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# Futures literacy in collaborative foresight networks: advancing sustainable shipbuilding

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**Abstract**

Businesses are facing increasing pressure from society and regulators to become more sustainable and do their part to address the climate crisis. These businesses will require continual sustainability innovation formulation and implementation processes to meet these demands. Collaborative foresight (CF) has high potential for helping business sectors produce a continuous stream of sustainability options to select and deploy in finished products. Recent developments in futures studies indicate that a capability called futures literacy (FL)—acts of individuals or groups switching their modes and purposes for imagining futures—is relevant to the production of innovation-related outcomes. FL may be key to driving the effectiveness of such foresight collaborations; however, little is known about its exact functions in such business networks and processes. This article examines this issue in the context of a luxury-cruise shipbuilding network in Finland. It analyzes research data from the foresight workstreams of a multi-partner consortium active across three sequential projects between 2016 and 2022. The foresight team took an interventionist research approach, conducting interviews and workshops as part of all three projects. In this article, we analyze the materials produced from these interventions for the appearances of FL enhancement. Based on this analysis, we found that FL can play key functions in CF, such as supporting actors in perceiving new developmental pathways, identifying new opportunities for innovation, and identifying alternative priorities built from new realizations and insights—a finding in line with existing claims by FL scholars and educators. This article contributes to ongoing discussions about the significance of CF and FL in addressing the most pressing environmental issues of our time. It offers an evidence-based argument for the relevance of taking a capabilities approach (i.e., introducing and developing FL) for business networks seeking to use foresight when engaging in sustainability innovation.

**Keywords** Futures literacy, Collaborative foresight, Anticipation, Sustainability innovation, Shipbuilding

## Introduction

Many business sectors around the world are attempting to innovate how they will address climate change. Due to the extent of this challenge, no one actor can take sufficient enough action on their own to fully address it, indicating collaborative approaches could lead to wider-scale and more effective impacts. The long-term futures perspective to sustainability highlights the importance of broad visions and unspecified goals or ideas for enhancement rather than specific solutions to improved sustainability performance or ways to fulfil certain sustainability indicators. Our approach to sustainability as a comprehensive, systems-level phenomenon is based on Aguinis' (2011) definition of sustainability as context-specific organizational actions and policies that take into account stakeholders' expectations and the triple bottom line of economic, social, and environmental performance.

The Club of Rome declared a climate emergency and called for collaborative action to address this grand challenge [14]. The United Nations Environment Programme (UNEP) has framed its current strategies to address the triple planetary crisis—climate change, biodiversity loss,

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and pollution and waste—and is aiming to produce a sufficient, multilateral response to these interlinked challenges [6]. Various levels of governance (e.g., the UN, the EU, and various nation-states) have put an increasing amount of interest in incorporating foresight into their policy formulation and operations such as expressed by the secretary-general in "Our Common Agenda" [73]. Companies, in some cases, take leading roles in boldly addressing climate change through innovative actions,yet, there is more to be done, and more can be done through coordinated actions.

Innovation, in general, is fuelled by creativity, novelty, and the identification of opportunities for different ways of doing and being [4, 5]. Businesses are in need of new approaches to contribute to the so-called green transition. Historically, business logics have constrained ambitions for sustainability, resulting in too few companies prioritizing climate mitigation, adaptation, or resilience at the whole-of-business level. As the climate crisis continues, a growing variety of policymakers, entrepreneurs, researchers, and educators are asking, "How can a new ambition level for climate innovation be unlocked?" (e.g., [22], EIT [16].

The maritime sector can best be described as a complex system involving many variables and technical, economic, and societal systems which collectively generate the sector's overall characteristics. There are many ships, many fuels, many shipowners, many shipbuilding companies, many suppliers, and many ports—all of whom operate under several modes of governance. In this setting, several collaborations among stakeholders in the maritime sector are ongoing and planned to advance a green transition. While it is not always clear where to invest innovation efforts, there is growing awareness that must be done to make ships and the maritime sector more sustainable and ideally in a coordinated way.

Meanwhile, collaborative foresight (CF) shows potential to enable a set of companies in a shared sector to raise their ambitions to address climate change and launch timely sustainability projects aimed at near-term and long-term impacts [46, 77]. However, further knowledge about what factors foster CF among several businesses (or other actors) is needed [20, 21]. One area to be developed further is future-oriented capabilities.

Futures literacy (FL) is one name given to such capabilities. FL involves skills for engaging anticipation processes and is argued to help foresight practitioners, participants, and users implement more effective and impactful foresight processes and activities (e.g., [45, 58]).[1] In at least one known case, FL has been overtly introduced to a multisector collaboration to help the maritime sector actors innovate to address climate change [59]. In Miller's [43, 44] conceptualization of FL, he emphasizes the importance of diversifying and varying "how and why" a person or group "uses the future." This diversification of modes and purposes for using futures can be to any extent, but jumping between two broad categories of anticipatory systems is beneficial: *anticipation for future* (AfF) and *anticipation for emergence* (AfE). In organizations, broadly speaking, AfF is arguably more commonly utilized, while AfE is less. In many cases, these anticipatory systems are implicitly active, even in systematic foresight processes [43].

Planning and building cruise ships are intrinsically future focused, and to design ships to be more environmentally friendly involves joint efforts from a supplier network. Raising the topic itself serves to initiate change, discussions, and formulations of new meanings of sustainability and define new outcome framings, such as maximizing the overall sustainability of a produced cruise ship. Shipbuilding has long-term implications because it takes many years to close a sale, design, and build the ship, and afterward, the ship's owner operates the vessel several decades, from 30 to 40 years (see, e.g., [65]. Therefore, sustainability enhancement of ships offers a rich area for exploring how futures are imagined and utilized in a collaborative setting.

This article presents an analysis and initial findings concerning the link between futures literacy (FL)—capabilities to engage with "anticipation systems and processes" (cf. [43], and CF—collaboration to generate and share insights about the future—in the shipbuilding sector of Finland. While FL and CP have gained increasing attention over the past decade, they—to our knowledge—have not been combined in an academic analysis.

Foresight research is criticized for too often being exploratory, methodological, and impact oriented without enough attention to developing theory and explanation [28]. This article seeks to answer such critiques by contributing to the conceptual and theoretical basis for why *corporate foresight* and CF networks can drive sustainable innovation.

Our research data comes from three foresight interventions conducted as part of a multi-partner consortium across three sequential business research projects between 2016 and 2022 (6 years). The three projects share a common topic of sustainability innovation in the planning and building of cruise ships and were undertaken as action research aimed at driving change for the participating businesses.

Our aims are (1) to demonstrate how data from business-focused action research can be retroactively

[1] In past and present futures studies, the specific term "futures literacy" is used by a variety of authors each giving it different definitions. We choose to use Riel Miller's definition because of its robustness and clear links to contemporary discussions about anticipation.

analyzed for appearances of FL and its characteristics and effects and (2) to attempt to illuminate its function in multi-company collaborations seeking to identify new sustainability innovation opportunities. We approach these aims by mobilizing the concept of "anticipatory systems and processes" [43] and looking for how research participants in a multi-partner consortium generate and use their ideas about the future. Our research question and analysis focus on anticipatory systems used in workshops concerning potentials of future sustainability development. The research task this paper takes is to find evidence of participants enacting anticipatory systems and processes and to identify patterns for how ideas concerning the future are used by actors in the multi-partner consortium.

Our first research question is to find examples in our data for how varying modes and purposes of anticipation (FL) supports participants in obtaining new realizations and conceptions of potential change. Second research question is to analyze the relationship between concepts of FL, especially AfE and CF. In line with our larger ambition of conducting interventionist research that contributes new understandings, we analyzed any patterns we find for new insights and initial findings about how these processes work.

