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Transdisciplinarity as strategy: lessons from the Maine aquaculture industry, USA

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Practice theorists and strategy researchers have argued for a practice-lens, yet this is a new concept for sustainability scientists and development actors who are rooted in traditional research paradigms. Practice-to-strategy emerged as a throughline for the Maine Aquaculture Hub, an organization established to develop aquaculture in Maine, USA. The authors observed a six-month strategy process where the Hub's Core Team leaders engaged in sense-making about the aquaculture industry, go-to-market approaches, service-scope, and their own leadership. Transdisciplinary research was a concept familiar to the Core Team, and was even etched into the Hub's mission statement. However, they had not expected to find transdisciplinarity permeating the Hub's day-to-day work, namely educating citizens about aquaculture species, harbor-use, workforce gaps, and diversity. The Core Team reflected on the Hub's approach to its work: acting through others (a network mindset), exposing and including diverse ways of knowing (productive conversation), and decision-making processes which were collective, scientific and narrative (strategic thinking). This three-pronged approach represented what we dubbed 'practice-transdisciplinarity'. Practice-theory lies at the heart of practice-transdisciplinarity, as practice-theory combines diverse knowledge, systems thinking, and reflective processes as lenses into operations. Not only was practice-transdisciplinarity evident as the Hub Core Team reflected on operations, but it was also embodied by the Hub Core Team themselves, doing strategy-development. Practice-transdisciplinarity elements flowed into strategy considerations like open data, broadening the workforce, and partnerships. The authors theorize that practice-transdisciplinarity is relevant where organizations' resource limitations and policy constraints require inclusive design and responsive action. A self-conscious practice-transdisciplinarity throughline into strategy could help development organizations to surface hidden strengths and to develop strategy reflexively and inclusively.

Keywords: strategy; transdisciplinarity; practice theory; aquaculture; strategic thinking; networks; productive conversation; Maine; USA

1. Introduction

The choice of strategic planning processes has long been a source of debate among organization leaders and scholars (Mainardi & Kleiner, 2010). Do we maneuver around economic threats? Streamline operations? Pivot on a dime? Execute flawlessly? Just as the strategy process debates simmer on, so, too, do debates about the content of strategy. Many organizations across all sectors aim for a triple bottom line of people, profit, and planet (Kaplan & McMillan, 2021), but struggle with forming a strategy to accomplish all three.

What if the process and content of strategy were one? In other words, the expression of the organization's strategic advantage was the way strategy-making was done? This was the question we asked in our research on a Maine-based aquaculture initiative, the Maine Aquaculture Hub (the Hub). The Hub's mission was to help the aquaculture industry reduce barriers to growth through hands-on public training ('Aquaculture in Shared Waters' or AQSW), investment via the distribution of grants, and the creation of an industry roadmap (Sadusky et al., 2022). The Core Team leaders who were responsible for creating the strategy came from industry, academia, research, and community-development organizations. The Hub prided itself in cultivating what transdisciplinarity scholar, Mark Lawrence (2022) refers to as a sort of 'unity of knowledge.' The Hub had integrated various social and physical science ideas so that they could be understood by clammers (fishers) and investors, alike. From an economic development perspective in Maine, the stakes are high for aquaculture, as food security, alternative livelihoods and economic resilience are at risk (Cannon et al., 2023). However, it takes skillful collaboration to work across differences in power, scientific knowledge, land-use preferences, and traditional ecological knowledge (TEK).

That skillful transdisciplinary collaboration in everyday operations, or 'practice-transdisciplinarity', interested the authors as they sought to understand how an organization was reflective on its operational transdisciplinarity and what it looked like when that figured in its strategic planning. We define practice-transdisciplinarity as what Arnaud et al. (2018) celebrate as 'practical, discursive achievements', harnessing diverse knowledge, systems thinking, and reflective processes inside the organization's operations. Practice-transdisciplinarity is also a necessary lens for exposing and studying the organization's capabilities because 'revaluing of the ordinary skills and routines involved in micro-level activity is an important adjustment for disciplines which have too often abstracted to the remote level of "the firm" and similar' (Whittington, 2011: 184). We asked if leaders saw practice-transdisciplinarity, whether it was evident in their strategy design behavior, and whether they also considered it a strategic

differentiator, worthy of codifying in the organization's strategy. More specifically, we wondered:

1. What conditions would create this reflexive 'throughline' from practice-transdisciplinarity, to design, to their strategy product? It takes skillful collaboration to overcome differences (e.g., in power, resource-ownership, scientific knowledge and TEK) in operations, so how would those differences rise the level of 'advantage' to 'exploit' in strategy?
2. Aquaculture is critical to livelihoods, food security, and sustainability in Coastal Maine. What lessons could the Hub's case study offer to the economic development practitioners where their organizations must also exploit internal and external networks' knowledge to inform planning?

