February 22nd I started a final sorting of literature in a combined effort to filter on last time and gain the last inspiration and knowledge for my problem field. Resulting in a literature set of 20 articles to represent contemporary knowledge in the field.

Appendix 2 - Domain-Specific Literature

Literature Search				
#	Year/Area	Title	Author(s)	Description of relevancy
1	2010 Maritime - Human Error	Getting closer to context: a case study of communication between ship and shore in an emergency situation	L. L. Froholdt	Investigating the challenges of the human and its cultural differences with attributing error to humans.
2	2015 Maritime - Humans & Technology	Human-centered Design for Enhanced Navigation Systems: Shifting the Focus on User Needs	M. R. Grech, N. Lemon	Investigating the paradigm shift regarding *e-navigation*, giving a fair amount of consideration to 'user needs' as it is an important component in developing such systems. It also addressed that a lack of such facilitation can lead to accidents.
3	2013 General - HAI/HCI	Human-Automation Interaction Research: Past, Present, and Future	P. A. Hancock, R. J. Jagacinski, R. Parasuraman, C. D. Wickens, G. F. Wilson, D. B. Kaber	A recap of the history of human and automation interactions. Addressing the various challenges and opportunities.
4	2016 Maritime - Organizational barriers to EE	Barriers to energy efficiency in shipping	H. Johnson, K. Andersson	Looking into what barriers exist in shipping that hesitates seemingly low-cost EE measures.
5	2015	Exploring Bridge-Engine Control	A. Kataria, E. Holder, G.	Investigating the socio-technical setting of the vessel and

	Maritime - Socio-technical setting	Room Collaborative Team Communication	Praetorius, M. Baldauf, J-U. Schröder-Hinrichs	interdisciplinary understanding.
6	2014 Maritime - Workload & Crew	Functions, performances, and perceptions of work on ships	M. Ljung. M. Lützhöft	Investigating the effects of the increasing administration workload and reduced crewing on the vessels.
7	2016 Maritime - Socio-technical systems	A static organization in a dynamic context e A qualitative study of changes in working conditions for Swedish engine officers	M. Lundh, L. W. Rydstedt	A qualitative study on the changes that shipping has/is undergoing while structures remain the same.
8	2019 Maritime - New Technology Systems	Facing the New Technology Landscape in the Maritime Domain: Knowledge Mobilisation, Networks, and Management in Human-Machine Collaboration	Y. Man, M. Lundh, S.N. MacKinnon	A discussion paper on how to adapt structures to the rapidly evolving technological scene, a changing landscape.
9	2018 Maritime - Socio-technical systems	Towards a Pluralistic Epistemology: Understanding Human-Technology Interactions in Shipping from Psychological, Sociological and Ecological Perspectives	Y. Man, M. Lundh, S.N. MacKinnon	Investigating the socio-technical setting of the vessel. Furthermore, a great literature review and summarization take place here.
10	2018 Maritime - Socio-technical systems	Maritime Energy Efficiency in a Sociotechnical System: A Collaborative Learning Synergy via Mediating Technologies	Y. Man, M. Lundh, S.N. MacKinnon	Investigating the socio-technical setting of the vessel and how it juxtaposes to EE. Perspectives on managerial initiatives, such as the SEEMP.

11	2018 Maritime - Human Factors	Human factor issues during remote ship monitoring tasks: An ecological lesson for system design in a distributed context	Y. Man, R. Weber, J. Cimbritz, M. Lundh, S. N. MacKinnon	Investigating how the operator's Situational Awareness will be affected by becoming a remote operator. Such as will be the case for unmanned ships.
12	2016 Maritime - Business Conditions	The Logic of Business vs. the Logic of Energy Management Practice: Understanding the Choices and Effects of Energy Consumption Monitoring Systems in Shipping Companies	R. T. Poulsen, H. Johnson	Understanding the operating conditions of Shipping Companies and its effect on the *system*.
13	2022 Maritime - Energy and Seafarers	Energy efficiency in ship operations - Exploring voyage decisions and decision-makers	R. T. Poulsen, M. Viktorelius, H. Varvne, H. B. Rasmussen, H. von Knorring	Energy Management and professional pride. Investigating the effect on the crew when systems are to take over.
14	2022 Maritime - Socio-technical systems	An overview of sociotechnical research on maritime energy efficiency	M. Viktorelius, H. Varvne, H. von Knorring	Addressing the trending theme on operational energy efficiency from a socio-technical perspective.
15	2017 Maritime - User-Oriented Design	Designing User-Oriented Future Ship Bridges – An Approach for Radical Concept Design	M. Wahlström, H. Karvonen, E. Kaasinen, P. Mannonen	Investigating an equilibrium in technology development of user input to support practices and innovation to evolve them.