#### Research setting and business context

The context of this research is a shipbuilding network located in Finland, anchored by a luxury-cruise shipbuilder that employs over 1500 employees. Their produced ships are large and complicated, necessitating a vast network of suppliers [52, 65]. The research cooperation began in early 2016 as a joint project between academic partners and the case company (Project 1). The project aimed to explore sustainability initiatives, practices, and their transparency as well as the communication of sustainability to interested parties. The second phase (Project 2) and the third phase (Project 3) of this collaboration broadened into a wider consortium, including more companies from the supply chain. All three projects were motivated by researcher and company interests to make the shipbuilding process and its resulting cruise ships more sustainable. The research themes of these projects covered cruise ship sustainability data, advanced data visualization, social and economic aspects of sustainability, and an environmental footprint evaluation. In all three projects, a foresight- and futures-oriented work package was included that sought to identify innovation pathways and modes for exchanging foresight information among consortia partners.

The foresight team experimented with a discrete set of interventions to start and maintain an ongoing CF system among the partners. In Project 3, this became a top concern for the foresight team. The team explored how to advance such a system based on the latest future studies theory developments concerning anticipation and capabilities approach, leading to a series of supporting FL interventions, including an FLL.

The sustainability goals and requirements of shipbuilding network in question—at the time of the case projects—were mainly based on the lead company's expectation for the supply chain actors [65]. Currently, the corporate sustainability reporting criterions such as the Corporate Sustainability Reporting Directive (CSRD)[2,3]guides companies to be active and independent in their sustainability development. The capabilities approach supports companies in their need to align resources and processes more proactively and inspired by changing circumstances. These challenges draw attention to capabilities such as FL to respond strategic decision and changes.

## Conceptual background

### Collaborative foresight (CF)

CF can be linked to the broader concept of *corporate foresight*, which refers to organization's ability to anticipate future changes and the processes or actions that companies adopt to prepare for the future [25, 61]. The terms *corporate foresight* and *strategic foresight* are often used interchangeably, depending on context (e.g., in companies vs. in organizations and governments), but largely refer to similar phenomena.

In this article, we use the term *corporate foresight* because our research is about foresight actions within business context. *Corporate foresight's* main functions have been seen to increase managers' abilities to anticipate future changes, help them prepare and make decisions, and bring a competitive advantage to companies [68]. Organizations are seen as active players in the future, including the idea of companies actively making the futures. In the context of the luxury-cruise shipbuilding network consortium members' futures thinking, we need to examine concepts that describe interorganizational actions and processes to anticipate futures. Such concepts are, i.e., *networked foresight* [74] and *open CF* [77]. Our approach also highlights actors' abilities to consider or respond to uncertainty and discontinuous change. This means accepting that a business environment (i.e., in sustainability development) includes unforeseeable systemic effects on multiple levels and across organizational borders.

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464).

[3] European Commission Corporate Sustainability Reporting Directive (CSRD) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464).

The traditional approach to *corporate foresight* is concerned with unknown elements in the business environment and helping decision-making process as pointed out above; this is called an American tradition [62]. However, *corporate/strategic foresight* discourse especially in the French tradition (la prospective) also has taken concern with *corporate/strategic foresight* as a learning process where the futures are invented and created [10, 57]. As this study takes a human-centered approach and puts focus on capabilities and collaboration, we follow this tradition in the evolution of corporate foresight. Recently, discourse on *corporate foresight* has increasingly focused on CF, which highlights interaction and joint knowledge creation as key elements in foresight activities [29, 77]. The concept of CF captures the essence of our research, which is to explore the interactive process of how futures are perceived. We followed Gattringer et al.'s [20] definition of CF:

> *A discussion and analysis process of a few organizations concerning future developments in specific search fields which are relevant for the participating organizations and wherein issues related to future individual strategy and innovation options are collectively considered. Thereby, the joint creation of future knowledge and "out-of-the-box thinking" are important objectives. The results are used by each organization for further individual deliberations [20], 298.*

Several other approaches to CF are based on socio-theoretical frameworks where future projections develop through communication and interaction in organizations and institutional settings [11, 75]. Emphasis on context and actors' relations facilitates the exploration of knowledge frames in their specific context [2] as actors engage in critical and reflexive dialogue on possible, probable, and preferable futures. The CF framework highlights the role of these foresight forums or spaces in generating insights and futures ideas in interorganizational settings. As a recent development in this area [38], the process of CF is understood as a shared responsibility that complements managerial practice.

One of the main modes of modern corporate foresight actions is the use of participatory methods, which enable stakeholders to explore possible future changes, find emergent possibilities, and identify environmental challenges [9, 63]. Participatory methods promote the imagination of radically different futures in a manner that challenges the usual lines of thinking. This paper aims to elaborate on the participatory methods used to embrace radical futures thinking within the project network concerning luxury-cruise shipbuilding in Finland.

Other approaches which concentrate on interorganizational collaboration such as open innovation usually pursue more general ideas or domains than CF [21, 74]. Still, open innovation and co-creation activities can be compared to CF. The purpose of both approaches is to bring a variety of people together in an open space to produce, evaluate, or analyze futures-focused information and insights. Similarly, open innovation and CF seek to find unexpected novel ideas and unorthodox couplings [51, 55, 69]. There is also a clear link between CF and the systems view of innovation, as both research approaches highlight the importance of engagement with a broad range of actors, interactions, and, more importantly, linkages between different systems [17, 23]. The collaborative and communicative strand of *corporate foresight* can serve joint strategic change and explore strategic issues (e.g., sustainable development) as well as strengthen relationships between partner organizations. We see these features as reflecting futures for emergence. The conceptual background is elaborated upon in the next "Moving towards comprehensive collaborative foresight by incorporating anticipation" section.

The capability point of view has put emphasis on capabilities to understand and use futures studies frameworks and methodology but also on activities and practices on an operational level. Sarpong and Maclean [67] see corporate foresight as social actions and practices in the context of the creative evolution of ideas and potentialities into future resources and productive outcomes. For extensive discussion on the evolution of corporate and strategic foresight, we refer to two recent articles by Marinković et al. [37] and Saritas et al. [66].

### Moving towards comprehensive collaborative foresight by incorporating anticipation

Contemporary corporate *foresight literature* broadly reflects two distinct approaches, emphasizing either an organization's ability to anticipate future changes [3, 72] or companies' actions to prepare for the future [25, 56, 61]. This distinction between competences and actions is joined by societal and business aspirations for a more broadly coordinated foresight activity, a so-called collaborative foresight (CF).

Meanwhile, in the larger futures field, biological anticipation (cf. "anticipatory systems," [64] is proposed as a cross-cutting explanatory framework relevant to foresight processes (e.g., [18, 34, 41]. Anticipatory systems have been hypothesized by biologist Robert Rosen as processes that exist and occur in all lifeforms, including humans. Anticipation enables living beings to build and utilize models of "what could happen next" to inform their actions in the present. In the early 2010s, the FuMee group and COST Action 22 (2007) have argued

that understanding anticipation is key to methodological development in foresight and futures studies and could serve as a theoretical perspective on how foresight processes function or could be made to function.