Using practice-transdisciplinarity as both a planning approach and a destination integrates science, policy and industry knowledge in a way that is both rigorous and inclusive. Practice-transdisciplinarity may provide an advantage for the strategic planning process as it improves the legitimacy of inputs (Cash et al., 2003), and improves the likelihood of the outcomes of that process being actionable because of their congruence with the organization's inherent mental models and capacities.

2. Literature review

This section addresses transdisciplinarity, practice-theory, and the connection between transdisciplinary research and practice-transdisciplinarity. Transdisciplinary research is an approach to science which honors and bridges different intellectual disciplines, and deliberately incorporates the perspectives of civil society (Lang et al., 2012; Jahn et al, 2012). Lang et al. (2012: 26) argued that transdisciplinarity goes even further to re-conceive social and scientific problems as being integrated together:

> Transdisciplinarity is a reflexive, integrative, method- driven scientific principle aiming at the solution or transition of societal problems and concurrently of related scientific problems by differentiating and integrating knowledge from various scientific and societal bodies of knowledge.

Transdisciplinary research can be a forcing function. In Rezaei's preface to his book 'Transdisciplinarity' (Rezaei, 2022: vii), he suggests that transdisciplinary research is a commitment, a position, a strategy 'to address prominent universal disagreements, complex

social, economic, public health, environmental and humanity issues, such as poverty, sustainability, public health, equality, justice and education.' Being willing to address universal disagreements is not about abdication from disciplines, but holding fast to the integrity of each incorporated discipline. Jahn and colleagues (2012: 5) state this clearly:

> [W]hile transdisciplinarity sets the frame for a research dynamic that couples societal and scientific progress, interdisciplinarity is the science-driven process of generating the new knowledge that fuels this progress.

Research and theorizing over two decades has shown that transdisciplinary research encompasses many collaboration strategies, such as non-linear, or systems thinking (Kish et al., 2021; McGinnis and Ostrom, 2013), co-creation of shared language (Clark, et al., 2016), roles focused on boundary-spanning (Guston, 2001; Clark et al., 2016), a quest for diversity in ways of knowing (Bruner, 1990), a reconciliation or juxtaposition of multiple scales of engagement (Clark & Hartley, 2020), knowledge and insight co-production (Lang, 2012), double loop learning or reflexivity (Lawrence et al., 2023), and, ultimately, the responsibility to know self and others enough to engage in intervention (Stokols, 2006; Lawrence et al., 2013). Rezeai (2022) notes that these transdisciplinary research collaboration strategies are inhabited by the principles of empathy, pluralism, and multilinguality.

In turn, these transdisciplinary research strategies may inhabit the business practices in day-to-day practice-transdisciplinarity. Pugh (2022) found three practice-transdisciplinarity operating categories that embody the transdisciplinary research strategies: network mindset, productive conversation, and strategic thinking (Table 1, and expanded below).

Transdisciplinary research is a model familiar to many scholars. But what of the people from multiple professional disciplines who collaborate to keep the business running? Practice theory can provide a useful lens for this. Arnaud and colleagues (2018: 693) define practice theory as a means to 'reposition work, processes and activities at the center of organizational analysis…while focusing on practice as a way to understand "organization as it happens." ' Whittington advocates for the practice-theoretic lens because it blends individual agency which is emergent, tacit, and embodied with a 'social essence that is irreducible to the psychological or biological' (Whittington, 2011: 185). Whittington goes on to assert:

> This mutual learning [across professional disciplines] will be facilitated by a disciplined focus on social practices and a respect for common themes. If we are disciplined in this

way, we can use practice theory to build a transdisciplinary project that is both wide-reaching and intellectually robust (2011: 185).

