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Published in:
Technological Forecasting and Social Change

DOI:
10.1016/j.techfore.2022.121966

Publication date:
2022

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Spaniol, M. J., & Rowland, N. J. (2022). Business ecosystems and the view from the future: The use of corporate foresight by stakeholders of the Ro-Ro shipping ecosystem in the Baltic Sea Region. *Technological Forecasting and Social Change*, *184*, [121966]. https://doi.org/10.1016/j.techfore.2022.121966

Technological Forecasting & Social Change 184 (2022) 121966

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

Business ecosystems and the view from the future: The use of corporate foresight by stakeholders of the Ro-Ro shipping ecosystem in the Baltic Sea Region

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ARTICLE INFO

Keywords:
Business ecosystems
Corporate foresight
Orchestration
Focal firm
Scenario planning
Roadmapping
Maritime
Shipping

ABSTRACT

Ecosystems are viewed as important sources of innovation. While contracts, rules, policies, and industrial standards have been identified as important for coordinating and aligning inter-firm relationships, tools for the collective, collaborative orchestration of ecosystems have yet to be fully identified and articulated by scholars. The core contribution of this paper, the authors contend, is that corporate foresight tools, as applied at the level of the ecosystem, have the potential to orchestrate ecosystems. To this end, the authors examine the practical use of corporate foresight tools, in this case, roadmapping and scenario planning, as employed by ECOPRODIGI, an Interreg Baltic Sea project designed to advance the EU's strategy for eco-efficient Sustainable Blue Economy in the Roll-on/Roll-off (Ro-Ro) shipping ecosystem. Results demonstrate how ecosystem-level foresight significantly differs from traditional foresight centered around a focal firm. Corporate foresight tools, as applied to an ecosystem: 1) Target a diverse set of ecosystem actors beyond the segment's focal firm, including complementary firms, investors, and non-market actors; 2) Engage ecosystem actors, rather than only the focal firm, in shared strategy development based on a diverse mix of foresight tools; and 3) serve to orient and reify the ecosystem by charting the collective anticipation of innovations, policies, etc., in a shared set of future options. In the end, the authors find that corporate foresight tools operate as constitutive elements of ecosystems, that is, the tools help enact the ecosystem not as an abstract concept but as a shared, lived reality.

1. Introduction

This article, about strategy and anticipation in ecosystems, is inspired by James F. Moore's (2006: 31) article "Business ecosystems and the view from the firm," which positioned ecosystems alongside markets and hierarchies as "pillars of modern business thinking." Of course, Moore (1993) is renowned for defining "business ecosystem" in a landmark *Harvard Business Review* piece. Still, it is Moore's, 2006 work that inspires this article. In particular, it was Moore's hints about the unique significance of "the future" for business ecosystems, which this article aims to unpack, embed in the literature, and, subsequently, operationalize, hence the kindred title of this article "Business ecosystems and the view from the future."

Consider Moore's (2006: 55) evocative use of the future in relation to "ideal" and "successful" intra-ecosystem relations, namely, that:

> The ideal business ecosystem achieves "collective action" … and members find ways to rally around valuable and exciting *futures*. The members of a successful business ecosystem [collaboratively] cocreate their *future*.[1]

The future is a core organizing principle of ecosystems requiring cooperation replete with competition, Moore (2006: 73) writes:

> In a business ecosystem, … a multitude of firms come together around a *broad vision of a future* they want to make happen. They understand that establishing *this future* will require both cooperation and competition among their firms.[2]

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[1] Emphasis added by the authors.
[2] Emphasis added by the authors.

https://doi.org/10.1016/j.techfore.2022.121966
Received 10 February 2022; Received in revised form 9 August 2022; Accepted 13 August 2022

Additionally, and while not much has been made about this aspect of Moore's thinking, Moore (2006: 74) inventively positions “commitments to the future” alongside the “invisible hand of the market,” writing:

> Business history moves forward from a first order consideration of exchanges, to a second order focus on activities, to a third order emphasis on the ideas that guide activities … The first order of consideration is the “invisible hand” of the market. The second order of consideration is the “visible hand” of the firm.“ The third order of consideration might be termed the “visible imagination” because the transactions that are coordinated [in business ecosystems] are not primarily for goods or activities, but for *commitments to the future*.[3]

And yet, seemingly none of these abstract insights about the future have been directly addressed in scholarship about business ecosystems or operationalized as a practical matter for real world ecosystem actors. This paper explores the link between ecosystems and the future conceptually, in the literature review, and then empirically, in a detailed, practice-oriented empirical case study.

Historically, our collective research gaze was leveled at the individual-level of the focal firm when it came to significant issues such as resource orchestration (Carnes et al., 2017; Sirmon et al., 2011). Increasingly, however, scholars are applying these insights to inter-organizational processes associated with business ecosystems (Helfat and Raubitschek, 2018; Jacobides et al., 2018; Linde et al., 2021). According to Laamanen (2017), a major priority in research on strategy is to understand how relationships are established and maintained within ecosystems (see also, Lingens et al., 2020).

The core contribution of this paper, it follows, is that corporate foresight tools, as applied at the level of the ecosystem, have the potential to orchestrate ecosystems. The application of foresight tools provides one way – of many possible ways – for individual ecosystem actors to coordinate the timing of important shared milestones, establish advantageous positions, and to cultivate innovation, not merely for themselves, but for the ecosystem as a whole. Foresight is about far more than simply seeing into the future; it fortifies social networks, models cooperation and partnerships, and it creates a shared language and vision of the future – all core features of “ideal” and “successful” business ecosystems, according to Moore (2006: 31).

The authors empirically explore the use of corporate foresight tools, in this case, roadmapping and scenario planning, as employed by ECOPRODIGI, an Interreg VB Baltic Sea project designed to advance the EU's strategy for eco-efficient Sustainable Blue Economy in the Roll-on/Roll-off (Ro-Ro) shipping ecosystem. This case is important to document because ecosystems are increasingly viewed as important sources of innovation, and this particular case presents a unique opportunity to study foresight tools as applied to the “floating platform,” that is, the Ro-Ro vessel and the broader ecosystem of its complementors. While contracts, rules, policies, and industrial standards have been identified as important for coordinating and aligning inter-firm relationships, tools for the collective, collaborative orchestration of ecosystems have yet to be fully identified, articulated, and empirically demonstrated by scholars. Results from this study demonstrate how ecosystem-level foresight significantly differs from traditional foresight centered around a focal firm. Corporate foresight tools, as applied to an ecosystem:

- Target a diverse set of ecosystem actors beyond the segment's focal firm, including complementary firms, investors, and non-market actors;
- Engage ecosystem actors, rather than only the focal firm, in shared strategy development based on a diverse mix of foresight tools; and
- Serves to orient and reify the ecosystem by charting the collective anticipation of innovations, policies, etc., in a shared set of future options.

In the end, the authors find that foresight tools operate as constitutive elements of ecosystems, that is, the tools help enact the ecosystem not as an abstract concept but as a shared, lived reality. Corporate foresight tools help to generate potential ideas for future shared projects and lay the ground to “pre-organize” future collaborative action – or, in Moore's (2006: 74) terms, “commitments to the future.”[4] In what follows, the authors review relevant literature, describe both the applied and empirical methods that they employ in the project, demonstrate the case study, and then provide readers with a discussion and concluding remarks.

2. Review of literature

This section reviews literature on platforms and ecosystems with special emphasis on decentering the “focal firm” in the context of inter-organizational coordination and orchestration of resources before examining background literature on foresight tools as a means to harness the future for use in the present. Please note, this article reviews a vast, diverse literature; the authors had to be selective, and acknowledge that some readers will not be satisfied by their choices.

2.1. *Platforms and ecosystems*[5]

Platforms and ecosystems are increasingly viewed as sources of real and potential innovation and, simultaneously, the progenitors of quasi-governance structures to reinforce inter-organizational and inter-institutional cooperation. Recognizable examples of platforms include Google Maps, which provides infrastructure to enable, for example, ridesharing service providers, or, for example, the Apple Store upon which application developers market, test, and gather feedback about their products and services (Eaton et al., 2011). According to Ashton (2009), pharmaceutical production, including a multitude of upstream and downstream partners in their supply and service networks, is a banner example of a business ecosystem, meanwhile critical infrastructure such as maritime terminal ports, according to de Langen et al. (2020), is sometimes distinguished from a business ecosystem and referred to as an industrial ecosystem.

The notion of the ecosystem in the context of strategic planning has been defined in multiple ways. Jacobides et al. (2018: 2264), for example, define an ecosystem as “a set of actors with varying degrees of multilateral, nongeneric complementarities that are not fully hierarchically controlled.” This definition is emblematic of a network or relation-centric view of the ecosystem construct and clarifies how partners voluntarily self-organize (e.g., via multilateral control). Adner

[3] Emphasis added by the authors.

[4] Thus, the performative potential of foresight practices, aimed at the level of the ecosystem, conceivably have the effect of a “self-fulfilling prophecy” (see, e.g., Merton, 1948). This is because planning together, within an ecosystem, is thought to fortify the network connections holding the actors together in a group. As actors propel themselves into the future together, the idea that those ecosystem actors, in effect, “belong together,” in an inter-organizational in-group, is reified. In so far as this may be true, ecosystems, in general, are likely as much a market reaction to shared economic challenges as they are the performed outcome of perceived commitment, which, the authors contend, can be strengthened by the application of corporate foresight tools.

[5] There are no hard and fast distinctions to be made between platforms and ecosystems. While some scholars use them synonymously, others have rammed them together with so much rhetorical force that the terms have fused into “platform ecosystems,” and still other scholars suggest that while platforms enable some ecosystems, not all ecosystems require platforms (see, e.g., Bogers et al., 2019). It is, however, beyond the scope of this paper to settle this distinction, once and for all, if it even exists.