This rising awareness that foresight practitioners and futures studies scholars can be more effective when they conceptualize their work as deployments of so-called anticipatory systems COST Action 22 (2007) is coupled with a rising interest in understanding and fostering the capability of FL (cf. Miller). For example, the UNESCO Futures Literacy program and its network of UNITWIN/UNESCO Chairs in anticipation and FL, which aims to advance human understanding and practical application of this capability, have grown to 37 chairs in 32 nations by the end of 2022. Meanwhile, anticipation studies and the FL approach can be seen to carry significant differences in emphasis from previous practices of foresight and futures research, which is indicative that there is a paradigmatic turn [32] or at least some set of "epistemic ruptures" [33] underway. It can be argued that at least three of four forms of epistemic rupture can be found in the FL approach as it changes key elements or ideal objects to use when searching for order in nature (see "Idealization" [33], 81)—e.g., "anticipatory systems and processes" and "capabilities"; what is to be measured and how key elements are described (see "Recoding" [33], 81)—e.g., anticipatory assumptions, and wholly new terms are introduced to describe discoveries (see "Reformulation," [33], 82)—e.g., anticipation for emergence. In our view, what is new in the FL approach in comparison to previous futures research are the following starting points for research endeavors: first, anticipation preexists—is already happening among actors in a given research setting. Second, people and organizations are already engaging and using anticipation, and the research task at hand—especially when conducting action research like we have—is to understand how anticipation functions for the actors and can be made to function more productively for collective needs. Inspired by these starting points, the analysis presented in this paper seeks to demonstrate the suitability of the FL approach for developing CF networks.

In our view, the function of a CF networks is too often reduced to the exchange of information concerning trends and developments, production of alternative futures or scenarios, or consolidating shared visions to drive action. While such exchanges have their uses, they can lack impact when too little attention is paid to developing capabilities to process, discuss, reflect, and experiment with such future-oriented information. The approach in this paper highlights the social construction of futures and the development of capabilities necessary for engaging in an increasing variety of anticipatory processes. We note how our project of creating a CF network is normatively motivated by the transformative potential of actors to innovate more effectively when doing so in a future-oriented way together. The FL approach can support this by helping actors express and reflect upon their own sources of imagined futures, develop new forms of agency, and critical reflective stance on their sources for imagining futures. In other words, both FL and CF endeavors carry emancipatory objectives.

We explored how the FL approach's attention to adding AfE to foresight's more commonly utilized AfF can be linked to a broader perspective on futures studies. For example, CF approach is often based on critical social theory [1, 48]. The critical social theory highlights multidisciplinary knowledge for advancing the emancipatory function of knowledge and critical realism [2, 24, 50]. This school of thought informed the development of critical futures studies, which focuses on how notions about futures are generated and imposed on others and which underlying structures affect how images of the future are constructed in a collaborative space [12, 70]. The critical stance challenges the legitimacy of dominant procedures to form context-specific visions or images. The FL approach seeks to disrupt the dominant procedures of foresight and futures studies by adding switching modes between AfF and AfE—attention to novelty and appreciation of difference—to the repertoire of foresight doers.

According to definitions of CF, the emphasis is on collective discussions and processes, the joint creation of future knowledge, and "out-of-the-box thinking" [77], 1). This relates to transformative elements in the FL approach, which aims to foster cyclical development of thoughts, reconceptualizations, negotiations, and differences as well as normative views of the future. Because of this apparent potential synergy between CF emphases and FL approach aims, the FL approach appears to be suitable for deepening our conceptual understanding of transformative elements in CF actions and processes.

## The FL approach

FL approach primarily aims to develop certain type of human capabilities to engage with a wider variety of forms of anticipation. The capability of FL provides a way to address biases and assumptions in addition to exercise of imagination and agency in relation to the unknowability of futures. We followed the definition of FL as a capability and utilized a Futures Literacy Lab (FLL) [44] to introduce and develop this capability among the network actors. We and several FL educators, researchers, and practitioners have used the working definition of the capability to diversify and vary how and why oneself (or oneself in a group) uses futures as well as sensing and making sense

[7]. The reference to "using futures" refers to the countless imagined futures people generate and how these affect perceptions and choices presently [42, 43, 58].

CF and FL, as applied here, share the basic ontological starting point: construction of reality through social processes and interaction [19, 60]. This paper has taken a social constructionist approach and highlighted the meaning of future-focused constructions of reality/understandings of future possibilities. Both frameworks, CF and FL, have roots in critical and transformative futures research tradition [47], 21). Anticipation alike has a link to chosen social constructionist approach. In the context of futures, research anticipation is commonly seen as synonymous with the *social constructivist foresight* defined broadly as an area of futures research that goes beyond forecasting and foresight to incorporate complexity, impredicativity, and intersubjectivity [53]. FL approach applied in this paper is aligned with above mentioned theoretical frameworks.

The FL approach has been under development since at least 2012. Its interventions emphasize developing the participants' capability to engage effectively in many forms and types of anticipation. FL tools such as FLL are built to couple their elements to various kinds of anticipation. In particular, the lab visits AfF followed by AfE and then flows into exercises aimed at producing insights, realizations, or something else of value to participants. An intended learning outcome for any first-time lab attendee is the awareness of how the futures they imagine drive perceptions of the present.

Recent discourse on FL has emerged, especially from FL practitioners' reports, where the focus has been on FL processes and interventions [13]. The key dimensions of these works have been FL's social and collective dynamics. This reflects the framing of FL development as having social and transformative learning dimensions [31, 59]. In existing literature, FL has been defined in several ways by various authors, including diverging conceptualizations of types of anticipatory systems [54]. However, the FL proposed by Miller (e.g., [43]) is robust enough to handle such differences.

When AfF is deployed, people build models and images of futures they hope to use to plan their actions. These imagined futures, for example, help define expectations of what could happen next or set visions of what would be desirable. Typical examples involve imagining futures for planning purposes [44] When AfE is in play, people are less concerned about what they will do with the futures they imagine and focus instead on noticing novelty and struggling to make sense of its meanings [43]. Therefore, FL is the capability to switch between these two categories of anticipatory systems. When developing FL is intentionally pursued, its precursor is awareness that both kinds of anticipatory systems exist, and that this switching is possible.

## Methods and materials

The methodological approach used to produce the research materials across all three projects is best described as interventionist research (cf. [35]. By engaging directly with our research setting, we sought to co-inquire with our research participants—to launch experiments and produce knowledge together. In addition to a goal of producing meaningful results for the participants, these interventions were motivated by intentions to contribute to academic discourse and theory-making. In this case, we sought to use a variety of methods over a series of project contexts to invite changed perspectives through futures thinking. Over the course of these projects, participants and researchers took interest in fostering collaborative foresight for the purpose of advancing sustainability in shipbuilding and the cruise industry. Our methodological approach was further inspired by the proposed conceptualization of Midgley's [40] "science as systemic intervention," in which all kinds of scientific methods and communications are considered to be interventions.

While all three projects shared a similar commitment to interventionist research, which can be described as finding out while trying to create change in the research setting, each had slightly different methodological and theoretical stances (Table 1).

The research setting had three distinct sequential research contexts, which are partially described in the "Introduction" section. Each context was a consortium project where partners collaborated to specify specific objectives and intended outcomes, actors and target groups, research participants, methods, and communication. Due to these evolving contexts, the foresight work packages of these projects deployed variations in these aspects while continuing to share a common goal of testing "using futures" to foster sustainability innovation in shipbuilding (see Table 2).

Methodological choices in the three sequential projects were based on the overall project objectives and reflect the iterative nature of sequential projects. All took a form of action research. The objective of Project 1 was to concentrate on the lead company's insights on sustainability development needs and get first-tier suppliers' opinions on communication and cooperation regarding sustainability with the lead company. The semi-structured interviews produced that kind of authentic insights from the core actors. (The interview process in the Projects 1 and 2 is presented in Additional file 1.)