Literature Reinterpreted				
#	Year/Area	Title	Author(s)	Description of relevancy

1	1983 General - Automation	Ironies of Automation	L. Bainbridge	In-depth study on automation. Automation explained so to say.
2	2019 Maritime - Terminologies	Autonomous Ships – Changing Perceptions and Expectations	S. Eriksen	A perspective on the use of words and their contexts, and the problems that follow. Author Stig Eriksen was also interviewed for this theme regarding mutual language.
3	2020 Maritime - Humans in Shipping	On-board Human Operators: Liabilities or Assets?	S. Eriksen	A perspective on the use of words and their contexts and what goes on on a vessel. Author Stig Eriksen was also interviewed for this theme regarding crewless vessels.
4	2021 Maritime - Humans in Shipping	An RCM approach for assessing reliability challenges and maintenance needs of unmanned cargo ships	S. Eriksen, I. B. Utne, M. Lützen	A perspective on the use of words and their contexts and what goes on on a vessel. Co-author Stig Eriksen was also interviewed for this theme regarding *why* there are crews onboard vessels.
5	2020 Blue Denmark	Open Innovation In Blue Denmark	J. Krause-Jensen, B. Skårup	In-depth research about the level of collaboration in Blue Denmark.
6	2020 Blue Denmark	The Robot/Technology as a Colleague	J. Krause-Jensen, S. Hansen, B. Skårup	In-depth research about the increasing human and technology interaction and collaboration in Blue Denmark.
7	2022 Blue Denmark	The Green Transition in Blue Denmark	P. Møhl, J. Krause-Jensen, B. Skårup	In-depth research about the discourse surrounding the green transition and the different values and norms that follow in Blue Denmark. Perle Møhl is an AU anthropologist and was also interviewed for her work in Blue Denmark.

8	2004 Maritime - Life at Sea	Lost at Sea and Lost at Home: the Predicament of Seafaring Families	M. Thomas	Perspectives of a life lived at sea. This article was heavily cited in my bachelor thesis for its description of life at sea.
9	2021 Maritime - Usability	Application and usability of ECDIS - A MAIB and DMAIB collaborative study on ECDIS use from the perspective of practitioners	UK's Marine Accident Investigation Branch, Danish Maritime Accident Investigation Board	In-depth study of the construction of the ECDIS and its usability. Co-author Oessur Jarleivson Hilduberg was interviewed for his expertise in human and system safety.

Appendix 3 - Approached Actors

Who	When	What	Why
Professors concerned with the human element in shipping	Multiple	Universities	Leading researchers in the area of seafarers and technology
DanPilot	Mar 2nd	Business Development	How to apply HCI. Danpilot is applying HCI methods in one of their drone-projects
Maersk	Multiple	Multiple	On being an innovative shipping company and more
BlueKey	Mar 24th	Co-Founder	How to be a start-up with digital interactive systems
Esvagt	Feb 15th	Head of Human Resources	To introduce the potential collaboration with LifeFinder, SearchMaster, and my project
Danish Maritime	Mar 2nd	CEO	Understanding of the workings and interests of the branch organizations
Innovationsfonden	Mar 19th	Program Officer	Understanding of the workings of the funds

Appendix 4 - Project Overview

This appendix is for convenience to quickly lookup abbreviations, informants, and event information.