(2017: 40), in complement, defines the ecosystem as "the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize." This definition indicates an activity-centric view or practice-orientation of the ecosystem construct and clarifies that partners selectively bind together to deliver on a shared objective (e.g., the value proposition). These definitions, blending structure and action, are consistent with previous (Djellal and Gallouj, 2001; Drejer, 2004; Moore, 1993, 2006) and current (Ganco et al., 2020) research on the origins of collaborative innovation based on the establishment of relationships to create joint offerings and serve customers in the context of business ecosystems. This makes sense given that past research implicates that strategic misalignment demotivates external stakeholders to collaboratively generate shared innovation (see, e.g., Bogers and West, 2012; von Hippel, 2005).

2.2. Resource orchestration and decentering the focal firm

Resource orchestration is perhaps one of the longest-lived challenges for modern organizations (Carnes et al., 2017; Sirmon et al., 2011). Thinking in strategic management typically has historically emphasized the internal efforts of strategists and decision-makers within a small number of powerful core or "focal firms" to shape, influence, and control their operating and transactional environment (Gawer and Henderson, 2007; Singer, 2006; Gustafsson and Autio, 2011). More recently, however, scholars have begun to apply insights on orchestration, coordination, and collaboration to inter-organizational processes at the level of platforms and ecosystems. For example, functional ecosystems are found to require trust (Perrons, 2009), which can be established through shared standards (West and Wood, 2014), contracts and rules (O'Mahony and Karp, 2017), institutions and standards regulating (Labarthe et al., 2021), platforms and multilateral modularity (Kapoor and Agarwal, 2017), and other forms of interdependencies (Baldwin, 2012; see also, Boudreau, 2010; Gawer, 2014; Jacobides et al., 2018; Moore, 1993, 2006; Zhang et al., 2020). The ecosystem view of business has eclipsed the notion that firms compete as isolated entities (Moore, 2006), and, perhaps intended by no one, this line of research has subtly decentered the focal firm in scholarly discussion about resource orchestration (Helfat and Raubitschek, 2018; Jacobides et al., 2018).

In conventional thinking, focal firms control core assets and capture of above-average rents (Jacobides and Tae, 2015). This reifies their central position in network structures that result in different advantages, for example, improved access to information, reputation, and prestige (Burt, 1992; Zaheer and Soda, 2009). Opportunistic behavior leads to information restriction that undermine open collaboration. This power becomes salient in innovation action, as focal firms retain the prerogative to delay resource commitments to mitigate risk (Dattée, Alexy, and Autio, 2018) and, thereby, assert control over the future. According to Masucci et al. (2020), new technologies are taken up in an ecosystem only when focal firms understand the potential of the proposed technology to broaden their portfolio of offerings and once the focal firm anticipates that it will be able to retain control over relevant intellectual property.

Research on the behavior of focal firms is found across many disparate literatures in business and management, from business model innovation (Zott and Amit, 2007), to open innovation (Bogers et al., 2017; Ollila and Elmquist, 2011), industrial, business, and innovation ecosystems (Kapoor, 2018: Adner, 2006), behavioral theories of the firm (Argote and Greve, 2007), corporate venture capital (Maula et al., 2013), and dynamic capabilities (Barreto, 2010). In this research, focal firms will often serve as the level of analysis for scholarly investigations and are often assumed to be the progenitor of emerging ecosystems, and with that comes a determinate understanding of ecosystem evolution.

Thus, it becomes difficult for the scholarly imagination to anticipate an ecosystem without focal firm involvement. Focal firms are recognized for their value creation in societies and economies, and so their cultivation has become an explicit goal of industrial policy (Levén et al., 2014; Yishu, 2019; Doeringer and Terkla, 1995). Policy and funding bodies find themselves in a situation where they reward the effectiveness and reputations of focal firms when awarding grants, and, reciprocally, policy and funding bodies basque in the reflected prestige of the focal firms they support. The net result exacerbates unfairness, inequity, and imbalance in the competitive funding landscape. Policy and funding bodies are effectively stuck subsidizing focal firms, and, in the process, ultimately undermining otherwise potentially level competitive playing fields. In order to sustain their privileged position to orchestrate the ecosystem to its benefit – including in the scholarly and policy contexts – Dattée, Alexy, and Autio, (2018: 467) explain what is expected:

> [t]he ecosystem champion, [focal firm,] or "keystone" (Iansiti and Levien, 2004), should come up with a compelling "blueprint" for the future ecosystem; one vision that clearly defines the ecosystem value proposition (i.e., what value is created, how, and for whom) and associated structures of governance and interaction (i.e., who does what, who controls what, and how everyone will benefit) (Adner, 2006, 2017; Edelman, 2015; Eisenmann, 2008; Iansiti and Levien, 2004; Williamson and De Meyer, 2012). A compelling vision, hence, reduces uncertainty, facilitates coordination, and enables the focal firm to paint the future ecosystem as an impending reality, prompting potential stakeholders to join early for fear of "missing the train" (Ozcan and Eisenhardt, 2009; Santos and Eisenhardt, 2009).

That said, similar to the myth of the lone inventor,[6] the "myth of the focal firm" has also been roundly criticized and ultimately replaced by the idea that innovation is an accomplishment of multiple actors embedded in broader socio-technical networks. After all, in the course of business history, given the transient nature of competitive advantage, firms come and go. "Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles," Moore (1996: 26) writes. Coordinating and aligning actors who collaborate and strive toward a shared future is a core concern in recent research on innovation ecosystems (Adner, 2017; Adner and Kapoor, 2010; Kapoor and Lee, 2013; Lingens et al., 2020; Talmar et al., 2020). Because firms source options from one another[7] and make decisions in a shared, networked environment, scholars have devoted significant analytical attention to the establishment, circulation, and exchange of expectations about the future of innovation embedded in ecosystems (Kapoor, 2018). Still, anticipating future trajectories in ecosystems is inevitably challenging, almost always collaborative, and unavoidably voluntary (Brem et al., 2017; Eaton et al., 2011; Autio and Thomas, 2014). To wit, according to Duysters et al. (1999: 348), the primary reason that inter-firm relationships fail to deliver on "a (future) portfolio of products and/or services" is due to a lack of clear, shared vision for the future and inter-firm conflict regarding goals and strategies.[8]

2.3. Backdrop of corporate foresight

Tools for foresight, the authors observe, are a noticeably absent omission in the literature on ecosystems. According to scholars, there is a paucity of ecosystem-level management tools capable of aligning ecosystems and orienting them toward shared futures (Damanpour, 2014). This paucity, scholars hint, reflects the inability of scholars to

[6] On this note, see, for example, Merton (1973) or Latour (1993).

[7] The authors would be remiss not to note that open innovation and openness, more generally, are tightly linked, especially in recent research, to platform and ecosystem thinking (Kiseleva et al., 2022; Ziakis et al., 2022; Yun et al., 2016), practice (Ilin et al., 2022; Osorno-Hinojosa et al., 2022; Yun et al., 2020), and policy and assessment (Tolstykh et al., 2020a, 2020b; Yun et al., 2018).

[8] Please note that the parentheses encasing the word "future" appear in the original.

conceptualize strategy as more encompassing than the prerogative of a focal firm at the heart of an ecosystem (Ben Letaifa, 2014; Kazadi et al., 2016; Ganco et al., 2019).

The historic link between foresight and business strategy is typically attributed to Whitehead in a 1931 Harvard Business School commencement address.[9] He claimed that foresight was the most critical skill for the business mind. Today, foresight is widely appreciated for generating speculative knowledge about plausible futures useful for strategy development (Ramírez and Selin, 2014; Rowland and Spaniol, 2015, 2017).

Corporate foresight, by fostering "strategic conversations" (van der Heijden, 2005), aids firms to think creatively about the future, improve decision-making, and, ultimately, impact firm performance (Rohrbeck and Kum, 2018; Schoemaker and Day, 2020). Further, corporate foresight has been demonstrated to support the development, evaluation, and rehearsal of strategic options (Kunc & O'Brien, 2017). These tools, as pioneered by western militaries and in think-tanks, expanded rapidly after the Second World War (Abella, 2009), and, subsequently, migrated to governments, policy agencies, and non-profit organizations in the latter half of the 20th century (Gordon et al., 2020).

2.3.1. *Multiple tools*

Each tool in the foresight toolbox affords a distinct approach to generate knowledge about the future.[10] Therefore, foresight tools are often paired and used in sequence. That way, outputs from one tool become the inputs for – or used in the calibration of – another tool. Research demonstrates that pairing and sequencing multiple corporate foresight tools improves the quality of outcomes and decision-making (Schoemaker et al., 2013; Phaal et al., 2006). Roadmapping, for example, has been blended with Delphi studies (da Silveira et al., 2018), horizon scanning (Kennicutt et al., 2022) and scenario planning (Strauss and Radnor, 2004; Saritas and Aylen, 2010; Siebelink et al., 2016). In this section, the authors provide background literature on roadmapping and scenario planning, which are paired and sequenced in the case study.

2.3.2. *Roadmapping*

Originally termed "technology roadmaps" in the 1980s, the tool was popularized by corporations like Siemens, Motorola, and Corning (Probert and Radnor, 2003; Willyard and McClees, 1987; Phaal et al., 2004). By the turn of the millennium, roadmaps were in widespread usage (Gordon et al., 2020).

While firms developed roadmaps to plan the trajectory of product development (Phaal et al., 2004; Strauss and Radnor, 2004), many tools predate roadmapping – for example, Swager's (1972: 283) "perspective trees" of "interrelate[d] sets of social, economic, political, and technological forecasts that pose threats and present opportunities." With time, roadmapping was used to manage uncertainty and systematically examine future opportunities (Carvalho et al., 2013; Siebelink et al., 2016; Vishnevskiy et al., 2016; Phaal et al., 2004). The US-based National Aeronautics and Space Association (NASA, 2015: 1), for example, adopted the roadmap as "a foundational element of the Strategic Technology Investment Plan" to produce an "actionable plan that lays out the strategy for developing technologies essential to the pursuit of NASA's mission and achievement of National Goals." According to Garcia and Bray (1997), roadmaps not only forecast technology and plan for its development, but also help planners establish a measure of consensus by harmonizing and managing discrepancies about the required resources. This echoes the viewpoint of the United Nations (UN, 2013: 2); the roadmapping "process," they claim, "is at least as important as the resulting roadmap and visualisation because the process itself has been found to increase communication between essential stakeholders and assists in consensus building."