**Table 1** Theoretical and methodological frameworks in the projects

| | Theoretical stance | Methodological stance |
|---|---|---|
| Project 1 | Company sustainability. Three aspects of sustainability: social, environmental, economic cf. Brundtland Report [8]. Sustainability indicators | Action research, knowledge transfer, communications, interviews |
| Project 2 | Future-focused sustainability agency | Action research, collaborative agency, interviews, participatory workshops |
| Project 3 | Anticipation and collaborative foresight | Interventionist research, futures literacy approach, participatory workshops |

Project 2 focused on a consortium, where six case companies were involved and the project aimed at exploring common themes in sustainability development. We used both semi-structured interviews and workshops: the interviews provided a set of themes, which were discussed in two sequential workshops. The first workshop used the data from the semi-structured interviews and grouped the most significant themes in collaborative sustainability development. The second workshop formed visionary (more than 10 years ahead) insights based on the first workshop outcomes. These workshops served the aims of the project by enabling the participants to identify new and meaningful insights. The workshop method implemented in Project 2 is further explained in the "Project 2: 'Hyperprojectivity' workshops" section.

Project 3 aimed again at producing stakeholder group insights on collaborative sustainability issues and especially on capabilities to see future possibilities. The overall project included several specific explorations including technologies for incorporating sustainable innovations into ship planning, developing new materials, and data models and indicator systems. For the foresight work package, a FL approach was taken to test how efforts to develop the consortium's capabilities to engage with a wider variety of anticipatory systems and processes could drive CF processes for sustainable innovation in the shipbuilding supply chain.

These details of the three projects are presented to clarify how the research setting changed over time and how the theoretical and methodological approaches, as well as objectives, actors, participants, methods, and communications varied yet were linked by a common intent: fostering sustainability in the local shipbuilding sector. In this paper, we are not seeking to make a comparative analysis. Each setting had some similarities and differences and several unique unreproducible characteristics due to when they happened in time, who participated, and what topics, assumptions, and themes were prevalent. Therefore, a comparative analysis is not viable, and we choose not to pursue that path.

The similarity across the three projects which supports the validity of our findings in this analysis is the intention across the three projects to foster collaboration and sustainability in shipbuilding. Because our overall aim in this article is to contribute to understanding how FL functions in CF can be understood in terms of shared intention, sector, and geography of the three projects, we claim that they are suitable to the goal of our analysis.

## Research materials and methods

### *Projects 1 and 2: Semi-structured interviews*

The semi-structured interview method was used in Projects 1 and 2 to gather data on sustainability enhancement in the partner companies. The lead company and key stakeholders of the company were interviewed. In total, 40 interviews (with 62 individuals, both women and men) were conducted across the two projects. The interviewees were the representatives from the case companies, mainly different individuals between Project 1 and 2. The interviewees were selected from a range of company functions, such as procurement, sales, design, human resources, environmental management, administration, HSE (health, safety, and environment), risk management, investments, and information and communication technology (ICT). The customer and supply chain representative interviews provided information on sustainability practices and reflections on the role of sustainability in the field.

Semi-structured interviews were selected as a method so that interviews could address sustainability themes based on the literature, allow researchers to deploy their own expertise in a flexible way, and support interviewees' authentically express their reasonings. Initial, content categorizing and coding were conducted in collaboration with three senior researchers (doctoral level researchers and experts on sustainability research). Coding process iterations were made to increase the validity of the data. The cross-checking and independent analysis, together with agreed-upon interview questions and templates, increased validity in capturing memories, practices, and notions on complex phenomena such as shipbuilding. This interview dataset is context-bound to a specific shipbuilding network, and its size allows for generalizations about overall phenomena, as specific issues or phenomena were mentioned by multiple informants.

**Table 2** Future-focused research interventions across the three projects

| | Objective of the project | Actors/target group | Method interventions | Communication interventions |
|---|---|---|---|---|
| Project 1 | Understanding how sustainability is seen in the lead company and 4 case companies regarding the construction phase of shipbuilding | The lead company, sustainability experts ($N=13$), case companies ($N=9$), sustainability experts ($N=16$) | Semi-structured interviews ($N=29$) about meanings of sustainability and its function in shipbuilding | A report book presenting the "state of the art" of sustainability development and initiatives |
| Project 2 | Elaboration of sustainability indicators and collaborative development | The same lead company as Project 1, case companies ($N=10$), sustainability experts ($N=41$) | Semi-structured interviews (41 interviewees) regarding sustainability-related practices<br>Participatory workshop ($N=31$) on collaborating for sustainability development | A report book presenting identified main topics for sustainability development |
| Project 3 SusC | Tools for collaborative sustainability development: evaluation systems, visualizations, future capabilities | The same lead company as Project 1 and Project 2, case companies ($N=8$) sustainability experts ($N=25$) | Interviews regarding sources of information about future developments ($N=8$)<br>Co-design sessions for Futures Literacy Lab ($N=11$)<br>Futures Literacy Lab on sustainable ship building ($N=19$) | Research meeting participation (e.g., work package updates mentioning FL)<br>Presentations about FL to consortium partners<br>Emails and summaries between co-design sessions<br>In-lab presentations about lab structure and futures literacy |

#### *Project 2: "Hyperprojectivity" workshops*

The workshop method in the study was used for data gathering, rather than a specific method for future construction. The workshop method used here is different from a future workshop, which is a formal method with its tradition [30], but the purpose of the workshops applied here was to examine interactive talks about futures within a project consortium [15, 26, 36]. The adopted workshop design accommodates both narrative and interactionist approaches for exploring future insights into sustainability. The workshop aimed to form a communicative setting—a space for "hyperprojectivity," as Mische [49] described as an analogical setting.

The primary research aim of the workshops was to enable data gathering on how sustainable development is discussed among project partners and stakeholders. The objectives of the two workshops were to produce ideas and opportunities to enhance sustainability in the network as well as in partner companies, discuss the implications of sustainability and its gains and bottlenecks, find visionary elements for collaborative sustainability, and produce data for understanding the dynamics of cooperation on sustainability issues at the network level.

The workshop process was split into two parts. The first phase's goal was to map sustainability themes raised from the interviews. The workshops also aimed to open futures-focused discussions with outsiders from the project consortium. The second phase was aimed at forming a collaborative space to construct visions and images of the future. The discussions in the workshops were loosely structured by topic and relatively intimate in groups of 3–4 persons. The method entails facilitation to allow clarification and promote the discussion flow of different viewpoints and interests, as well as to provide expertise.

The data from two consecutive workshops consists of transcripts and video footage on thematic discussions. The data also included facilitators' notes on flip charts. The group's discussions were analyzed by their content and interaction, producing changes in futures and development in the discussed themes. Altogether, 12 themes derived from the interviews were discussed to envisage futures images, and potential changes, and to reflect on the consequences of enhanced sustainability. The workshop attendees were representatives of the project consortium, including hand-picked participants from organizations and academics interested in the maritime industry. Altogether, 31 persons participated, 10 from partner companies, 11 project researchers, eight from academia stakeholders, and two NGO representatives in the two workshops held in 2018.

#### *Project 3: Interviews and Futures Literacy Lab*

In Project 3, there were two key research interventions: a series of stakeholder interviews and an FLL. The interviews were semi-structured and focused on the interviewee's sources of future-oriented information (e.g., publications, online resources). The data were analyzed to find similarities and differences in these patterns among those interviewed. Because this data does not directly involve FL, it was omitted from this paper's analysis. The FLL followed the UNESCO-recommended procedure for producing it via a co-design process as well as customizing a meta-design pattern developed by Riel Miller and tested worldwide by the Global FL Network.