Citation Style

Autoethnographic Epiphanies	(ae)
Informants	(timestamp, name)
Pre-Project Informants	(name, timestamp)
Fieldwork, Official	(fieldnotes, event name)
Fieldwork, Other	(fieldnotes)
Pre-Project Fieldwork, Official	(fieldnotes, event name)
Pre-Project Fieldwork, Other	(fieldnotes)

Sites of the System

Main Affiliated Site	Organization	Description
Development of Fund Strategies	The Danish Maritime Fund (DMF)	DMF is a private fund with a focus on *wild* ideas. DMF is one of the first steps to realizing such ideas
Product Testing, Implementation, & Nursing	Danish Maritime Accident Investigation Board (DMAIB)	DMAIB conducts research and investigate root causes of accidents in Blue Denmark
Product Testing, Implementation, & Nursing	Jonas Pedersen	Jonas Pedersen is an active captain who engage a lot with his shipping company to address issues with technology
Product Testing, Implementation, & Nursing	Marstal Maritime Academy	SIMAC is one of the Maritime Academies in Blue Denmark and tests many modern technologies such as autonomy
Product Testing, Implementation, & Nursing	SIMAC	SIMAC is one of the Maritime Academies in Blue Denmark and also conducts research together with SDU
Project Execution	Aprendio	Aprendio is a newly formed company developing a platform for mutual learning at sea
Project Execution	Maritime DTU (DTUM)	DTUM is a part of MRA and organizes research and functions as the Orients Fund's applied sciences consultant
Project Execution	Esvagt	Esvagt is a shipping company mainly engaged in the North Sea
Project Execution	LifeFinder	LifeFinder is a start-up that has developed an innovation location beacon for maritime personnel
Project Execution	SearchMaster	SearchMaster is a start-up that developed an intelligent searchlight for vessels
Project Facilitation	Green Ship of the Future (GSF)	GSF is an independent collaborative platform for other companies in Blue Denmark
Project Facilitation	Maritime Research Alliance (MRA)	MRA is an initiative to facilitate and broadcast research across Blue Denmark

Project Facilitation	ShippingLab	ShippingLab is a public-funded initiative to directly address the climate crisis through technical innovation
Societal Change of Direction *Creating Trends*	Perle Møhl	Perle Møhl is an anthropologist, Senior Researcher at AU, and Author
Societal Change of Direction *Creating Trends*	Torben Elgaard Jensen	Torben Elgaard Jensen is a Professor in Techno-Anthropology and Science & Technology Studies at AAU

Informants

Citation ID	Name (date)	Area	Position	Recent Education (year)
Gary	Magnus Gary (18-03-22)	Project Facilitation & Funding	Project Director at ShippingLab	DTU, MBA. Executive Master in Management of Technology (17)
M. Hansen	Mikkel Navarro Hansen (10-03-22)	Companies & Start-Up	CEO & Co-founder at Aprendio	SIMAC, Master Mariner (98), CBS MBA, Shipping & Logistics (85)
S. Hansen	Mette Sanne Hansen (18-03-22)	Universities & Research	Head of Maritime DTU	DTU, Ph.D. in Strategic Simulation (12)
Jensen	Torben Elgaard Jensen (02-03-22)	Universities, Research, Technology, & Start-Up	Professor in Techno-Anthropology and Science & Technology Studies at AAU, Boardmember of AAU Incubator	KU, MSc. Psychology (95)
Lundberg	Lotte Lundberg (11-03-22)	Funds & Shipping	Head of Danish Maritime Fund	Shipping Trainee (82), CBS, DPA, HD(U) (87)
Mogensen	Søren Mogensen (10-03-22)	Companies & Start-Up	Owner of SeaMaster ApS & SearchMaster ApS	EUC, Electrical Engineering (84)
Olesen	Thomas Roslyng Olesen (09-03-22)	Project Facilitation, Universities, & Research	Project Manager at Maritime Research Alliance	SDU, Ph.D. in History (12)
Overgaard	Nils Overgaard (09-05-22)	Shipping Companies & Shipping	Head Of Business Development at ESVAGT	DTU, B. Eng. (82), CBS, HD(A) (89)
Riis	Frederik Schur Riis (05-04-22)	Project Facilitation & Funding	Head of Green Ship of the Future	CBS, MSc. Management of Innovation & Business Development (17)