Most recently, roadmapping has been employed to develop mission-based policies for research and innovation in the EU (Mazzucato, 2019). Inspired by roadmaps developed in the Science, Technology, and Innovation (STI) policy space (Carayannis et al., 2016) and national systems of foresight (Geels, 2002; Freeman, 1995; Lundvall et al., 2002), roadmapping aligns policymakers and aids in the development of ambitious innovation policies needed to tackle grand societal challenges such as the UN's Sustainable Development Goals (Mazzucato, 2018a, 2018b; Schot and Steinmueller, 2018).

Empirical examples of managing mission-based policy implementation with foresight tools are beginning to emerge (Spaniol & Rowland, 2022). Until recently, evidence has been based on experimentation with policy models (Schot and Steinmueller, 2018), promising early implications (Grillitsch et al., 2019), and, in some instances, the exploration of hypothetical cases (Mazzucato, 2018a, 2018b). Still, tackling "grand challenges" rests undeniably on the co-development of the missions and shared understanding of the problem and solution agenda (Wanzenböck et al., 2020). In this space, roadmaps have been proposed to anticipate change and support investments (Miedzinski et al., 2019). This is because societal-level problems must be parsed-out and managed at the level of ecosystems (Wanzenböck et al., 2020; Spaniol & Rowland, 2022).

2.3.3. *Scenario planning*

Shell Oil and Gas pioneered scenario planning in the 1970s (van der Heijden, 2005), which was documented later that decade (Linneman and Klein, 1979). Since then, the prevailing incantation of scenario planning is the Intuitive Logics (IL) tradition (Schwartz, 1996). The IL process starts with the identification of the end states of two critical uncertainties relevant for imagining the future operational context of a case. The uncertainties are then juxtaposed against one another using a 2×2 matrix, thus creating four distinct quadrants from which scenarios can be developed. According to an analysis of the "scenario" concept, based on a 50-year review of the literature, the resulting four scenarios should be future-oriented, appear in a narrative format, and be meaningfully different from one another (Spaniol and Rowland, 2019). The core, motivating questions in scenario planning are: "How would each scenario impact the case or area of concern?" And, "What, if anything, would be a prudent course of action in each scenario?"

Corporations use scenario planning to inform strategic planning (Grant, 2003; Ramírez et al., 2011; Vecchiato, 2019). When undertaken prior to strategic planning, scenario planning provides a mechanism to think broadly about a range of futures, and, because of the hypothetical premise underpinning the exercise, can safely incorporate many voices and perspectives. In this way, the decisions that follow in the strategy process can be said to have attempted to mitigate the negative effects of bias, particularly representativeness, availability, and anchoring and adjustment heuristics (Bradfield, 2008; Schoemaker, 1993).

A notable concern, often attributed to St. Augustine of Hippo, is that the future and the past do not exist (Cairns, 2020). And yet, the future can exist in representations produced in the present, and it is, then, the purpose of foresight to render these images of the future salient in the present, and leverage them to build intersubjective meaning and shared expectations for the future (Lang and Ramírez, 2017). The notion of intersubjectivity, which is germane to this article, is key in foresight. Any accurate depiction of the future should not – perhaps cannot – be specific to any one, particular source, but rather the scenario must be understandable to – and, in good form, cocreated with – a distributed group of sources and stakeholders. To this end, the authors now transition to the empirical case study, providing case-specific background before demonstrating their practice-based empirical materials.

[9] This piece was not published for a widespread readership until years later; see Whitehead (1967).

[10] And, in the process, generate and manage various ontologies of the futures and futures; however, going into detail on this matter is beyond the scope of this article; still, for curious readers, Poli's (2010) and Rowland and Spaniol's (2015) unorthodox articles on ontology and ontologies may be instructive.

3. Case background

To set the stage for the empirical case, the authors provide background literature on Ro-Ro Shipping and the Sustainable Blue Economy to flesh-out the empirical context.

3.1. Background on Ro-Ro shipping

The value proposition of Roll-on/Roll-off (Ro-Ro) cargo shipping is the transportation of wheeled cargo such as tractor trailers, passenger vehicles, buses, and construction equipment, as well as containers that are driven onto and off of the vessel. Lift-on/Lift-off (Lo-Lo) vessel transportation, by contrast, uses cranes to pick-up cargo from docks whereas Ro-Ro vessels use ramps. The largest Ro-Ro vessels can carry up to 450 truck trailers. Ro-Ro shipping, especially when operating in low-power "slow-steaming" mode, contributes to the decarbonization of transport; one voyage can eliminate the need for numerous independent lorry and personal vehicle trips.

Ferry routes wrap European coastlines from the Baltic Sea to the Black Sea, with the largest corridors between the UK and France and between Scandinavia and Continental Europe. In 2019, the Danish DFDS (Det Forenede Dampskibs-Selskab or The United Steamship Company), the largest operator of Ro-Ro vessels in Northern Europe and the UK and the 2nd largest in Europe, operated 21 routes across 8 terminals (i.e., ports), employed 8400 people, and reported revenues of over 2 bn€ (DFDS, 2019).

The Ro-Ro ecosystem is multiform: The Ro-Ro vessel can be characterized as a floating parking garage (Mitsui O.S.K Lines, 2021), floating car park (MacGregor, 2020), and floating bridge (BBC, 2020), thus, for the sake of this paper, the Ro-Ro supporting vessel is a "floating platform" which contributes the unique productive resource to the ecosystem. However, like all ecosystems, the activity and value generation expands well beyond the multiform route and floating platform. It is a network of modular services onboard and onshore that depend on the success of the ecosystem as a whole to deliver the multifaceted services to a range of customers with a variety of needs.

The customers of Ro-Ro services are the freight forwarders, haulage companies, manufacturers, retailers, distributors, and passengers that make the voyage (DFDS, 2019). The Ro-Ro activity system begins with demand for transport services, where they reserve and book or contract services for their wheeled trailers and vehicles (hereafter cargo) on a particular route and schedule. Ro-Ro operators are dependent on intermodal infrastructure provided at ports (hereafter terminal), the location where, as departure time approaches, the cargo must present itself. Moving beyond security checks and dimension measurement, the cargo is staged in the terminal parking lot. Around this time, the vessel will arrive and moor to the quay, and the cargo that is already onboard will roll off of the vessel and continue onward to its final destination. Upon completion of disembarkment, the cargo that is waiting for departure will roll onto the vessel according to a stowage plan that ensures that the vessel is optimized for balance (to achieve safety thresholds and energy efficiency) and the vessel will sail back to where it came from: In most cases, Ro-Ro vessels operate back and forth across a single route.

Ecosystem partners are thus those that not only enable and facilitate the accomplishment of the intermodal cargo transport according to the standards of national and international regulations, but are also those that leverage the customer base of the platform to deliver a range of services and amenities, both onshore and onboard. While maritime history goes back thousands of years, the shared anticipation of future developments grows increasingly complex: Growing global interconnectedness, advancing standards and regulations, public concern over the health of oceans and seas, and increasing pace of technological change, and other driving forces, drive rifts between the platform provider and the complementary firms.

3.2. Background on sustainable blue economy

Ocean economies are a complex policy and regulatory environment (Klinger et al., 2018). Uneven perceptions and experiences across the maritime, marine, and ocean industries has led to a divergence in expectations and agendas among maritime researchers, industry practitioners, and policymakers, which makes coordinated and collaborative research, investment, and policy agendas difficult, but, the authors contend, necessary to align (Lacroix et al., 2016; Kokkinou and Korres, 2018). The shipping industry, for example, is financially conservative and inflexible because large assets, namely ships and terminals with long payback horizons, are not easily modified or liquidated, which lock-in investors (Scarsi, 2007; Stopford, 2008). This makes sustainable growth on the world's oceans a slow, challenging, but, the authors agree, necessary process to pursue (Howard, 2018; van den Burg et al., 2017). Furthermore, the harsh conditions of the sea, the long distances to onshore ICT systems and general lack of infrastructure make innovation challenging.

All of this is, for example, reflected in the EU's ongoing sustainable blue economy strategy.[11] Recognizing these barriers to innovation in the blue industrial ecosystem, these economic growth initiatives endeavor to integrate maritime policy, research, and strategy (Commission of the European Communities, 2007; European Commission, 2017). In this context, scholarly literature on so-called "sustainable blue economy" still lacks clear, shared definitions (Eikeset et al., 2018). The net result, intended by no one, is a general lack of cohesion and low levels of collaboration, inhibiting the development of research and policy in the sector (Pinto et al., 2015). The uptake of innovation, therefore, is relatively slow in the ocean economies, which is marked by precautionary policies in the public sector and hesitant investors in the private sector (van den Burg et al., 2017). On balance, however, are the recent calls for cleaner shipping and the sustainable use of marine resources (Acciaro and Sys, 2020; Ashrafi et al., 2020).

In the field of maritime studies, scholars routinely report on the use of corporate foresight tools in the context of financial sectors, supply chains, and broader geopolitical trends; however, with rare exception (de Langen et al., 2020), the notion of "industrial ecosystem" has not entered into these discussions, and even the exception does not involve the application of foresight tools. Examples of the use of corporate foresight tools to explore the futures of maritime, marine, and offshore industries include: dry bulk shipping (Dinwoodie et al., 2014; Ariel, 1989); container ships (Gomez Paz et al., 2015); container shipping (Lam and van de Voorde, 2011); container terminal operations (Serra et al., 2015); fisheries, aquaculture, and seafood processing (van Hoof et al., 2019); research agendas for studying public perceptions of oceans (Lacroix et al., 2016); decision-making in maritime clusters (Stavroulakis and Papadimitriou, 2017); the role of oceans in global geopolitics (Suárez-de Vivero and Rodríguez Mateos, 2017); the possibility of shipping in the Arctic (Brigham, 2008), and the future of ports (Allen, 2011). Thus, in maritime studies, the terminology of "ecosystem" is almost exclusively reserved for reference to ocean ecology, hence, the value of this article's contribution to maritime studies as well as the scholarly community.