This design pattern aims to introduce FL to a group through a "learning by doing" experience. Following the pattern takes participants on a "tour" of the two broad categories of anticipatory systems—AfF and AfE. In the first phase, AfF is used by participants when they discuss what kinds of futures they believe are probable and what kinds of futures they believe are desirable. These are the kinds of ideas about the future that are used in daily life to prepare and make plans. In the second phase, the participants are given a so-called reframe model,' which is designed to deliver assumptions about the future they likeliest do not frequently or ever use when imagining the future. The goal of this reframe device is not to convince them of any specific ideas about the future; rather, it is to spark a whole stream of ideas about the future that are novel to them. The third and fourth phases of an FLL aim to produce value in the form of insights or identified next actions. These aims are achieved through reflection and the invention of the next actions. Each phase follows a pattern of introduction, group work, and group presentations. Groups are typically 5–8 people for in-person events and 3–5 people for virtual/online ones.

The procedure for making an FLL is most effective when it follows the best practices established through trial and error in the Global FL Network. These practices include working with a host within an organization, co-designing the lab with the host and a small group of likely participants, having members of the host organization or community serve as co-facilitators, and debriefing and following up on the lab. Cross-cutting all of these practices is the goal of promoting the uptake of FL as a capability by customizing the event to the context within which it is held.

For Project 3, the FLL was operationalized in the following ways. The project consortium was considered the host. The lab itself was foreseen in the overall project plan and, therefore, needed to be completed to fulfil funder expectations, which introduced special challenges to igniting intrinsic motivation for the host. Co-designers volunteered from all partners of the consortium. The co-design team met virtually three times to make key choices about the lab design, including what topic to discuss, whom to invite, when to hold the event, by what means (virtual or in-person), what kinds

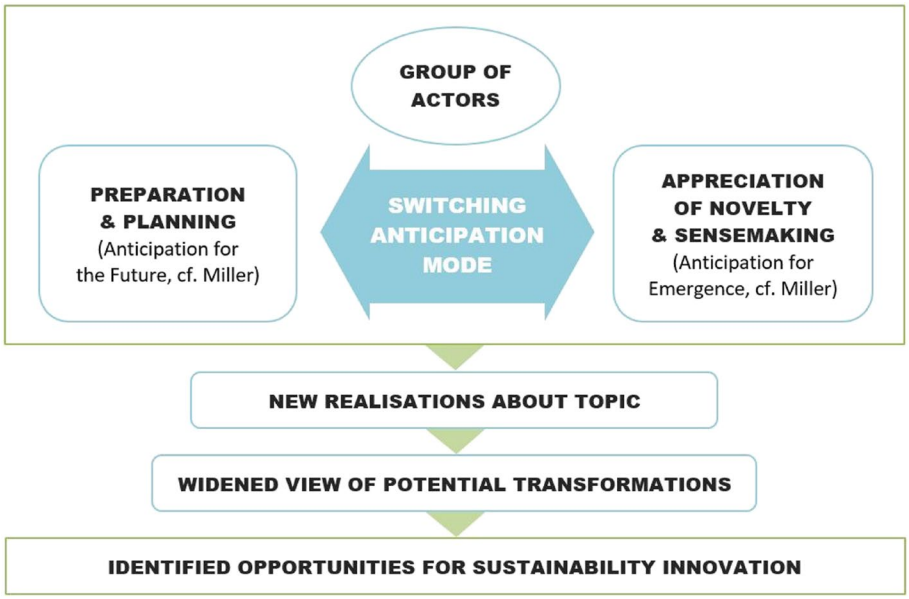


**Fig. 1** Proposed model for how CF actors enact FL to produce sustainability innovations

of outcomes to produce, and what types of exercises to do for each phase.

The topic selected was advancing sustainability in shipbuilding. The invite list included people from a mix of consortium partners, nationally relevant actors, researchers, companies, and organizations from outside Finland. The date selected was just before Finland's summer holiday month (July) and was held online to maximize participation possibilities for outside actors and hedge against the risk of a COVID-19 resurgence. The exercises chosen were layered analysis (inspired by Inayatullah's [27] *causal layered analysis*, future people and improvised newsroom, reflection cards, and an opportunity canvas. The invitee list was sent invitations as well as follow-up messages. Nineteen people attended: 6 facilitators and 13 participants; only 2 were from outside the Project 3 consortium.

The entire proceedings of the FLL—plenaries, and groups—were recorded via the Internet video meeting platform Zoom.us. The recordings were then transcribed and anonymized before analysis. Artifacts from the digital whiteboard and observation notes from the research team were also collected. All participants were provided with research information about the project and the lab's purpose and a research participant consent form.

#### *Selecting which datasets to include in this analysis*

It is important to keep a whole context in mind while analyzing data produced from interventionist research. After a close review of all three project's data, we found that Project 1 interviews served largely as preliminary work, to identify themes for the following interventions, and that the Project 2 interviews were similarly less suitable for this analysis. For time efficiency purposes, we narrowed this analysis on the two workshops of Project 2 and the FL workshop of Project 3.

To analyze this operationalized analytical framework built from a model for how FL leads to new realizations (Fig. 1) and looking for examples of AfF and AfE (see Table 3, next section).

#### *Analytical approach*

The analytical approach aims to identify manifestations of FL in the research data for an operationalized definition of the capability as a switching among modes and purposes of anticipation resulting in new realizations or insights. Despite Project 3 being the only one which overtly aimed at introducing and fostering FL for its participants, it is still possible to treat anticipatory systems and processes (cf. [43], 20–21) as the analyzable units in Projects 1 and 2. This is because they are theorized to exist and therefore can be expected to have existed even before these concepts were overtly active in the research setting. This selection of units is a suitable choice for analyzing datasets from the three differently formulated futures-oriented interventions of the three research projects.

The analysis looks for dynamic participant movements among types of anticipation systems. We operationalize a definition of FL as a person or groups' capability to change which anticipatory systems they are using when

**Table 3** Two broadly defined types of anticipation

| Type | Description | Examples |
|---|---|---|
| Anticipation for future (AfF) | The person or group anticipating has high concern for the futures they model or imagine because they intend to use it to plan and prepare | • Best-case or worst-case futures<br>• Most probable future or range of probable futures<br>• Desirable futures, aspirational futures, or visions |
| Anticipation for emergence (AfE) | The person or group anticipating has low concern for the futures they model or imagine and do so mainly in search of novelty | • Playful, explorative, "just because," production of future images<br>• New words, terms<br>• New meanings or realizations |

Cf.: the "Futures Literacy Framework," [43]

considering potential future developments of a given topic. From this framing, we analyzed the data evidence of manifestations of research participants switching between which anticipatory systems they use, as mentioned in "The FL approach" section. Miller proposes there are two broad categories of anticipatory systems which are commonly encountered in our modern world: (AfF) and (AfE) (see Table 3).

Figure 1 illustrates the dynamic nature of FL as a capability which a group of actors can use to arrive at new realizations and identify new opportunities for sustainability innovation.

The model presented in Fig. 1 was inspired by the Futures Literacy framework and design rationale for an FLL proposed by Miller [43, 44]. This model informs what we are looking for in our analytical approach. The process it describes is as follows: Actors vary their mode of anticipation between preparation and planning (link to AfF) and appreciating novelty (link to AfE). Doing so enables the actors to have new realizations about a topic they are discussing, which in our project is sustainable shipbuilding. These new realizations serve to widen perception of what can change and why. Responding to these perceived potential transformations, the actors are then able to identify new opportunities for sustainability innovation.