Pre-Project Informants

Citation ID	Name (date)	Area	Position	Recent Education (year)
Eriksen	Stig Eriksen (28-10-21)	Seafarers, Maritime Academies, Autonomy, & Research	Former Seafarer, Assistant Professor at SIMAC, and Researcher	Master Mariner, SDU, Ph.D. Autonomous Shipping (22)
Hilduberg	Oessur Jarleivson Hilduberg (10-11-21)	Seafarers, Human Factors, Safety, Data, & Technology	Former Seafarer, Head of Danish Maritime Accident Investigation Board	Master Mariner, Lund University, MSc, Human Factors & System Safety (15)
Møhl	Perle Møhl (21-11-21)	Blue Denmark & Anthropology	Anthropologist, Senior Researcher at AU, and Author	Ph.D. Anthropology (05)
Pedersen	Jonas Pedersen (26-11-21)	Seafarers & Practices	Seafarer, An active Captain	Master Mariner (07)
Petersen	Kresten Wium Petersen (10-11-21)	Seafarers, Maritime Academies, & Technology	Former Seafarer, Maritime Lecturer at Marstal Navigational School	Master Mariner, AAU, MMT. Master of Technology Management (19)
Schening	Anders Nilsson Schening (08-12-21)	Start-Up, User Involvement & Engineering	CEO, Life Finder Systems International AB	Lund University, BSc, Engineering, MBA, International Management and Leadership (11)

Events and Other

Event - Marine Sustainability by Digitalization (MSD) (2021-2022)
In a series of six webinars Aalborg Maritime Network (AMN) (previously hosted by MARLOG) invites representatives from the industry to discuss marine sustainability through digitalization (AMN 2022). Part 1 - From Data to Business 2nd of November 2021, Part 2 - Collaborative Robots 7th of December 2021, Part 3 - The Digital Future of Ships 1st of February 2022, Part 4 - Frequency Optimization 1st of March 2022, Part 5 - BI in practice 5th of April 2022, Part 6 - Marine sustainability by digitalization 3rd of May 2022.

Event - Values and Norms of the Green Transition in Blue Denmark (28-01-22)
A formal presentation of the last of three research publications from Aarhus University (AU) about technology. The publications are; Open Innovation, The Robot/Technology as a Colleague, and Values and Norms of the Green Transition in Blue Denmark (AU 2022). Of which the latter is the one presented here. All three publications have been a great source of data and inspiration to me as they are heavily cited throughout my work. I have had the pleasure of meeting and discussing these topics with the authors. Even more, I was lucky enough to be a *small* part of the last publication during my time at MARLOG. I will take this opportunity to address the main theme of the three projects; The open innovation project addresses the need for collaboration across all industries in Blue Denmark. Especially regarding the development and implementation of new technologies. However, aiming to investigate the non-technical aspects of such collaboration. Among the findings is open innovation across shipping companies and industries in Blue Denmark, that are affected by traditions in a business-centered culture (AU 2022). The project, the robot/technology as a colleague, addresses the apparent increasing task that automation *steals* from the human operator. It is noted that a majority of actors have a stronger focus on the technologies themselves and a low understanding of the human operator's practice (AU 2022). In this webinar, the findings of the third research project are shown and discussed among prominent personalities in Blue Denmark, including Danish Shipping and Danish Maritime (MARLOG 2022b). Values and Norms of the Green Transition in Blue Denmark. It seems apparent that the green transition is a necessity and something that we should *do*, however, it does not seem apparent what the green transition is. The project investigates the different meanings that have been ascribed to the term by different actors in Blue Denmark (AU 2022).

Event - Digital Harbor (DH) (01-03-22)
The Digital Harbor in Esbjerg on the first of March 2022 was hosted by MARLOG where digitalization and collaboration were central elements of the debates. The event included a guided bus tour around the harbor of Esbjerg and a presentation from MARLOG's CEO, Business Esbjerg's CEO, digitalization possibilities from Esbjerg Harbor, and an interactive workshop facilitated by RUC. Along with a tech presentation from Lorenz Technology, DanPilot, and Sea Machines Robotics (MARLOG 2022a).

Event - InnoFounder and InnoBooster (IF/IB) (04-03-22)
A short presentation on how to apply best for funds was attended on the 4th of March by Aalborg University's Innovation Officer. Specifically to apply to InnoFounder and InnoBooster (AAU 2022a).

Event - An Update on Maritime Autonomous Navigation (IDAMAN) (07-03-22)
On the 7th of March, IDA Maritime facilitated a presentation to update on maritime navigation technology. The scope was to address progress on autonomous navigation in Denmark by SL's autonomy project. This was followed by an interesting presentation on Denmark being a player on the satellite front by Sternula. Lastly underwater surveying by CEO Mads Andersen, Blue Atlas Robotics (IDA Maritime 2022).