4. Applied and empirical methods

The authors distinguish their applied method from their empirical method, in congruence with a recent critique of the conduct of science in research on strategy (Rowland and Spaniol, 2020). This critique suggests, consistent with past research (e.g., Hodgkinson & Healey, 2008; Hodgkinson & Wright, 2002; 2006), that scholarship in this area routinely suffers from a "conflict of interest inherent in the practice of

[11] For at least a decade prior, the EU's maritime, ocean, and aquaculture strategy was known as the "blue growth" strategy.

self-observation among facilitators" as well as the basic "inadequacy of retrospective scientific accounts by proponents of their own methods" (Rowland and Spaniol, 2020: 2). Given the practice turn in management literature, this is especially important because "greater emphasis on enactment in practice" implies "greater scrutiny of the methods used to evaluate, examine, and explore those practices" (ibid: 1; see also, Bowman and MacKay, 2020; Jarzabkowski and Spee, 2009). To this end, the authors distinguish their unique roles in deploying each method in the project consistent with the "collaborative 'facilitator-observer' model of inquiry" proposed in futures studies (Rowland and Spaniol, 2020: 4).

4.1. Applied approach: foresight and the facilitator

The foresight method was deployed by the facilitating author for ECOPRODIGI, an EU-Interreg Baltic Sea initiative that aims to support the development of the EU's Sustainable Blue Economy policy with a focus on innovation and the eco-efficiency of Ro-Ro shipping in the Baltic Sea Region.[12] As we shall see, the foresight output was developed as a part of the ECOPORDIGI work package (WP4), which was undertaken in three day-long workshops that leveraged digital tools to prepare for the workshops in 2019 and subsequently process workshop outputs in 2020.[13]

The core team assembled to construct the foresight included actors from across the project consortium and represented various actors in the ecosystem, all of which had practical and/or academic experience with the maritime sector. Participants in the workshops and survey respondents included actors from across the ecosystem, including logistics companies, technical specialists in maritime communication, experts in maritime research and policy, cargo stowage and lashing, vessel operators, and representatives from maritime technology industrial associations. In all, 60 different workshop attendees and 40 survey respondents from Denmark, Finland, Lithuania, Poland, Norway, Sweden, and the UK were involved, resulting in 100 unique points of project input.

Three innovation roadmaps were originally planned; one for maritime logistics, one for ship operations, and one for shipyards. The first two were ultimately combined into an integrated logistics-operations roadmap.[14] The shipyard roadmap was completed as planned, and later published as a public roadmap for shipyards.[15] As such, this paper examines the integrated logistics-operations roadmap.

The corporate foresight tools used in this project were adapted to address the broader community of actors at the heart of the ecosystem concept rather than a single, focal firm, which is the norm in the application of corporate foresight tools. The adapted foresight process involved horizon scanning blended with innovation forecasting to produce the integrated logistics-operations and shipyard roadmaps. The workshops were followed by surveys designed to forecast, assess, and ultimately anchor discrete events identified during the workshops. The community also developed scenarios during workshops and used them to stress-test the roadmap for robustness. During the roadmap development, crowdsourcing techniques and digital tools were also used to reach the actors across the ecosystem. As such, the sequencing and integration of tools included both qualitative and quantitative inputs.[16]

4.2. Empirical approach: ethnography and the observer

The empirical ethnographic method was deployed by the observing author based on the sociologically-informed "extended case method" (Burawoy, 1998). Per this method, the author approaches the field with an "a-priori theoretical framing," which allows for theoretically-informed ethnographic observations of the enactment of roadmapping practices (Tavory and Timmermans, 2009: 244). This technique is often thought of as an alternative to the grounded theory tradition of ethnography, the point of which is to enter the field with no theoretical preconceptions with the intention of developing new theory.

In the analysis that follows, the authors adopt a schematic, activity-oriented approach to observing ecosystems, as recommended by Adner (2017).[17] This model for analyzing, understanding, and demonstrating the ecosystem construct presents the ecosystem as it is enacted in actual, networked human practices, and, thus, ecosystems in this analysis will appear as they were experienced and planned for. Scholars contend that strategy is not something an organization has, but is based on ongoing practice, such that strategy, and its implementation, is something that firms actively do (Ocasio et al., 2018; Zhao et al., 2020; see also, Jarzabkowski and Spee, 2009; Whittington, 2006). Such a lived-world approach implies that ecosystems are not simply "out there" to be observed, but that human practices of organizing and planning for ecosystems also are responsible for constructing and bringing those ecosystems to life. While it is premature to discuss concluding remarks, the authors contend that, from this perspective, foresight tools, once employed, enact an ecosystem. These tools are capable of establishing, focusing, and, conceivably, sustaining an ecosystem. In the absence of these enactment practices, the notion of an ecosystem remains an abstract, academic concept rather than the promising driver of innovation that the broader research and global policy enterprises propose it could be.

4.3. Timeline and analysis

The following analysis describes activities for anchoring the roadmap, populating it, and then editing and, subsequently, appendicizing

[12] Additional details available at https://ecoprodigi.eu/ (accessed 26-07-2022).

[13] Additional details available at https://ecoprodigi.eu/publications (accessed 26-07-2022) under the heading "Digitalisation roadmaps for maritime industry" with the description: "Digitalisation roadmaps have been produced as part of ECOPRODIGI's work package 4. They provide a glimpse of the future of maritime operations in the Baltic Sea region with a focus on Ro-Ro shipping and shipyard operations. The roadmaps are a product of interdisciplinary collaboration, the core of which consisted of ECOPRODIGI consortium members. Early drafts were validated through consultation with experts, and results were summarized and validated together with wider industry and policy actors through surveys."

[14] Available at ECOPRODIGI website (accessed 26-07-2022) and Researchgate (accessed 26-07-2022). For additional details on methodology, see the Appendix of the report "Maritime in the 21st Century: The state of play, a brief history, a roadmap, and scenarios."

[15] Available at the ECOPRODIGI website (accessed 26-07-2022) and at Researchgate (accessed 26-07-2022). For additional details on methodology, see Appendix 2 in "Road to Shipyard 4.0: The state of play, a brief history of maritime developments, and a future roadmap" available at the ECOPRODIGI website (accessed 26-07-2022).

[16] For readers curious about foresight tools or the use of multiple foresight tools, please return to 2.3.1 "Multiple tool use."

[17] Verbatim transcriptions of human interactions will only be selectively available in this article due to the preferences of respondents and our clients, client organizations, and various other actors willing to participate in the process while respectfully declining to be involved in some aspects of the research process associated with this planning experience. As authors, we include what we can, consider our schematic approach to evidence to satisfy the "proof of concept" standard, even if some readers are not satisfied with this level of granularity. Therefore, please note that this article adopts a schematic approach to data presentation. Rather than present moment-by-moment human interactions, evidence will chiefly take the form of generalized descriptions that operate, as noted, at the standard of "proof of concept."

Table 1
Summary of workshops and corporate foresight tool application.

	Stage 1. Klaipéda, Lithuania (November 2019)	Stage 2. Copenhagen, Denmark (January 2020)	Stage 3. Tønsberg, Norway (February 2020)
Phase 1. Project purview development	Framing the foresight in relation to the SDGs[a] and EU missions	Ecosystem purview, connecting the present to the past and future	Content refinement and validation
Phase 2. Roadmapping	Brainstorming key trends, technologies and standards	Populating the roadmap. 2nd iteration on physical walls	Refinement and stabilization of the roadmap
Phase 3. Scenario planning	Introduction and uncertainty exploration	Axis prototyping and scenario narrative development	Using the scenario to stress test the roadmap
Phase 4. Post-processing work following this workshop	Preparation for collective forecast; refinement of key technology and industrial standards descriptions	Moving the roadmap into digital space; Scenario descriptions' refinement and editing	Validation survey preparation and deployment; processing of participant assessments of scenarios' impacts on the roadmap

[a] Sustainable Development Goals (of the United Nations).

aspects of it. It also describes how elements on roadmaps are actively positioned, repositioned, and subjected to stress-testing. Table 1 provides an overview of primary occasions of the foresight tools across the workshops, hereafter referred to in terms of stages and phases.[18] Each workshop represents a stage in the process. Each stage [S] is composed of a series of chronological phases [P]. When individual stages and phases are referenced, they will be succinctly communicated in a shorthand, for example, "[S1P3]" would denote the third phase of the first workshop. As such, Table 1 can be read as a combination summary and timeline of the events as they unfolded in the process of deploying foresight tools across a large, distributed group of ecosystem actors. Readers should take note that (these) foresight activities operate iteratively, meaning, similar steps are repeated by different groups over time to revise and refine the foresight outputs. Additionally, after each workshop, post-processing the workshop outcomes and the preparation of digital engagement methods ensued (involving reflexive debriefing, reflection on process, assigning and prioritizing tasks, etc.), contributing to the overall process by summarizing what was accomplished in one workshop and preparing for the subsequent workshop (or completion of the process following the final workshop).

4.4. "Anchoring" the roadmap[19]

In Stage 1, after an introduction to the foresight work package [S1P1, then, later, S1P3], a brainstorming session to develop early content for the roadmap was undertaken [S1P2] and a core concern for the roadmap was identified as a candidate to "anchor" it and was piloted for its comprehensibility with the core group [all material was re-reviewed in S1P4]. This core group was composed of approximately 10 individuals from across the Baltic Sea Region. Most of the individuals were responsible for the work packages at the core of the grant. Regional integration across Europe is one broad aim of the INTERREG granting mechanism,[20] and this grant was positioned in the Baltic Sea Region, and since a number of the foundational members of the grant were situated in Lithuania, the November 2019 meeting was held in Klaipéda. The major partners oversaw tours of a number of the significant facilities that inhabit and give life to the ecosystem. Additionally, positioning the meeting in Lithuania allowed greater access to actors local to this portion of the region to enroll into the foresight process as well as establish and reinforce network connections. To put attendance at these meetings into perspective, the ten core members attended each workshop, including the author deploying the foresight methodology. Each individual workshop (or Stage in the process) convened approximately 30–40 local operators in each section or portion of a region, resulting in a little more than 100 total individual actors spread out across the entire Baltic Sea Region drawn from a vast array of industries and operations associated with the Sustainable Blue Economy.