To aid in this search, abductive reasoning guided the coding of our qualitative data. The abductive reasoning seeks out new perspectives, observations, and interpretations rather than explicit causalities or theories compared to the deductive or inductive reasoning [39, 71]. The abductive approach adapted here was compatible with the dynamic modes of futures realizations. All the data sets were coded according the original purpose of the project. After that, we chose to narrow down to the workshops of Project 2 and the FLL of Project 3. We first tried to identify moments where participants express realizations or identify new insights and then search the transcript preceding those moments for evidence they were using either AfF or AfE. If both can be found in the research intervention's transcription leading up to that point, a switching of anticipatory systems had occurred.

The selected research material is analyzed for appearance of *AfF* and *AfE* in the research data and looks for evidence of their use by participants in reaching new insights, new realizations, and other forms of intervention-produced value. We analyzed the interviews (Projects 1 and 2) and the workshop discussions (Project 2) by identifying utterances where research participants use either anticipatory systems: *AfF* or *AfE*. We constructed a framework and coding system to help pinpoint our research data.

Even though the objectives, time periods, and methods varied between the workshops in Project 2 and the FLL in Project 3, we found merit in analyzing them together to illuminate how actors engaged in anticipation functioned in the research setting's specific CF network. We embarked on our analysis expecting we could identify the appearances of either or both kinds of anticipatory systems—AfF or AfE in the research material, as well as movement between these kinds of anticipation, an indicator of FL.

We also analyzed participant expressions of experienced value in the two different kinds of interventions: the interviews and workshops in Project 2 and FLL. There, we tried to identify reformulated opportunities, new insights or questions, changed frames for anticipating futures, and new ideas for action.

We aimed to find signs and features that describe FL as the capability to vary and diversify how and why futures are imagined and utilized. The "Conclusion and discussion" section will further reflect on how FL plays several key functions in CF for sustainability innovation.

## Results

### Analysis of the workshops (Project 2) and FLL (Project 3)

First, we analyzed AfF, thinking, and imagining futures to get an overall picture of how futures could evolve. We analyzed realizations of probable futures, desirable futures, hopes, and dreams. Projects 2 and 3 included these aspects, even when the workshops were conducted

**Table 4** Examples of AfF in Project 2 and FLL Project 3

| Workshop in Project 2 | FLL Project 3 |
|---|---|
| ***Preparation and planning AfF*** | ***Preparation and planning AfF*** |
| The importance of recycling will increase | Cruise ships will be zero emissions and carbon negative |
| The networks of shipbuilders will strive to understand systemic sustainability transformations | All ship designs will be easy to recycle and can be reused |
| **Ideal vision**: We will build ships as profitably as it is possible to do sustainably | **Ideal vision**: Ships working without any fuel consumption |
| Sustainability and corporate responsibility will be integrated into economic thinking at all hierarchical levels | **Hopes and dreams**: New ships will be more integrated into the natural sea environment to improve the recovery of polluted areas |
| **Hopes and dreams**: There will be collaborative integrative strategic planning and partnership in the development process and a proactive marketing strategy within the network | |

differently. The workshops and FLL audio and video recordings were transcribed *verbatim*, and the transcripts were analyzed thematically based on workshops and FLL's procedure. One author performed the initial coding, which was subsequently modified following discussion with the other researchers. Using NVivo 12 software, the coding phase sought to identify issues, which reflected switching of modes. The analysis was based on multiple rounds of reading and interpretation of the transcripts. Still, we encountered problems to identify exactly how and why switching of modes happened. However, we could find examples in the transcripts, which reflected each mode and was explicit enough to link either AfF or AfE. We present in the following Tables 4 and 5 examples of issues which reflect AfF and AfE found in the workshops and FLL.

The topics of the workshops were not the same, and there was a 4-year period between the workshops. Still, we see that the anticipated future had similar preferences for recycling and striving for sustainability transformations. Desirable futures had differences in focus, as the workshop in Project 2 focused on business and collaboration. The FLL focused on enhancing sustainability innovation in cruise ships and their functions. This might depend mainly on the workshop objectives and instructions. We conclude, as expected, that the AfF content on sustainable development within the shipbuilding industry is uniform in both projects.

Second, we analyzed how AfE—appreciation of novelties and striving to make sense of it—were present in the workshop discussions. See Table 5 for examples of AfE in the workshop/FLL.

The results in Tables 4 and 5 show that we were able to identify the appearance of FL as participants using at least two modes of anticipation—AfF, planning and preparation, and AfE, appreciation of novelty and sensemaking.

The appearance of FL in the FLL setting can be seen as self-evident due to the lab's first two phases being directly coupled to AfE and AfF. However, we interpreted that the data clearly showed participant reflections to be more profoundly connected to their guided experience applying FL than merely reporting back the contents of the FLL. The participants pointed out the meaningfulness and value they found in questioning and challenging underlying assumptions, which we claim prove the case.

**Table 5** Examples of AfE in Project 2 workshop and Project 3 FLL

| Workshop in Project 2 | FLL in Project 3 |
|---|---|
| **Appreciation of novelty and sensemaking AfE**: Identified wild cards, such as terrorism, pandemic, and war | **Appreciation of novelty and sensemaking AfE**: Change of perspective and individual mindsets. A vision created in the FLL is far removed from current cruise ship practices |
| Effects of economic crises on tourism | **Sensemaking**: Allowing one to question and challenge assumptions leads to a change in an individual way of thinking |
| **Sensemaking**: Strategic sustainability communication at the top management level and communicating the strategic meaning of sustainability to the public and stakeholders will promote the enhancement of sustainability | Identification of unasked questions and the very bottom-line subject topic help to bring in something new |
| Aligning quality standards and sustainability indicators will reinforce the sustainability discourse at the firm-network level | Decision-making or sensemaking mindsets reveal events, signals, or evidence that fosters the shaping of the industry's future |
| Coordination of interorganizational collaboration at the network level is needed for the enhancement of sustainability | Finding opportunities to create a type of momentum or political will to enhance sustainability |
| Process innovations are needed, such as local stakeholders having a shared understanding of the enhancement of sustainability | Finding efficient and smart ways to give incentives to companies for breaking silos and inspire policymaking |
| The point of the local network is the culture of working together, which cannot be duplicated | To create links for recognizing potential opportunities |
| Collaboration on issues that are problematic for every actor in the industry | |

**Table 6** Examples of participant-perceived value in Project 2 workshop and Project 3 FLL

| Workshop in Project 2 | FL Lab Project 3 |
|---|---|
| **Reformulated opportunities**: Making explicit the gains and benefits of recycling<br>**New insights or questions**: Productive communication within the network and its integrative and multilingual work environments<br>**Changed frames**: Individual understanding and motivation to act sustainably<br>**New ideas for action**: Coordinated safety and human resource management between shipyards on global/national levels | **Reformulated opportunities**: Creating a space for disruptive thinking and learning<br>Finding novel development directions<br>**New insights or questions**: How to implement ideas produced in the FLL. How to do this kind of thinking in daily work<br>**Changed frames**: Completely new technologies or cruise-tourism concepts<br>**New ideas for action**: To enable a process to move from vision to committed actions and to pin ideas for current actions |

Third, our approach to FL appearance was to analyze experienced participant value in the two kinds of workshops. The participant value was expected to reflect FL capability building and abilities to reflect focusing long term (10–30 years ahead). See Table 6 for examples of participant value in the workshop and FLL.

The above table shows that participants from both the Project 2 workshop and the Project 3 FLL were able to enact AfE as well as AfF and arrive at new realizations and identify innovation opportunities. The new meanings created in both workshops were similar, as both recognized the need and will for collaboration in sustainability development. However, there are differences in the contents, likely due to the framing of the topics, the differing time horizons under consideration by the participants, and the overt coupling of the FLL first two phases to AfE and AfF. It is clear that the realizations, widened perception of potential, and identified opportunities for innovation (see Fig. 1) are more "within reach" for the Project 2 workshop in comparison to those of Project 3's FLL which raise ambitions to integrate the disruption of conventional thinking to find novel innovation pathways in pursuit of completely cruise-tourism ideas and put them into action in daily operations.