Event - The New AI Regulation (AIReg) (09-03-22)
On March 9th MARLOG facilitated an event where Emilie Loiborg from HORTON elaborated on some of the legal challenges regarding AI regulation and Mads Billesø from DFDS presented their progress on AI solutions, lastly, Bjørn Borbye Pedersen from the Danish Maritime Authority addressed possibilities and challenges in AI usage (MARLOG 2022c).

Event - World Maritime Technology Conference 2022 (WMTC) (26-04-22)
The 7th World Maritime Technology Conference was held from 26-28th April and brought together some of the most influential and brightest minds affiliated with the maritime world. Numerous events, talks, workshops, and presentations went on during these days. I participated in keynote speeches by Esben Poulsson from ICS, David Loosley from BIMCO, Knut Ørbeck-Nillsen CEO of DNV Maritime, and a presentation on how to meet IMO's 2030 and 2050 Goals & implementation by Maximillian Schroer from DTU, Claus Graugaard from Mærsk McKinney Møller Center for Zero Carbon Shipping, Lamin Jawara from World Maritime University (WMTC 2022).

Workshop - Predicting future trends based on past predictions (MRA WMTC) (26-04-22)
An interactive workshop on assessing old predictions for the maritime industry by MRA. Sector experts were gathered to assess how these past predictions and their state could be used to see what solution we should follow.

Pre-Project Events

Event - Summer Business Networking 2021 (25-08-21)
Networking event in Copenhagen Organized by MARLOG hosted by DLA Piper, my first (MARLOG 2021b).

Event - DanaDynamics Presentation 2021 (31-08-21)
A televised event where the company DanaDynamic presented the autonomous vessel sailing in the harbor of Svendborg. Many important personalities participated including the Head of the Danish Maritime Authority (DanaDynamics 2021).

Event - TechBBQ 2021 (16,17-09-21)
Huge gathering of many start-ups, funds, and other hopeful tech individuals (TechBBQ 2021).

Workshop - Maritime Competencies of the Future (01-10-21)
A workshop hosted by MARLOG to discuss how Blue Denmark can make the maritime sector more attractive to new students thereby creating support for the green transition to gain traction in the sector. E.g. by adding new competencies in youth. During three workshops.

Event - Autonomous Ships from the Perspective of Operation and Maintenance (06-10-21)
Hosted by MARLOG, lecturer and researcher Stig Eriksen, talks about some of the unanswered questions regarding autonomous shipping (MARLOG 2021a).

Event - Autonomy ships and new paradigm (25-10-21)
Hosted by MARLOG, anthropologists, and researchers Adrienne Mannov and Peter Aske Svendsen talk about the effect autonomous shipping can have on seafarers (MARLOG 2021c).

Event - Human + Tech = Problems? (28-10-21)
Organized by MARLOG and hosted by SIMAC in Svendborg, the theme was to discuss and foresee problems with the growing need for socio-technical collaboration (MARLOG 2021d).

Workshop - User Involvement (16-11-21)
A major workshop hosted by MARLOG where seafarers, start-ups, shipping companies, and researchers were put head-to-head in discussing user involvement. At times tensions were high. The workshop was extremely valuable and gave an enormous amount of insight into all camps.

Event - ShippingLab Conference (24-11-21)
A conference hosted by DTU on the 24th of November 2021 where other actors were invited to meet the people behind ShippingLab and discuss the Future (ShippingLab 2022a).

Event - Digital Tech Summit 2021 (30-11, 01-12-21)
A large event gathering many tech enthusiasts from different industries. Together with MARLOG and MRA, we hosted the Maritime stand at the event (DIREC 2021)

Project - The Connected Ship (2021)
The TCS project is a consortium of partners and developers that work together to create and build an IoT platform for vessels. The platform enables data sharing and improves vessel efficiency, such as engine and navigation. This platform will be utilized by developers to create and ship their apps, which will be installed on vessels to improve the experience of sailors and improve safety. This project is a large-scale initiative, and it is exciting to be a part of it (SARGASSO 2021).