Table 1: Extending transdisciplinary research (TR) into practice-transdisciplinarity (PT): three PT operating categories

PT Operating Category	TR strategies (Pugh, 2022):	References
Network mindset	Incorporation of civil society and researchers	Lang et al., 2012; Jahn et al, 2012.
	Boundary-spanning	Guston, 2001; Clark et al., 2016; Galinsky et al., 2015; Page, 2008
	Operation on multiple scales	Clark & Hartley, 2020
Productive conversation	Shared language (for boundary crossing)	Clark, et al., 2016b
	Diversity in ways of knowing	Bruner, 1990
	Knowledge co-production	Lang, 2012
Strategic thinking	Systems thinking	McGinnis & Ostrom, 2014; Kish et al., 2021.
	Reflexivity	Lawrence et al., 2023
	Intervention	Stokols, 2006; Lawrence et al., 2013

Source: Pugh, 2022: 43.

Via practice theory, we hold ourselves accountable for considering transdisciplinary research concepts in the emergence of practice-transdisciplinarity. We can see practice-transdisciplinarity in such activities as meetings with stakeholders, business-development, new product development, and, most notably for our research, *strategic planning*. Below we elaborate on each of the three operating categories of practice-transdisciplinarity.

2.1 Network mindset

The network mindset category of practice-transdisciplinarity uses the transdisciplinary research strategies of incorporation of civil society and researchers, roles focused on boundary-spanning, and reconciliation or juxtaposition of multiple scales of engagement. Having a network mindset means holding a perspective that vital ideas come from the collective, and the network can discover, amplify and create them (Ehrlichman, 2021). Networks span the boundaries across professional disciplines, such as research, industry regulation, economic development, and food security. Differences in heuristics, perspectives and interpretations that come with those different ways of knowing, in turn, improve the organization's ability to generate options, execute, and recall (Galinsky et al., 2015; Page, 2008). Incorporating different ways of knowing can be a source of network legitimacy and productivity, alike (Freitag, 2014). For example, indigenous knowledge systems and TEK blend intuition, norms, and perception. Daigle and colleagues (2019: 783) capture this with the Passamaquoddy word for place-based decision making, 'Menakatoluhkatomon' or 'We move together'.

Practically speaking, for practice-transdisciplinarity, networks can accomplish a variety of outcomes, such as to channel a group's energy toward economic outputs (e.g., sustainability solutions), to support members' problem-solving (e.g., by comparing experiences), or to assemble leverage through their numbers (e.g., joint buying). For most network objectives, networks require diligent facilitation and engagement to get those outcomes (Pugh & Prusak, 2013; Ehrlichman, 2021).

2.2 Productive conversation

The productive conversation category of practice-transdisciplinarity uses the transdisciplinary research strategies of co-creation of shared language (for boundary crossing), a quest for diversity in ways of knowing, and knowledge and insight co-production. Productive conversation comes from the research on dialogue. Dialogue is a form of human interaction where participants welcome and respect diverse perspectives, carry a readiness to hear others' truths, bring willingness to examine one's own thinking, and commit to generating a collective intelligence (Dixon, 2021). However, dialogue is only part of the conversational needs of the organization, particularly where conversations span time and space, or where people come in and out. Skifstad and Pugh (2014) asserted that when dialogue also includes idea-translation and explicit inclusion, it is called *productive conversation*. In productive conversation knowledge, intent, meaning and shared value are cultivated intentionally.

Pugh & Altmann (2024) describe the five discussion disciplines that make up productive conversation. To the practices of dialogue (Isaacs, 1999), were added the disciplines of deliberate

acknowledgement (to individuals, groups, movements) and summarization (nonjudgmental upleveling and synthesis in order to propel the group forward). The resultant five discussion disciplines are the rhetorical intents of the speakers (or writers, in the case of online discussions):

1. Integrity: the act of making statements: 'The reason we are considering this is…' or 'We should…The point was…'
2. Integrity Q: the act of inquiring: 'What are…? How is…? Please can you help me understand…?'
3. Courtesy: the act of being positive, kind, and respectful: 'These are great examples…This gets better with practice…'
4. Inclusion: the act of acknowledging, bringing in: 'Preeti, as you said…Ahmed, can you share your perspective on…? Let's hear from someone who hasn't spoken…'
5. Translation: the act of synthesizing, extrapolating, or summarizing: 'On the one hand…on the other hand…We can look at this puzzle together…We can hold divergent views out there and look at them together. This is what we can agree upon and this is where we disagree….'

A sixth, Snarky, rhetorical intent, is the opposite of each of the five. Snarky reduces shared meaning and/or relationships. It could entail hyperbole or innuendo, insincerity, negativity, disrespect, exclusion, or a type of abstraction that is exclusive and/or self-sealing.