In Stage 2, with brainstorming complete and background materials at hand, the formal roadmapping [S2P1, S2P2] was initiated employing Phaal et al.'s (2003) template. This template was put-up on the wall to offer participants a blank canvas.[21] To begin the process, an aggregation of forecasts was made, detailed below, the function of which was to align participants' expectations behind a future date that the event was expected to occur [S2P2]. Note that this approach is often referred to as harnessing the "wisdom of crowds" (Surowiecki, 2005).[22] Aggregated forecasts assume that information is unequally distributed across networks, for example, within industrial ecosystems, and this information informs individuals' forecasts. Therefore, to protect against assessments influenced by status-hierarchies and group-think, individual assessments, conducted independently, are amassed and subsequently aggregated to arrive at an answer or response from the group as a whole [S1P2, S2P2, S3P2]. The outcome is thought to reflect the "crowd's wisdom" or perhaps, in this instance, the "wisdom of the ecosystem." Based on Surowiecki's (2004) landmark book, *The Wisdom of the Crowd: Why the Many Are Smarter than the Few and How Collective Wisdom Shapes Business, Economies, Societies, and Nations*, Rowland and Spaniol (2015: 559–60) note, in the context of foresight, that:

distributed decision markets should be effective in [...] predicting certain social, political and economic events provided the following conditions are satisfied:

- a diversity of individual guesses must be amassed and aggregated; and
- guesses must be arrived at independently without group-level input and must not be centrally organized (i.e. must be decentralized).

Under these circumstances, the aggregate estimate of individual guesses is expected to, on average, outperform the best individual guess, hence the wisdom of crowds.

In order to deploy Surowiecki's insights as applied to foresight at the ecosystem-level, during the workshops [S1P2, S2P2, S3P2], the

[18] We appreciate that some empirical materials, for example, foresight worksheets, facilitation protocols, or perhaps the resulting foresight estimations, would be extremely useful in this section of the article; however, many of these forms of evidence are items that we are not at liberty to share as they are either private or they are proprietary.

[19] Note that because the process was iterative, the roadmap is "anchored" multiple times. Therefore, it follows that the events described in this section, as well as the subsequent analysis sections, will shift stages – for example, descriptions will be fluid and describe events from Stage 1, then Stage 2, and possibly back to Stage 1 because the process is iterative. That said, the authors endeavored to present their findings in as close to chronological order as possible.

[20] According to the Interreg website, "Interreg is one of the key instruments of the European Union (EU) supporting cooperation across borders through project funding. Its aim is to jointly tackle common challenges and find shared solutions in fields such as health, environment, research, education, transport, sustainable energy and more" (https://interreg.eu/about-interreg/ accessed 09-Aug-2022).

[21] Please note that, later on, a more fully populated version of the template is available in Figure 3.

[22] For background on forecast methods as they relate to the "wisdom of the crowd" see Spaniol & Rowland (2022).

anchoring event formulation was distributed via real-time polling software (note that results were specific to each workshop, but also aggregated across all workshops in the expression of the final roadmap). Figs. 1 & 2 below show the results of the questions, which, after the 24 active participants in the workshop had answered, were revealed to the participants in real-time. Across the X axis on the wall-roadmap is a time scale extending 25 years into the future.[23] The blue circles indicate the mean guess, and above the X axis are the individual responses in light blue (Note: in Figs. 1 & 2, the software is programmed to find the mean of the answers, whereas in the workshop, the median dates were calculated and used instead) (Turoff and Linstone, 2002). The questions selected as anchors include:

1. When will [it be] an accepted practice that ship performance data is sent to a central repository for monitoring?
2. When will it become accepted practice that AI [Artificial Intelligence] is used for cargo stowage optimization decision support?

These are the earliest manifestations of the content that would develop into two roadmaps (later to be combined into one), namely the vessel operations roadmap and the integrated logistics roadmap (see Section 4.1 for further details on the finalized roadmaps).

The critical events were then transferred onto the blank roadmap canvas on the wall at their appropriate future event time [example drawn from S2P2].

4.5. "Populating" the roadmap

With critical events anchoring the roadmaps, supporting content would begin its expansion [S2P2]. A follow-up question to each critical event was posed to the participants: "what is needed to make this happen?" Open-ended answers, which were submitted by the audience via mobile devices, were displayed in real-time back to the participants on a live projector casting the quotes directly onto the wall.[24] Responses were anonymous, but participants routinely revealed that they had authored particular responses during later discussion. Responses were typically brief, composed of approximately 5–10 words each, which was encouraged by the facilitator, to keep comments "short, and to the point." Example responses, associated with planning for either ship performance data or the widespread use of AI in shipping, include "the development of a shared but secure data supply chain," "multi-industry participation," and "the development of government and industry standards and regulations for the use, sharing, and storage of data." These open-ended text responses were then consolidated to reduce redundancy or repetitiveness, allowing individuals to modify or revise their and others' comments after discussion, consideration, and exploration of the comments once presented together as a group. The resulting revised comments were then transcribed onto large post-it notes, and then collectively placed through discussion, but only tentatively, in relation to the anchoring events on the emerging roadmaps [S2P2]. At this stage, the group was in a dynamic, multi-vector discussion, exploring the content of a comment while simultaneously arguing over the plausibility of a particular standard or regulation becoming accepted by one future date or another. The result of these rigorous deliberations is to position these comments, once revised, and then, based on discussion of when they are expected to take place (if at all), they are positioned on the emerging roadmap in relation to the anchors as previously articulated by the group [also in S2P2]. In the foresight literature, this technique is known as backcasting (see, e.g., Robinson, 2003; and additional literature on the use of multiple foresight tools, see Section 2.3.1).

Once answers were exhausted, another foresight technique, horizon scanning, was deployed. There is reason to believe that the horizon scanning metaphor originated from maritime application. Sailors took turns climbing the mast to the so-called "bird's nest" to look out over the horizon, searching for land, obstacles, or other vessels. Sailors alerted and warned the rest of the crew so that they could prepare and take action for contingencies. Today, horizon scanning (also known as environmental scanning) is the exercise of searching for, collecting, and curating information that could provide harbingers or "signals" of forthcoming change (Amanatidou et al., 2012; Jain, 1984; Day and Schoemaker, 2005). For the most part, the output of horizon scanning activities are compiled into so-called intelligence repositories and/or reports, mostly for use by corporate strategists and policy analysts.

In the first workshop [S1P2], participants were asked to identify the trends that were expected to impact the ecosystem in the future. Participants identified general technological trends such as digitalization, automation, and the synchronization of data and information across stakeholders. Technological platforms such as aerial and submerged drones, and program algorithms such as machine learning and AI, as well as cloud computing were also listed. Sustainability was discussed as a social movement, economic trends such as the pressure to reduce costs, and regulatory trends such as the increasing sophistication of industry standards and the increasing use of market-making public sector policies. However beneficial these trends are in framing discussions, they are not possible to plot on roadmaps (see section 4.6 below).

In post-processing the content that emerged from the first workshop [S1P4], the project team set out to identify any discrete impacts of the identified trends on Ro-Ro ecosystem actors. The anticipation of discrete events is demarcated in a technology that is introduced to create a new value-adding activity (or innovation), or specific policies and/or standards along with their expected date of implementation (Spaniol & Rowland, 2022). In the case of the latter, standards organizations and regulatory authorities are often communicating schedules for deliberation and timelines for implementation, and the International Maritime Organization (IMO) and other relevant authorities' websites were reviewed for information [S1P4]. For innovations, this information is much more distributed across the ecosystem, and so informants from across the ecosystem were sought out on an as-needed basis to provide input on the state-of-the-art on technology [initially done in S1P4; repeated again in S2P4].

The output from S1P4 resulted in an extensive list of events that were then brought into S2P2 for assessment, and these were offered to participants to be placed on the roadmaps. When creative energy was decreasing in the workshop, a number of additional events, which were developed in another EU project, PERISCOPE (Spaniol & Rowland, 2022) were then distributed to the participants. This Interreg North Sea project was undertaking an horizon scanning activity for maritime and offshore industries, and those events which were deemed relevant for

[23] Mentimeter is the provider of the software (https://www.mentimeter.com/ accessed 09-Aug-2022). 25 years is the limit of the timescale available on this software. There is no firm standard for precisely where (or when) to bound a timescale during a foresight exercise; however, there are mathematical reasons to bound a timescale associated with calculating the mean and median – an infinite timeline has the potential to skew the presentation and communication of the "wisdom" of the crowd, or, in this case, the ecosystem. Not also that when it comes to presenting the result of this exercise, the authors prefer the use of a median to the use of the mean, and the reason is that a median is middle or center-most "guess" or estimation of likelihood, which is always communicated as a whole number or, in this case, year (e.g., 2024 or 2031). This is preferred to the presentation of mean scores because of their general unintelligibility "on the fly" – after all, 7.7 years into the future starting in November of 2019, does not automatically communicate to participants that the innovation is expected by the group at some point in July of 2027, meanwhile, the median, 2028 communicates the expectations of the group in a clean, punctuated expression. Also, returning to the core point about bounding, on a more conceptual level, bounding a sliding scale "force[s] respondents to differentiate between [an] event's plausibility and its possibility" (Spaniol & Rowland, 2022: 4; see also, on the important distinction between plausibility and possibility in scenario planning and other foresight thought, especially see Ramírez and Selin, 2014).

[24] This is also a function of Mentimeter software previously referenced.