Project - VHF Data Exchange System (VDES) (2021)
VDES is a radio communication system that operates between ships, shore stations, and satellites like the Automatic Identification System (AIS), often addressed as the AIS 2.0. It is a project that aims to bring world connectivity to the maritime sector (IALA 2021). When interning at MARLOG, I was connected to the project by giving user input from my experiences.

Abbreviations

AAU - Aalborg University
AGCS - Allianz Global Corporate & Specialty
AIR - The New AI Regulation
AIS - Automatic Identification System
AMN - Aalborg Maritime Network
ANT - Actor-Network Theory
AU - Aarhus University
CBS - Copenhagen Business School
CCR - Cargo Control Room
CTT - Critical Theory of Technology
DH - Digital Harbor
DKK - Danish Krone
DMAIB - Danish Maritime Accident Investigation Board
DMA - Danish Maritime Authority
DMF - Danish Maritime Fund
DTU - Denmark Technical University
ECDIS - Electronic Chart Display and Information System
ECR - Engine Control Room
EE - Energy Efficiency
GPS - Global Positioning System
GSF - Green Ship of the Future
IALA - International Association of Marine Aids to Navigation and Lighthouse Authorities
IDAM - IDA Maritime
IDAMAN - An Update on Maritime Autonomous Navigation
IF/IB - InnoFounder and InnoBooster
IMO - International Maritime Organization
ITU - IT University Copenhagen
KEFM - Klima- Energi- og Forsyningsministeriet
Maritime DTU - DTUM
MI - Mission Innovation
MRA - Maritime Research Alliance
MSD - Marine Sustainability by Digitalization
NM - Nautical Miles
NTSB - National Tansportation Safety Board
OCIMF - Oil Companies International Marine Forum
OECD - Organization for Economic Co-operation and Development
PMS - Planned Maintenance System
RADAR - Radio Detection and Ranging
RRI - Responsible Research and Innovation
RINA - The Royal Institution of Naval Architects

RUC - Roskilde University
SCOT - Social Construction of Technology
SDU - University of Southern Denmark
SEEMP - Ship Energy Efficiency Management Plan
SMS - Safety Management System
STS - Science and Technology Studies
TAN - Techno-Anthropology
USD - United States Dollar
VDES - VHF Data Exchange System
VHF - Very High Frequency
WMTC - World Maritime Technology Conference

Appendix 5 - Interview Guide (MRA)

Hello and thank you for taking your time to talk to me. Before we start I will just say that this conversation is recorded for further reference and use in my thesis. My thesis, democratization of Blue Denmark, is about exploring the ways in which technology can be developed by studying and incorporating practices and uses of current technologies through an anthropology-driven approach i.e. collecting data from practitioners through ethnographic work. We have previously discussed the issue of the complexity in the socio-technical setting of the maritime world. Academic research is increasingly becoming broader, specialized, and accessible. Funds for research are heavily poured onto those claiming they can make shipping more energy efficient. Today I hope that we can enter into a conversation regarding the scope of the maritime research alliance. Why does it exist and what does academic collaboration pose in terms of opportunities and challenges, and why is it necessary? First of all, would you like to introduce yourself and what you do, where you work?

Introduction:

- What is MRA, how do you operate and how are you financed? How and why was MRA created? How is MRA a Value Creator and how is your success measured?

Collaboration with MRA and other Facilitators and Academic knowledge:

- How do you see MRA positioned in relation to other Facilitators such as MARLOG, ShippingLab, or Green Ship of The Future? Is there competition, understood in the sense that they can individually start collaborating with researchers? Is there overlap? How do you think other Facilitators view MRA? How do the Shipping Companies fit into this structure?
- How would you describe the Danish research environment, is there collaboration or is research conducted in silos? How does the world view Denmark, our technology, and our research? How does research affect other actors such as industry organizations and development project management organizations?
- Is there a difference between technical and social research? How would you describe the connection between “pure science” and “applied science” in relation to contributing to a “society's course change”?

The Green Transition in a world of Funding:

- Are “green research” trending for the right reasons and do you feel that funding is “greenwashing”? Like a “black energy fee” could we have a “lack of user understanding/plan for implementation fee ”? Can it put pressure on funding?
- Do you think that success can be measured in real terms via GDP? Are you encouraged to apply, or does it happen only of your own free will? How do you look at funding, is it a battle of getting a first place? How will a fund control your success/result?