Each utterance in conversation can be coded as one or more discussion disciplines. Each discussion discipline in an utterance is called a move. In Pugh and colleagues (2023), which paralleled the Hub strategy-development program, we hand-coded approximately 1,100 moves (utterances-parts reflecting one discussion-discipline). These came from seven aquaculture-related town hall-like community meetings, and four similar unfacilitated conversations. We used these training data to train a large language model (LLM), the Bi-directional Encoding Representations from Transformers (BERT). (BERT is the ancestor of ChatGPT, which has fewer parameters than ChatGPT.) We then used that LLM on 23,000 open-source utterances, and then measured in a statistically significant manner the impacts of each discussion discipline on three outcomes: options-generation, intent-to-act, and relationship-building (Pugh et al., 2023). Using big, open data to run our model, we found that a 10% increase in the share of Inclusion or Courtesy increased the likelihood that the conversation would show evidence of Intent-to-Act by 45% and 35%, respectively. Productive conversation analysis corroborated what social scientists have shown about observability (Rand et al., 2014) and psychological safety (Edmondson & Lei, 2014): the more observable you are, the more likely you are to make public commitments to act; and the more psychologically safe you are, the more likely you are to make public commitments to act. The large language model research paralleling the study of transdisciplinarity in the

Maine Aquaculture Hub served as a benchmark of naturally-occurring distributions of discussion disciplines and outcomes.

2.3 Strategic thinking

The strategic thinking category of practice-transdisciplinarity uses the transdisciplinary research strategies of non-linear, or 'systems' thinking, double loop learning or reflexivity, and the responsibility to know the system of self and others enough to engage in intervention. Strategic thinking practices channel mission-articulation, inquiry, story, and systems thinking into the strategy development process (Liedtke, 1998). Liedtke (1998) argued that strategic thinking was a counterweight to strategic *planning*, which risks becoming a technical exercise, being less about ideation and integration, and more about quantification and (re)sequencing.

Strategic thinking practices are 'intent-focused' (being purpose-led), 'hypothesis-driven' (inquiring with data), 'thinking-in-time' (using analogies), 'systems perspective' (being interdependency-focused), and 'intelligent opportunism' (projecting the organization's capabilities forward) (Liedtke, 1998). These five practices are typical of a successful project team who must be tolerant of ambiguity, be respectful of both heritage and outside perspectives, and be skilled at sense-making (Gratton & Erickson, 2007). Strategic thinking uses imagination and engages in possibility-development, while it brings the whole system into the planning conversation (Moon, 2013). For a sustainability-oriented organization, strategic thinking can help to articulate social-ecological dilemmas, reflect on analogies across domains, generate options, and use data to inform pathways to achieving goals.

3. Research methodology

Over 1,100 Maine residents participated in the aquaculture industry in 2020, and the industry has been identified as a source of innovation and job growth for the Maine economy (Haines et al., 2020), with a year-over-year growth of 19%. It has been heralded as improving trade balance for the USA, producing food security, and creating a net improvement in wild fish weight around farms (Zajicek et al., 2021, Johnson, H., 2020). Yet, stakeholders must negotiate sometimes mutually-incompatible positions on aesthetics, food security, biodiversity, climate change, commercial and recreational craft navigation, and even the legitimacy of aquaculture (Zajicek et al., 2021; Cotton et al., 2023).

It is in this context that the Maine Aquaculture Hub emerged, a United States National Oceanographic and Atmospheric Association (NOAA)-funded initiative for educating the public

about aquaculture and advancing open science through training, research, and grants. The Hub had a sector-wide reputation as neutral, even amid widespread disagreement about aquaculture's role in the Maine economy. Established in 2019, the Hub's mission was 'to create a statewide, transdisciplinary collaboration…[and] focus collective efforts to build capacity for industry-driven innovation, diversification, and workforce development in Maine's aquaculture sector' (Hub Grant offering Letter of Interest, 2020). At the time of the study, the Hub fostered individual, organizational, and public aquaculture education through training, grants, and an industry roadmap. The Hub considered its stakeholders to be aquaculture farmers, equipment suppliers, harbormasters, researchers, regulators, investors, landowners, and consumers.