These results support the interpretation that an FLL can serve as an efficient space to promote diverse and unconventional thinking. However, the departures from conventional thinking it encourages make it more challenging to translate the resulting identified opportunities into specific concrete actions. Another side of far-sighted ideation seems to be the difficulty of combining and implementing futures-focused ideas in the planning or foresight systems of companies or network collaboration. The FLL methodology includes a phase (see Additional file 2) in which ideas and further actions are discussed. The FLL produced general ideas, questions, and issues to explore further. Respectively, the workshops in Project 2 produced mainly short-term possibilities (5–10 years) for specific actions which built upon preexisting ideas from sustainability. This difference can be explained, in part, as a result of differences in the workshop objectives. However, additional explanatory power can come from anticipation and the FLF.

Our analysis indicates that the intentional mobilization of AfE in the Project 3 FLL led to more unconventional insights with greater difference from preexisting discussions. It can be argued that these ideas, due to their newness, were more difficult for the participants to instantly translate into concrete, clear, and specific actions for companies. This observation raises questions about the practicality of an FLL: why hold one if a more classic form of futures workshop can lead to more immediately useful results? The answer merits some nuance regarding practicality. In the Project 2 workshop, practicality focused on "what should we do next?". In the Project 3 FLL, practicality focused on questions of "how do we need to change?" in terms of learning and capability development. Both "hands" of practicality are highly relevant in business.

#### Analysis of the relationship between AfE and CF

We adapted an approach to CF that highlights collaboration, interaction, and divergent thinking [20], 298). The approach used here stressed construction and making futures rather than scanning horizons, and trends, or creating alternative coherent scenarios and visions (see, e.g., [29]. The CF perspective taken highlights the transformative potential of actors as well as making the future or, in other words, the "decolonization" of futures [43].

Our analysis focused on how sustainability futures were discussed and constructed among the participants. The workshop setting and methodology in Projects 2 and 3 were participatory processes characterized by flexible long-term thinking, diversity, and inclusivity, encompassing actors beyond organizational borders and facilitating co-development within sustainability enhancement or the construction of images concerning sustainability enhancement. We tried to identify dynamic future-focused actions, opportunities, and sharing of futures ideas in the workshop and FLL participant talks. Only the FLL was designed to promote AfE, but we also tried to find elements of AfE in the workshops in Project 2.

Variables of the analysis are as follows:

- Dynamic forward-looking actions were understood as future perceptions, creative thoughts, and indeterminate perceptions of multiple future possibilities and their applications.
- Opportunities identified were coded as clearly expressing new possibilities for sustainability development.
- Ideas shared about the future were analyzed by the reported transformative visions or lines for actions.

First, we found several future perceptions that matched creative thoughts or indeterminate perceptions of multiple future possibilities and applications, especially in the FLL. In the workshops in Project 2, we expected creative future possibilities to appear, but the ideas were directed more by problem-solving and identifying development needs. This difference is relatively self-evident; it still reflects the power of FLL methodology in producing creative thinking beyond conventions.

Some extracts from the talks described multiple future possibilities:

*We can export sustainability values for new and emerging markets. This could be a new way of thinking to build sustainable relationships and create sustainability innovations. (Workshop Project 2).*

*…could we see, ships, more than just transporters, that could they be actually a solution to cleaning the oceans and could they have functions, multifunctions in a way, that they are not only seen as transporting things or goods or people. (FLL).*

*…scenarios [of future cruise ships], could be lifesaving spaces of innovation driven by young people, you know like, like being this sort of link between the ocean and the land. (FLL).*

Second, the identified opportunities were coded as clearly expressing new possibilities for sustainable development. We noticed that the new possibilities were similar in both projects. FLL produced more novelties and workshops in more business cases in Project 2. The most commonly identified opportunities were innovations in fuels and their consumption.

Some extracts from the talks described new possibilities:

*Thinking from the economic perspective, we need to include a broad understanding of eco-efficiency so that we don´t only speak about ecological issues but also on the economy and new business solutions so that these solutions would be 'win–win' for every party. (Workshop Project 2).*

*There's a whole question of fueling it, and I hear there's a, there's a big push to have nuclear-powered cruise ships. (FLL).*

*…sustainable living and gardening [on] ships offshore [locations]. (FLL).*

Ideas shared about the future were analyzed by the reported transformative visions or lines for actions. We tried to separate transformative elements for the new ideas and opportunities and considered the talks in the reporting-back sessions. We perceived that, again, FLL produced transformative and far-reaching visions; as in workshop 1, the Project 2 visions were connected to topical issues.

Some extracts from the talks describe sharing ideas about the futures.

*I'm thinking about a closed circle and circular economy. If we talk about a carbon-neutral society, we can benchmark, for example, the construction industry, and find development partnerships from there. A new strategic partner might help us start from scratch. (Workshop Project 2)*

*..accepting both, the good and the bad sides of humanity, this bipolar in a sense of nature, like perhaps how we can escape, from these two ends, by accepting it. Even the bad parts of the for-profit parts, and try somehow, (present or) conceptualize our ways of doing things (FLL)*

*..much of the discussion is more about getting zero emissions and, getting no carbon stuff and like that, so what we, if we would aim higher, then we would actually work for sealife health and environmental health in the oceans and coastal areas. (FLL)*

To conclude the results, we found evidence that an FLL format promotes creative thoughts and indeterminate perceptions of multiple future possibilities. We considered this as an element of AfE. FLL methodology, as applied here, strengthens creativity and opens avenues for novelties and sensemaking in this context. However, the workshop conducted in the Project 2 contained also elements of AfE even though it was not as clearly promoted than in the FLL. We also observed that the definition of FL was problematic as an analytical tool for empirical data. This concept needs more clarity and strength to differentiate it from other concepts. The FL contribution to CF seems obvious, especially in opening up broader perspectives on innovation. Overall, we confirm that the idea of "walking on two legs" is solid ground for CF practices. Building FL capabilities, we

state that imagining futures via AfF and AfE are integral parts of the process. These functions are also essential to innovation processes and, therefore, play a double role in making CF systems more effective and supportive of sustainability innovation.

## Conclusion and discussion

This paper analyzed data from three action research projects aimed at fostering CF in support of sustainable shipbuilding, each utilizing different theoretical and methodological starting points. Only the research interventions of the third project directly mobilized contemporary understandings of anticipation and FL. We prepared a crude model, built from the FLF [43] wherein toggling between AfF and AfE leads to new realizations, widens perception of potential transformation, and can drive new sustainability innovations.

After narrowing our analysis on the workshop of Project 2 and the FLL of Project 3, we were able to identify manifestations of both AfF and AfE in the two projects. We also showed examples of AfF, AfE, and new insights produced by participants in both interventions and observed that Project 2's examples are more practically oriented and closer at hand and Project 3's more radically differ from present-day discussions about sustainable shipbuilding. Despite this contrast, both interventions helped the participants reach new realizations and identify new ways of doing things. This finding indicates that when a group of actors switches between AfF and AfE during a workshop (or innovation process), they can produce new insights and perspectives on what can change and how. In other words, the participants in both interventions could perceive potentials for transformation and think of near-term actions relevant to these potentials. How participants utilized their innovation ideas after they were conceived is outside the scope of this article yet worthy of follow-up studies.