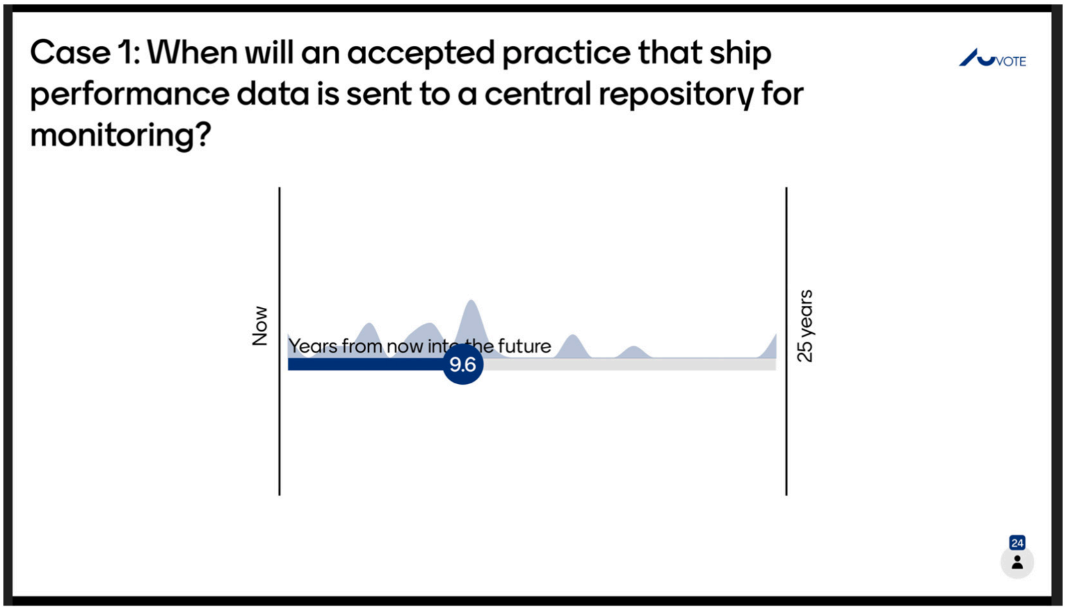

Fig. 1. "When will [it become] an accepted practice that ship performance data is sent to a central repository for monitoring?" Copenhagen, Denmark (January 2020) [S2P2].

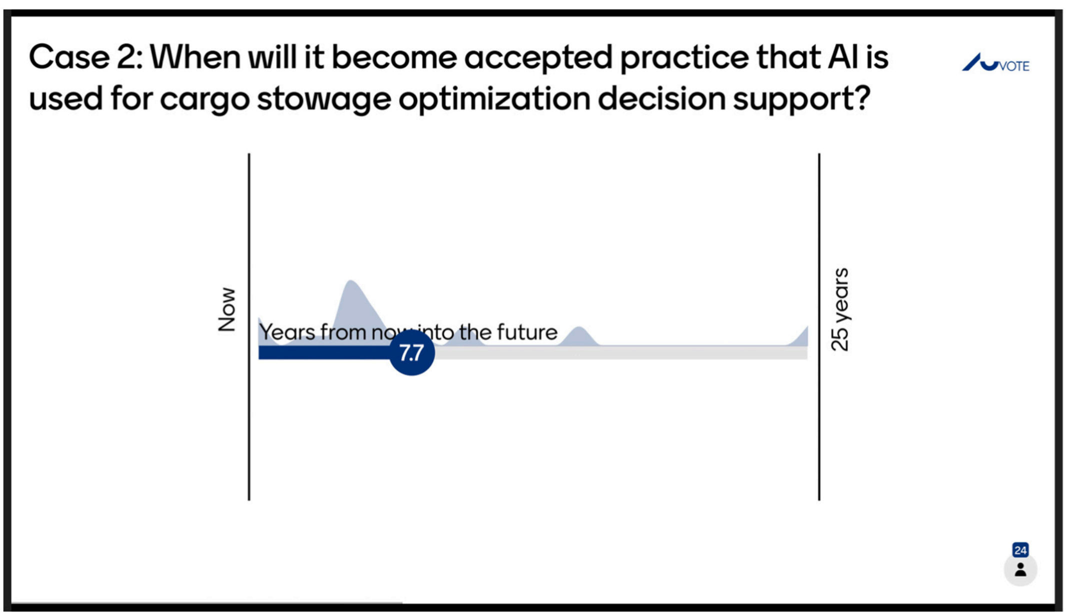

Fig. 2. "When will it become accepted practice that AI is used for cargo stowage optimization decision support?" Copenhagen, Denmark (January 2020) [S2P2].

the roadmaps in question were then included. This resulted in two roadmap prototypes (see, e.g., Fig. 3 from the second workshop).

The roadmaps were initially represented with time on the X axis and 5 categories on the Y axis, from top to bottom: 1) General social and economic trends; 2) Technology drivers and platforms; 3) New technological capabilities; 3) Technology mandated by regulations; 4) Standards; and 5) Political drivers and regulations (Phaal et al., 2004). After the second workshop [S2P4], project partners thought they would be able to increase further the audience and engagement from the wider ecosystem, and since much of the content on the vessel operations was relevant also for integrated logistics and vice versa, post processing the 2nd workshop was digitized and moved online [S2P4]. Furthermore, the category on "General social and economic trends" was deemed to be more important in the provision of context for the roadmaps and was transferred to provide the eventual textual introduction to the roadmap report, leaving events with discrete time horizons on the roadmap.

In the third workshop [S3P2], 20 participants were divided into groups based on the 4 remaining categories, and with shared access to the online roadmap, discussed further the language and validity and repositioned the elements in the digital canvas. See Fig. 4 for the roadmap after the third workshop in Tønsberg [S3P4]. Not long after, the categories "Technology drivers and platforms" would be collapsed into "Technical capabilities" and the category "Technology mandated by authorities" would be collapsed into "Standards and Regulations." In the end, all categories would be eliminated, as well as the lone arrow after the 3rd workshop leaving only a timeline and events placed on it (see Fig. 5).

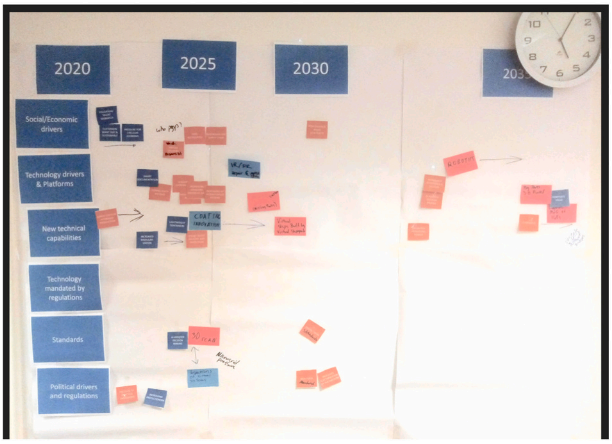

Fig. 3. Emerging roadmap, populated during the second workshop (Copenhagen, Denmark, January 2020) [S2P2].

This process of "appendicizing" the roadmap led to a considerable refinement of the language and content in the roadmap. It helped to further articulate and distinguish events and tasks-to-be-done from generic trends and technologies. Although trends support the notion of continuous change, discrete events can be forecasted, predicting their time to "accepted practice" and/or "commercial availability," which can be placed on a roadmap. In some cases, elements were deemed to be redundant and, thus, were consolidated. In other cases, seemingly discrete events were determined not to be sufficiently so, and so split into two or more. When the content of the elements had stabilized based on the appendicizing exercise, there was a count of 32 events on the roadmap. However, what had destabilized were the placements of many of the time horizons. With this challenge, the core team saw an opportunity to again engage the wider ecosystem to help with the confirmation or repositioning of the elements on the roadmap.

4.7. *"Repositioning" elements on the roadmap*

With the elements' textual descriptions stabilized in the appendix, a

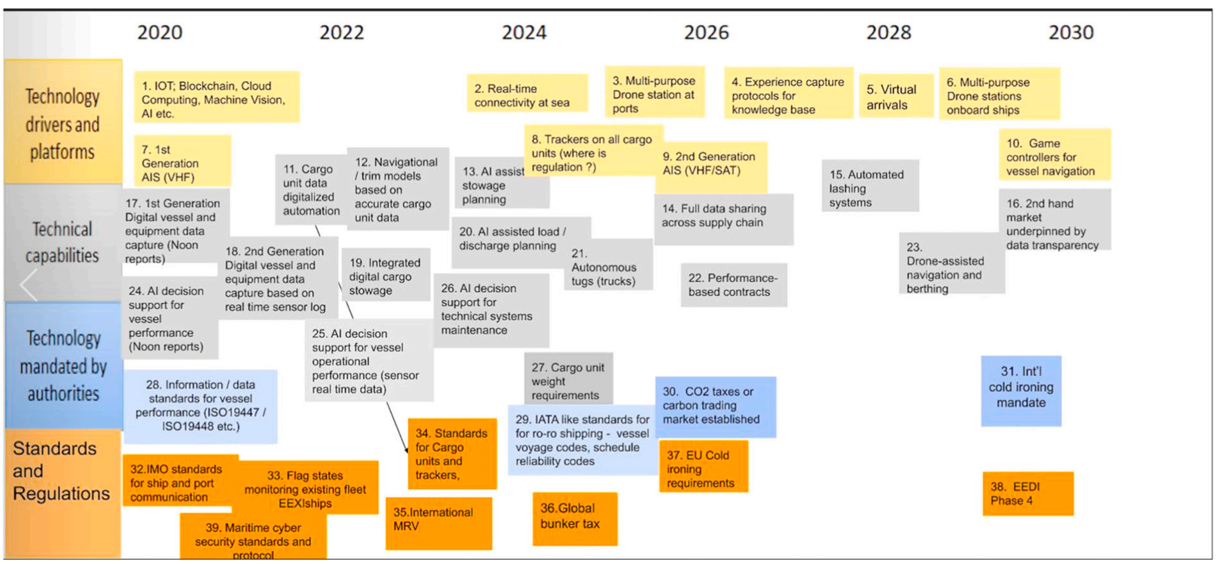

Fig. 4. Draft roadmap rendered in digital form during post-processing (Copenhagen, Denmark, January 2020) [S2P4].

4.6. *"Appendicizing" the roadmap*

After the 3rd workshop [S3P4], the core team of roadmap developers were tasked with writing short (approximately 200 words in length) descriptions of the elements in the roadmap. These texts were to serve as an appendix that roadmap users could reference in association with Fig. 5. Each element was assigned to those who had knowledge of the topic, who were tasked to describe:

1. The current practice of a job or task that needs to be done and how it is accomplished today and why it is suboptimal;
2. A (non-technical) description of the technology, industry standard or regulation that would entail a change in current practice;
3. Benefits or advantages that would result from the implementation of the proposed change, and;
4. Obvious obstacles that must be overcome for the proposed change to be implemented.