From July 2021 to February 2022, the Hub Core Team conducted a strategic planning process to consider the Hub's scope and positioning. At this time, the field of aquaculture-related research and aquaculture workforce development agencies and nonprofits was crowded, with approximately 25 entities vying for share of mind. Our research consisted of interviews, social network analysis, coding and analysis of meeting transcripts, and industry research. The Core Team member affiliations consisted of Maine Sea Grant (the Hub's parent organization, funded by the US National Oceanographic and Atmospheric Association), the Maine Aquaculture Association (an aquaculture industry trade organization), Coastal Enterprises, Inc. (a nonprofit community investment/development organization), the Maine Aquaculture Innovation Center (a research sponsor/facilitator focused on technology transfer and commercialization), and the University of Maine Aquaculture Research Institute (a university-based research center). The Coordinator of the Hub, an employee of Maine Sea Grant, was a former international marine scientist.

The Hub Core Team engaged in the strategy process to determine how the Hub might adapt as new, competing aquaculture education organizations emerged, special interest groups contributed to polarization, and diversity issues loomed, all against the backdrop of a warming Gulf of Maine. The Core Team was animated by three questions: 'Where should we play in the aquaculture sector?', 'How can we differentiate what we do?' and 'How can we continue over time with limited resources?' The strategy process involved industry analysis, two Core Team meetings, options-development, and action-planning.

Our research inquired into practice-transdisciplinarity in the day-to-day operations of the Hub. We also observed practice-transdisciplinarity in the Core Team's strategy process interactions. We evaluated three practice-transdisciplinarity features: network mindset, productive conversation, and strategic thinking. First, we conducted interviews to surface accomplishments, headwinds, opportunities, and perceptions of the Hub's strengths. Second, we transcribed two of

the Core Team's strategic planning conversations, 'Conversation 1: Strategy initiation' and 'Conversation 2: Options evaluation.' We coded each conversation move (sub-utterance classifiable as a discussion discipline) for the five discussion disciplines (rhetorical intent), and also coded the conversations for the presence or absence of strategic thinking practices. Conversation 1 had 140 moves (some utterances were more than one move). Conversation 2 had 75 moves. Third, we observed the Hub's operations, including network-convening, using observation and social network analysis. We incorporated our own experiences of strategic planning, transdisciplinary research, and aquaculture.

We used the parallel study of aquaculture community town halls, or 'lease scoping sessions' (Pugh et al., 2023). The discussion discipline proportions of those town halls served as a benchmark against which we assessed the discussion discipline proportions in the Hub Core Team conversations. We compared distributions of the discussion disciplines found in the two Hub Core Team conversations to the distributions of the discussion disciplines in the 745 moves across seven aquaculture community town halls. The variance from the aquaculture community benchmark was used to understand conditions where the Hub Core Team's actions may be spurred or stalled, creativity expanded or quelched, or relationships expanded or stunted.

4. Findings

Since its inception in 2019, the Hub has used practice-transdisciplinarity to convene and educate citizens in the diverse, and sometimes politically-fraught, aquaculture sector. However, the Core Team's framing of this was inchoate. In the interviews, the Core Team expressed that it was familiar with transdisciplinary research, and even had it in their mission statement. But Core Team members lacked a common understanding of how transdisciplinary research worked on an operational level as practice-transdisciplinarity. During strategy development, this awareness changed. The Core Team appeared to translate the Hub's practice-transdisciplinarity, namely its network mindset, productive conversation capacity and its strategic thinking capacity, into both its named competitive advantage and its strategy-process. Once an implicit part of the Hub's operations, practice-transdisciplinarity became a lens for reflection and design (Lawrence, 2023).

4.1 Network mindset as practice-transdisciplinarity and strategy process

In the Core Team's interviews, they explained that Maine aquaculture had significant headwinds, such as supply chain gaps, consumer misunderstandings, and tensions between farmers, riparian landowners and Native American fishers using TEK. Tensions created silos, or, in social network analysis (SNA) terms, self-reinforcing clusters. One Core Team member put it bluntly,

'Communities are in conflict. They have not come together on their vision for aquaculture.' Another pointed to competition among agencies like the Hub: 'There are overlaps between [aquaculture] workforce development programs.'

Despite this background, the Hub was adept at bridging across segments of the sector. Since its inception, the Hub had connected aquaculture farmers, biologists, and regulators, and leaned into multidisciplinary methods, language, and love for Maine. The Hub's activities, like the AQSW, were a safe space for people interested in the aquaculture sector to learn next to each other. The activities also contributed to the loyalty of the Hub's volunteers, including aquaculture farmers, community leaders and researchers. In 2022, the Hub interacted with 105 unique organizations, in 12 different convenings. In addition, 80 individuals had participated in AQSW training programs during that time.