Based on leading FL research [43], we expected the capability would look more like our participants' intentionally switching between modes of anticipation. We can see, for example, that in Project 2, the occurrence of AfE was perhaps less strong than in Project 3. The earlier project prompted AfE using existing foresight heuristics like "wild cards" or "black swans," which are good for reframing yet still quite linked to purposes of planning and preparation (AfF). In Project 3, the use of AfE was more strongly invited changing underlying assumptions and encouraging imagining futures just to see what they would be like. Common to both projects, the switching from AfF to AfE was imposed by the intervention design and not necessarily self-directed. We would expect to find self-directed application of FL "in the wild." At best, we can claim the capabilities appearing were a proto-FL, arising due to the enabling structures, serving to spark interest among participants to go further in developing their network's FL.

This is indicative of the value in emphasizing FL development as part of the designs of many kinds of futures interventions. Placing attention on growing capabilities to access a wider variety of anticipatory systems and processes has immediate- and long-term effects. Project 3 illuminates how an aim to develop FL through a futures intervention is key to how far participants can go in formulating new insights. While other factors of an intervention design also play a role—such as time horizon or formulation of the topic or tolerance for nuance and ambiguity—it does appear that attention to FL development shows promise as a key contributor to the function of a CF Network.

Based on our analysis, we found that FL can play key functions in CF, such as supporting actors in creating novel ideas, identifying new opportunities for innovation, and identifying alternative priorities built from new realizations and insights—a finding that is in line with existing claims by FL scholars and educators. Utilizing AfE is also important to CF as it opens up ways for radically novel perspectives. FL can reveal tacit knowledge that this is often the "less familiar" of these two kinds of anticipation. This makes sense because business logics inside their markets and regulatory environments have become much more dependent on AfF. At a general level, more practice and integration of AfE would balance this picture, in ways that both modes would play an equal role. Applying this insight to CF processes, AfE will bring in important perspective as it appreciates complexity and the novelty it generates. AfE concerns engaging this novelty, struggling to invent new words to describe it, find meaning in a continually changing world, and acknowledgment of the unknowability of the futures. We see the potential for the same skills involved in AfE to help CF networks more deeply interact with each other's latent potentials for cooperation, ideas about the future, and be more flexibly tuned to how the world overall is changing and potentially could change.

This paper also contributes an initial viable model for analyzing any futures-oriented intervention for appearances of FL. When analyzing the data from the three projects, we experienced difficulties in empirically elaborating on FL elements from the overall expressions of novelties, creativity, and completely new perspectives. However, we found evidence that FLL methodology is strong in promoting creativity and divergent thinking. Although the analysis undertaken in this article included two different kinds of interventions and therefore produced different kinds of content and discussion, we claim

that both have fostered more expansive thinking about the future and laid groundwork for FL development. We can see how an FLL—as an intervention designed directly for the task of introducing and fostering FL—offers stronger appearances of AfF and AfE and therefore more terrain for participants to arrive at their own conclusions about why FL capabilities are worth developing. An FLL's emphasis on reflexivity and the intersubjectivity of futures also support this (cf. [44], p.97). Other interventions with these characteristics may already exist and could be surfaced by future research applying and building the initial model we used here.

We found a clear need for more conceptual work to elaborate on how applying FL leads to the identification of opportunities. Our analysis found evidence that FLL methodology can promote creativity and unconventional and divergent thinking, while the Project 2 workshop promoted practical, yet future-oriented thinking. Although this article included different kinds of interventions and therefore produced different kinds of content and discussion, an important question is raised: What patterns for applying FL lead to practical actionable innovation ideas and which patterns lead to radical ones? Our analysis indicates there is some link between the intensity of engaging AfE and the production of ideas which are more difficult to translate into practical next steps.

This article contributes a practical recommendation to all sectors seeking to launch multistakeholder CF systems. Taking a capabilities approach by introducing and developing FL with network actors has several benefits (see "Conceptual background" section). Our analysis indicates that this capability is a potent force for supporting creativity and innovation. However, the nuances of this recommendation are also key. When people know that when they are imagining the future one way, they could be instead imagining it another way; they can more fully engage a specific foresight tool being used or at least see its limitations. A key point or a take-home lesson is to enable a combination of visionary elements with strategy and innovation.

A participant in the FLL said:

> *How can we actually span the arch from a future vision to evidence that there's serious commitment right now to invest in this vision? [...] To really say look this is not just the sort of, window dressing something that we can do in the future but really how do you, how do you pin it to today?*

From an interventionist researcher's perspective, the research events of the three sequential research projects described in this paper were primarily intended to produce value for the research participants. This paper gives some indication of how this occurred, but it was not the focus. Future research is needed to follow up with these research participants to search for any longer-term impacts of their participation. Further research can also focus on methods to identity and analyze changed frames and new ideas for action. We see the need for deeper understanding how changes happen within a FLL and what kind of implication these changes have on an operational level in an organizations' daily work. A possible way forward could be to create methodology to analyze cognitive and affective elements and actors' reactions to them in the FLL environment. FLL implications to organizations' practical procedures, such as foresight systems, need to be studied also on human behavioral level, e.g., how making sense of futures-focused possibilities or problem-solving situations happen and how futures are used and attention moves between AfF and AfE type of issues. Crucially, such studies should tune into actor capabilities for engaging these two kinds of anticipatory systems.

Another contribution is discussions about a paradigm shift in futures studies. We demonstrated an analytical approach that could be used by other researchers in other contexts to continue testing our underlying hypothesis inspired by the past decade's work in anticipation studies. If anticipatory systems and processes are everywhere and happening constantly, it should be possible to find evidence of them in past research data. Once found, their usage patterns and outcomes can be further elaborated. Such research activity would have significant implications for foresight practice—as explanations for why specific processes lead to some types of outcomes become more apparent.

We conclude that this article contributes to ongoing discussions about the significance of CF and FL in addressing the most pressing environmental issues of our time. It offers an evidence-based argument for the relevance of taking a capabilities approach (i.e., introducing and developing FL) for business networks seeking to use foresight to conduct sustainability innovation. Based on our study, we see strong potential for FL to give companies a new kind of confidence when working in uncertainty, competing interests, and the unknowability of tomorrow. Visions of the future so often disappoint, when they do not arrive or do arrive with unexpected features. We do not know how our FL-applying CF will turn out in our research setting, but we see potential for it to actualize significant change and help address the climate emergency.

**Abbreviations**

| | |
|---|---|
| AfF | Anticipation for future |
| AfE | Anticipation for emergence |
| CF | Collaborative foresight |
| FL | Futures literacy |
| FLF | Futures literacy framework |
| FLL | Futures Literacy Lab |

## Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40309-023-00221-1.

**Additional file 1: Appendix 1.** Semi-structured interview process in the project 1 and 2, sample and interviews.

**Additional file 2: Appendix 2.** Futures Literacy Lab: Advancing Sustainability of Future Ships – 9-10 June 202.

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**Authors' contributions**
(1) Original idea and the concept of the article, collaborative foresight theory, analyzing of the results, and major contributor to writing the article. (2) Original idea and the concept of the article, futures literacy theory, Futures Literacy Lab principal facilitator, and major contributor to writing the article. (3) Data gathering, conducting interviews, context description, and commenting the article. All authors read and approved the final manuscript.

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**Availability of data and materials**
The datasets generated and analyzed during the current study are not publicly available due to case companies' request but are available and anonymized from the corresponding author on reasonable request.

## Declarations

**Ethics approval and consent to participate**
Research integrity issues are agreed in the consortium agreements in the Projects 1–3. In addition, the consent to participate in the Project 3 is also made separately. Consent to publish the research results in the journal is granted by the steering committees in the Projects 1–3.

**Consent for publication**
Not applicable.

**Competing interests**
The authors declare that they have no competing interests.

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