Authors were asked to provide references for their descriptions when appropriate, and to reach out to other informants in the ecosystem for feedback, if necessary. Each element would also undergo "peer-review" by (an)other actor(s) in the ecosystem.

realization emerged that they would need to be repositioned by repeating the forecasting exercise [see S2P2] for each of the 32 elements. Short summary descriptions of each of the elements targeting 60 characters including spaces were written, and these were developed into a survey that would ask respondents to estimate "how many years from now" that each element would become "accepted practice" or "commercially available."[25] Included after each question was a checkbox option for "will never happen" that activated a responsive dropdown space for respondents to explain why they thought it would never happen in an open-ended text box. This reformatting of the content enabled an additional opportunity to engage the wider ecosystem in the validation of the roadmap prior to publication. The logic of ecosystem foresight follows that those who engaged in such an activity would have partial ownership of the results.

The survey was first piloted on core members from the project consortium. Median response times for completion were determined close to 15 min. A cronbach-alpha test was conducted on the results of the pilot to ascertain the interpretive ambiguity of any questions. In other

[25] See also, Spaniol and Rowland (2022) for additional relevant methodological considerations on this approach to foresight.

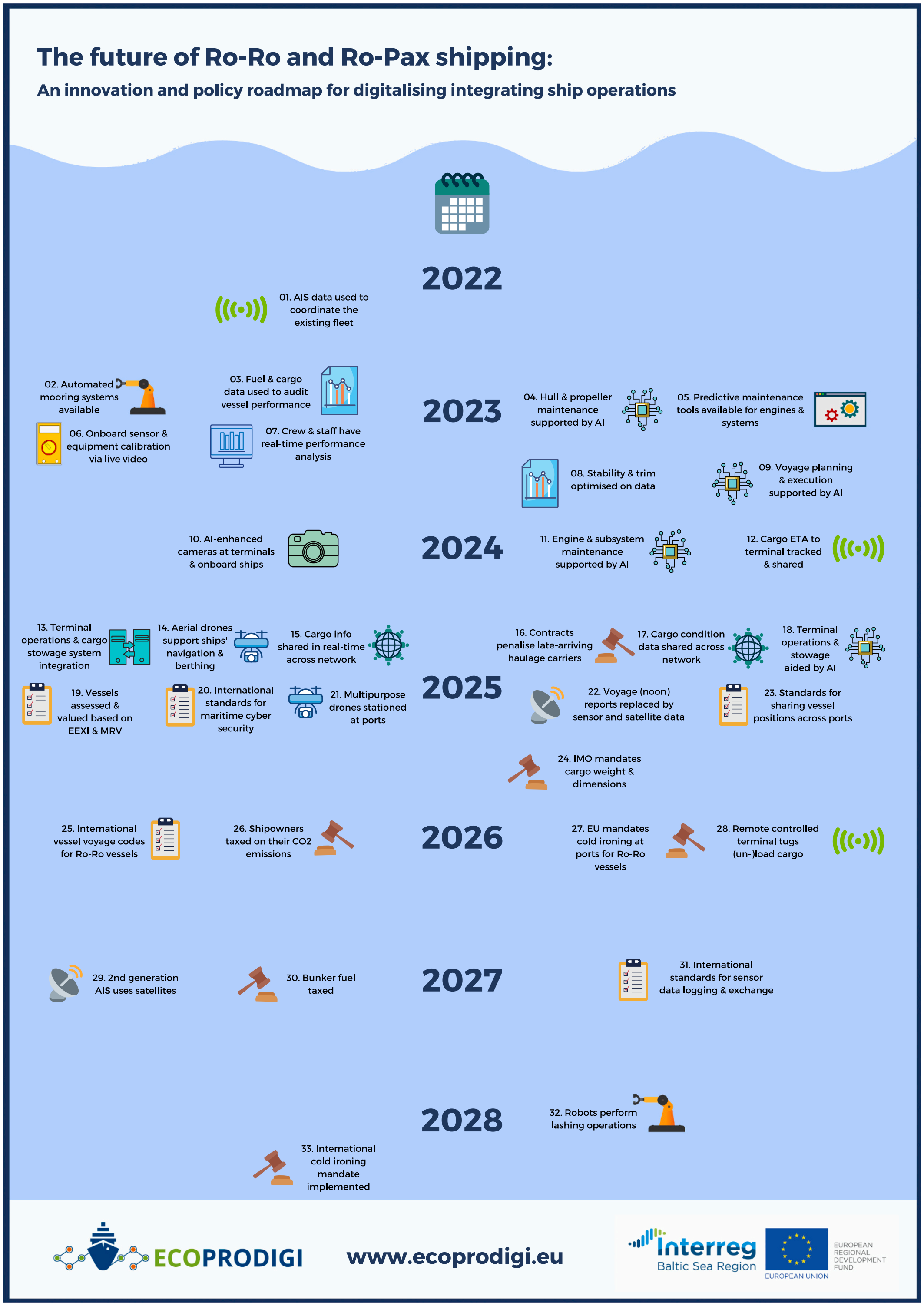

Fig. 5. Finalized roadmap "The future of Ro-Ro and Ro-Pax shipping" after the third workshop (Tønsberg, Norway, February 2020) [S3P4].

words, being that the descriptions had been shortened down to the 60 character target, the test determined if they had lost any clarity. It was assessed that, indeed, one of the questions was determined to be unclear, and it was thusly modified before sending it out to the wider ecosystem actors.

A snowball approach was used. The first respondents were identified by project partners as actors in the ecosystem who they considered to have a qualified opinion. An introductory text to the survey guaranteed their anonymity and explained how their estimate would be aggregated into a crowdsourced forecast. Respondents were also asked to forward it on to any actors they thought to also have a stake in the matter. The appendix with the 200-word descriptions was attached to the invitation to partake in the survey for reference. The survey collected answers from 40 respondents, and again, a cronbach-alpha test was conducted to ascertain clarity on the questions, and a further question from the roadmap was deemed ambiguous, resulting in its elimination from the roadmap. In all, 31 elements populated the final version. The median date for each of the events was used to position each discrete event on the roadmap (Turoff and Linstone, 2002; see also Fig. 5).

4.8. "Stress-testing" the roadmap

Initial frames for the scenarios were developed in desk research and interviews and piloted already in the 1st workshop [S1P3; see also Section 2.3.3]. Discussions helped to recast the frames for the scenarios and in the 2nd workshop [S2P3], a total of 12 scenarios were framed and worked through for the three initial topics: shipyards, integrated logistics, and vessel operations.

While scenario planning in the second workshop, participants were divided into 3 roughly equal groups and tasked to "flesh-out" the scenarios and determine the implications for their team topic, guided by a worksheet [S2P3]. In order to ease post-processing, worksheets were collected, pictures were taken of the workspaces, and participants who were asked to present their scenarios were video recorded [still S2P3]. After the workshop [S2P4], the core team condensed each of the scenarios into paragraph length, and these were brought into the third workshop [S3P3].

While scenario planning in the third workshop [S3P3], where the focus had, by now, been narrowed to a single roadmap that combined integrated logistics and vessel operations, each of the 8 scenarios were presented to the participants, one-by-one, for their assessment. The 8 scenarios were titled: 1) "Autonomous Autonomy," 2) "Circle Back," 3) "King Quality," 4) "Fast & Cheap," 5) "A New Logic," 6) "Ecosystems Rule," 7) "A Failure of Consumer-led Enforcement," and 8) "We Didn't Start the Fire." After the facilitator read each scenario description, participants were asked to comment from their seats using anonymous digital real-time polling software in open text boxes[26] to two questions: How does this scenario impact the roadmap? And what can or should be done about this scenario [from an eco-efficiency advocacy standpoint]? The responses and comments from the participants were displayed by the software in real-time as they came in on the front wall so participants could see them. Respondents were allowed to put in more than one answer, which many did after seeing the answers of others. Approximately 5 min were allocated for each scenario, or until the facilitator noticed that incoming comments had slowed or stopped. A discussion was then held in plenum to clarify, assess, and further develop the comments. This process was repeated for all 8 of the scenarios. Student assistants audio recorded and transcribed the conversations.

In the post-processing of the workshop [S3P4], comments collected by the software and notes taken by the students were coded and analyzed inductively and organized into themes (Gioia et al., 2013). Four themes emerged from the data, namely, 1) elaborations on the scenario, 2) impacts on ecosystem stakeholders and how they may respond, 3) actionable strategies to advance eco-efficiency, and 4) impact of the scenario on the roadmap. These codes did not appear across all of the participants' responses for every scenario. When they were, however, they were used as a rough guide for the organization of text titles "participants' assessment [of scenario X]:". The composition of text, however, was predicated on readability and flow that would, at times, override the codes. Also, as all codes did not appear across all of the participants' responses to every scenario, they were not adequate to be incorporated as sub-headlines in the text that combined participants' assessments. The participant assessments were included in the report, wherein direct language from respondents was indicated in quotation marks (see an excerpt in Table 2).[27]

The benefit of ecosystem level assessments to stress-test the roadmap, seen in retrospect, is that such assessments can travel across the ecosystem actors, and can support distributed conversations about the future. In scenario planning at the firm level, a major problem for scholarship is that such assessments are often deemed confidential and rarely shared outside of the firm, as the logic goes, if you understand the scenarios that are being developed, you can anticipate the actions that follow.

Table 2
Example scenario prompt and participants assessment.