A Core Team member explained that the network mindset was an advantage worth exploiting, 'We bring people in the aquaculture space together. We [listen to] many voices…[W]e've been getting to know the municipalities and AQSW students.' Another added, 'The Hub is also this connection between hundreds [of] start up companies.' Core team interviewees believed that these ties were stronger because of the Hub's real-time interactions (AQSW classes, focus groups, or 1:1s), which benefited from the Hub's adept facilitation. In addition to being a central component of the strategy, the network mindset was a resource leveraged in the two strategy conversations: Core Team members drew in insight from outside the conversation, and engaged in pattern-finding. Noted one Core Team member, while watching the Core Team's strategy discussions, so rich with narratives from inside and outside the sector: 'We have a wider lens on the industry. We've been able to see the common threads.'

4.2 Productive conversation as practice-transdisciplinarity and strategy process

When conversation participants suspend judgment and invite different perspectives, idea-generation and problem-solving improve (Page, 2008; Dixon, 2018). Our parallel research on conversation in the aquaculture industry showed direct correlations from the discussion-discipline-shares to outcomes. For example, we found that the shares of Integrity-Q and Translation correlated with Options-Generation, that Inclusion correlated with Intent-to-Act, and that Courtesy correlated with Relationship-Building (Pugh, 2022; Pugh et al., 2023).

Core Team members saw productive conversation as fundamental to the Hub's brand. One stated, 'The Hub is a safe place to have difficult conversations.' That member went on to suggest that the Hub uses conversation skills in each of its offerings, namely AQSW training events, re-

granting, and the focus groups. Conversation capacity, in real time and in asynchronous communications, had contributed to its sector-wide reputation as being neutral.

We wondered if these patterns would be evident in the Core Team's strategy conversation, and if percentages of the discussion disciplines would match up with the strategy-process tasks of generating options and inspiring accountability. As described above, we transcribed and analyzed the Core Team's 'Strategy initiation' and 'Options evaluation' conversations. We coded each for the five discussion disciplines. Table 2 juxtaposes the two strategy conversations with each other, and with our aquaculture industry benchmark.

Table 2: Hub Core Team conversation transcript analysis showing outcomes correlated with those discussion discipline shared in the reference research (right)

Discussion Discipline*	Reference Transcripts %	Conversation 1 "Strategy Initiation"	Conversation 2 "Options Evaluation"	
Integrity ("We could jump to another level of productivity")	52%	44%	39%	
Integrity-Q ("Are regulators included?")	15%	20%	20%	Options-generation
Courtesy ("You have done an amazing job on all of this.")	12%	7%	14%	Relationship-Building
Inclusion ("[Name]. do you have anything to add?")	11%	8%	4%	(Intent-to-Act)
Translation ("Despite [those] different missions, we work together.")	6%	19%	18%	Options-generation
Anti/Snarky ("X is banging his head against the wall.")	6%	1%	4%	

-= more than benchmark. = less than benchmark.

Note: Conversation 1 had 140 moves. Conversation 2 had 75 moves. (In each, some utterances contained more than one move). Aquaculture reference transcripts had 745 moves. Outcome types (right, outside the table) and Reference Transcripts (Column 2) are based on aquaculture conversation modeling (Pugh et al., 2023). *Discussion disciplines are Integrity (statements); Integrity Q (inquiry); Courtesy (positivity, respect); Inclusion (acknowledgement); Translation (synthesis, extrapolation); Snarky (sarcasm, indirection, insincerity). Green circles represent a positive outcome, relative to the benchmark. Red circle represents a negative outcome, relative to the benchmark. Columns may not sum to 100% due to rounding.
Source: Authors.

Was the conversation conducive to strategy-generation? The higher-than-benchmark Integrity Q (inquiry) and Translation (synthesis), indicated that the conversation was likely to generate options. The increase in Courtesy between Conversation 1 and 2 indicated that the conversation was likely to deepen relationships. Indeed, psychological safety appeared to have enabled members to try on novel business models. One Core Team member noted, 'The Core Team respects each other's interests. We are moving collectively forward.'