Scenario 1 prompt: Autonomous autonomy
The economic recession took its toll—especially on less efficient operators. All investment went into autonomous systems to cut costs. Autonomous machines buzz around the ports, loading autonomous trucks. Customers track the movements of their Amazon orders in real-time.
Participants' assessment (consolidated and summarized by facilitator):
For real-time, "on the map" tracking to happen, participants explain that "data has to be recalculated at all times." The current bottleneck to the unfolding of this scenario is due to the limitations for the amount of data that can be transmitted, the "lack of communication capacity" and the "lack of frequencies" that would require the system to undergo an "override." "Smarter systems" that provide for "data saving solutions" such as "not resending already sent data," but "only updates" were proposed as an initial step.
For the full effect of this scenario to happen, respondents point to necessary investments. Data transmission infrastructure would need upgrading to "full coverage." But even before this, "the issue of regulation should be addressed," and respondents propose that "standards should be done and moved forward in time." If this direction is taken, participants expect "a big change in education systems" are needed to provide the "knowledge development" for the "skills" that would be "highly demanded."
Beyond this scenario, respondents explain how "technology implementation" and "interconnectivity" will allow "operational and commercial processes and get digitalized end2end." This development will further "enable authorities to monitor and track all cargo […] vessel operations, as well as […] emissions," which is important because "autonomy needs to be combined with sustainable energy sources."
Participants think that this scenario will "synchronize well" with the roadmap, perhaps even "increase the speed of change" and the speed of "technology development," effectively "shift[ing it] to the left" as there could be "earlier adoption" of technology. A driver of this would be when "AI" gets integrated across the "whole supply chain" that is used to enhance "planning."

5. Discussion

This article positioned an empirical case study about strategy and anticipation as deployed in an ecosystem beyond the standard purview of – and, thereby, intentionally decentering – the focal firm. The authors facilitated and observed, respectively, the adoption of multiple corporate foresight tools by stakeholders as they attempted to coordinate their activities in what scholars refer to as a business ecosystem (Adner, 2017; Jacobides et al., 2018). The authors adopted Surowieki's (2004) notion of the "wisdom of the crowd," and, through the use of foresight tools with actors in an ecosystem in the Baltic Sea Region across three workshops in 2019 and 2020, adapted the model in order to harness the "wisdom of the ecosystem." In the end, these foresight practices were a matter of significant practical relevance to the stakeholders involved in the process who aimed to catalyze, develop, and, someday, maintain these ecosystems.

Their core issue, as framed in the academic literature, was the challenge and opportunity of coordinating and aligning ecosystem actors. According to scholars, there is a paucity of tools to accomplish the task of actor alignment at the level of the ecosystem, either to establish or maintain them, without a focal firm (Baldwin, 2012; Damanpour, 2014). While future-oriented corporate foresight tools have been known to create opportunities for alignment and the orchestration of resources, this research has been historically undertaken within firms or from the perspective of a single firm. This case study demonstrates evidence of a living experiment whereby the stakeholders involved explored the potential of corporate foresight tools to address their, very real, ecosystem-level concerns about coordination, collaboration, and alignment. The

[26] Using Mentimeter, as noted above.

[27] The eight scenario prompts and their assessments can be found in the full report available at the ECOPRODIGI website (accessed 26-07-2022) and Researchgate (accessed 26-07-2022)..

authors are grateful for their willingness to experiment, and the opportunity to facilitate and observe the results, because all too rarely do the worlds of practice and theory meet in empirically observable cases such as the case examined in this paper.

It appears to be, and we agree with Lang and Ramírez (2017) on this matter, that it is the gradual generation of a shared vision for the future of the ecosystem that bonds and coheres the otherwise disparate actors in the ecosystem. This sense of cohesion co-emerges with the slow development, curation, materialization, and use of foresight outputs. This is also notable because, by decentering focal firms in their deliberations, stakeholders were not merely imitating business models from the private sector; by employing corporate foresight tools, stakeholders were also simultaneously adapting and modifying the tools for their own use at the level of the ecosystem.[28] Results from this paper confirm that the deliberate refinement of a shared vision for joint projects promotes the formation of new configurations of connection, innovation, and collaboration. In this model, the value to be captured and capitalized upon is effectively independent from a focal firm, which deviates significantly from open innovation models (see, e.g., Bogers and West, 2012). The bottomline is that coordinating the timing of multiple actors around important milestones helps those actors (i.e., firms, partners, providers, etc.) to establish advantageous positions not merely for themselves, but for the ecosystem as a whole (Hallen and Eisenhardt, 2012).

In conventional academic thought about innovation in ecosystems, it is challenging to imagine an alternative to the traditional model of focal firms at the heart of ecosystems driving innovation or, in some fashion, coaxing it out of other ecosystem actors. This is because, in this line of thinking, focal firms intentionally restrict flows of information in order to lock ecosystems into stable structures that are, within reason, predictable. Masucci et al. (2020) identify two conditions for new technologies to be taken up in an ecosystem: 1) the focal firm must understand the potential of proposed technology and 2) the focal firm must be able to retain control over information, including intellectual property. From this perspective, the only radical innovation in the ecosystem is either controlled (i.e., sanctioned) by the focal firm or the focal firm establishes a monopoly over forms of innovation they wish to produce in-house. It follows that empirical examples of focal-firm-driven ecosystem foresight will remain scarce or, if they exist at all, tightly controlled by the focal firm – until we enter a true era of collaboration at the ecosystem-level, as Moore (1993) foresees.

Alternatively, in the ECOPRODIGI case study, there is not – nor need there be – a focal firm. There is no owner of the roadmap; no owner of the visions; no control over the ideas; no control over the flow of the information. Broadly speaking, roadmaps seem appropriate for use in ecosystems for a number of reasons. Foremost, roadmaps encapsulate, and, thereby, represent, the future goals of the ecosystem as a whole. They are information-rich and, arguably, aesthetically pleasing. While they are easily comprehensible at-a-glance, the roadmap is supported by a detailed appendix. As such, similar to what scholars have called a “boundary object” (see, e.g., Spee and Jarzabkowski, 2009), roadmaps can be circulated through multiple organizations and sectors, speak to multiple audiences, and create, in effect, a shared language to talk about the future of actors in the ecosystem. In all possibility, simply speaking about the future of the group, the members of which populate the ecosystem, may have a modest, indirect influence on the perceived internal coherence of the group; it implicitly fortifies consensus surrounding plans, and, possibly, glues-together stakeholders, making the ecosystem more inevitable and less likely to fracture and break apart.

6. Conclusion

This paper began by acknowledging that ecosystems are recognized as progenitors of innovation. Central to the success of these ecosystems is thought to be the application of tools for the collective, collaborative orchestration of ecosystems. Corporate foresight tools, specifically as applied at the level of the ecosystem, have the potential to enact, orient, and, subsequently, orchestrate ecosystems, which the authors facilitated and observed in the case study examination of roadmapping and scenario planning for ECOPRODIGI on eco-efficient sustainable blue economy in Ro-Ro shipping. To the best of our knowledge, this is the first empirical demonstration of the use of corporate foresight tools at the level of the ecosystem with no identifiable focal firm as the driving force.

While corporate foresight tools have historically been designed to serve the needs of a single, central, or focal firm, the results of the article imply that when those tools are deployed at the level of the ecosystem, the notion of the focal firm is so profoundly decentered that it becomes almost incomprehensible. In this context, foresight tools such as horizon scanning, forecasting, roadmapping, and scenario-based stress-testing repeatedly enact and orient the ecosystem toward the future by collectively charting and anticipating shared innovation and policy. To this end, roadmapping is a practical means of curating and maintaining boundary-spanning conversations that support the orchestration of ecosystems far beyond the purview of the focal firm.

Based on the authors' observations, a roadmap produced in the ECOPRODIGI project constituted a set of predictions that signposted the innovation and regulatory trajectory of the ecosystem (see Fig. 5). The hope, palpable in the workshops, but not entirely possible to demonstrate with available evidence, was that with predictions for the future come real consequences in the present. The hope, communicated to the authors, is reminiscent of a construct developed in the social sciences. Self-fulfilling prophecies describe phenomena created when predictions are thought to cause an impact on behavior in such a way that the original prophecy is enacted (Merton, 1948). This is similar to more recent discussions in economic sociology (MacKenzie, 2008) and elsewhere (e.g., Passoth and Rowland, 2010) on the role of performativity in markets and nation states, respectively. The impact of roadmaps, from this performative perspective, could have similar impacts on ecosystem actors, although this is a matter for future researchers to examine, and, if possible, empirically demonstrate.

Regarding the implications of self-fulfilling prophecies as they might apply to foresight, some caution is warranted. While scholars acknowledge that information about the future can help to motivate action in the present, the extent to which these predictions “come true” is often beside the point and well beyond the scope of this paper. Also, the authors do not need to remind readers of the very real possibility of disruptive innovation in competing ecosystems or the unintended consequences associated with following roadmaps too closely or without adequate consultation and healthy skepticism.

Still, the above points underscore that, in its effect, the roadmap is a form of technology capable of shaping expectations for the behavior of actors within ecosystems, and, thus, ecosystems themselves (Baldwin, 2018). The roadmap is, at once, a product of the ecosystem, and, at the same time, the roadmap also clearly reproduces the ecosystem, confirms its boundaries, and coheres network connections that give form to the ecosystem in the first place. In what we observed, foresight practices are mutually reinforcing and co-constitutive of the very ecosystems they anticipate.

[28] In the long literature on technology diffusion, innovations have sometimes been referred to as “cultural carriers” in that as innovations spread they bring with them taken-for-granted assumptions and ways of seeing the world from past contexts of use, which simply get thrust into these new environments of their adoption (see, e.g., Scott, 1995). Some of these aspects of an innovation persist in a variety of contexts, meanwhile others whither away never to be seen again. It is, of course, beyond the scope of this study to examine precisely what assumptions were “imported” from other contexts into this case study or how the application of corporate foresight tools may, in turn, alter those assumptions or add to the rich repertoire of past examples or illustrative stories employed by facilitators. Still, future research in this direction would be useful to understand how innovations like corporate foresight change, adapt, and are modified for use in “other” contexts.

In closing, and as an additional contribution, this paper provides a practical blueprint for developing roadmaps for aligning ambitions for innovation, research, investment, and policy agendas at the ecosystem-level. Still, this paper is neither an analysis of the content of the roadmap, nor does it take a longitudinal perspective on its long-term accuracy. The authors acknowledge additional research is necessary to unlock those insights and to understand their potential impact on planning practices and the ecosystems they serve and rejuvenate.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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