However, consider the conversations' percentages of Inclusion (acknowledgement) in Table 2. Neither conversation was high in Inclusion, relative to the benchmark (8% and 4% for Conversations 1 and 2, respectively, compared to a benchmark of 11%), and more moves were Translation (synthesis). It is possible that low Inclusion was associated with lower Intent-to-Act in the conversations. Low Intent-to-Act may have also resulted in the long time-gap between Conversation 1 and Conversation 2, and between Conversation 2 and the Core Team's strategy ratification.

4.3 Strategic thinking as practice-transdisciplinarity and strategy process

When we coded and analyzed conversation content for the Core Team, we also saw evidence of the Core Team's strategic thinking practices, namely their proclivity to generate a shared intent,

Table 3: Strategic thinking practices from the Core Team's conversations

Strategic thinking practice	Definition	Statement in Hub strategy conversation
Intent-focused	Being mission-affirming, combining energy and direction	'Shared waters is the DNA of the Hub.'
Hypothesis-driven	Using data-informed propositions, combining imagination and data	'There are a lot of others in this space, so I ask myself about where we can have an impact.'
Thinking-in-time	Using analogies, respecting the past and peers, but leaning toward the future	'It's useful to see who is doing things, for example [peer organizations]…This isn't exhaustive, but it's useful to think about who's in this sector.'
Systems perspective	Having an interdependency-focus, attending to heterogeneous elements, like talent, revenue, politics, nature.	'[We considered] the importance of fisheries and aquaculture *both* for the economy. The elements got broader as we were thinking them through. I don't know if others had thought that. It was a bit of a shift.'
Intelligent opportunism	Iteratively pivoting and projecting capabilities forward	'[The Hub has] the reputation of the different entities and the people who work for them. We have years of experience. People see that, understand it, and respect it.'

Note: Examples of strategic thinking practice by the Core Team during the strategy meetings. Definitions adapted from Liedke (1998). Source: Authors

Table 4: Progression of strategic thinking frequency at two strategy meetings

Conversation 1: Strategy initiation

Moves with Strategic Thinking	1 Systems perspective	2 Intent-focused	3 Thinking-in-time	4 Intelligent opportunism	5 Hypothesis-driven
#1-20 (11)	30%	10%	10%	30%	20%
#21-40 (6)	0%	0%	17%	50%	33%
#41-60 (4)	0%	75%	0%	25%	0%
#61-80 (3)	0%	0%	33%	67%	0%
#81-100 (10)	0%	30%	20%	50%	0%
#100-120 (10)	0%	18%	27%	45%	9%
#121-133 (10)	10%	20%	0%	30%	40%
% total	**6%**	**22%**	**15%**	**42%**	**15%**

Conversation 2: Options evaluation

Moves with Strategic Thinking	1 Intent-focused	2 Hypothesis-driven	3 Thinking- in-time	4 Systems perspective	5 Intelligent opportunism	Other**
#1-20 (7)	**14%***	43%	14%	14%	14%	0%
#21-40 (4)	0%	25%	25%	0%	50%	0%
#41-60 (5)	20%	20%	60%	0%	0%	0%
#61-80 (8)	13%	38%	25%	0%	25%	0%
#81-100 (7)	43%	14%	43%	0%	0%	0%
#100-120 (5)	0%	0%	0%	40%	40%	20%
#121-133 (8)	13%	13%	0%	0%	50%	25%
% total	**15%**	**22%**	**24%**	**8%**	**26%**	**6%**

Note: Table 4 shows the strategic thinking evolution chronologically (numbered 1-5 in row 1) in each conversation. Moves are represented in rows, in groups of ten. The number of moves which contain strategic thinking are in parenthesis in Column 1. Percentages indicate the share of the moves in the row identified as the specific strategic thinking practice. (For example, in Conversation 2, for the row containing utterances #100-120, there were five moves. Two moves were systems perspective, two intelligent opportunism, and one was Other. Cells have moderate shading if 2 or more utterances contain the strategic thinking practice. Cells are shaded dark if three or more utterances contain the strategic thinking practice. This shows a progression from upper left to lower right.

*A close reading of the text showed that, in the first five moves in Conversation 2, intent-focus emphatically led, though not in number of utterances.

** 'Other' was 'anti-hypothesis driven' where a speaker spoke out of certainty, contrasting to other hypothesis-driven moves which involved conjecture.

Source: Authors

to use far-ranging stories and analogies, to pose testable hypotheses, and to consider exploiting its strengths. Table 3 provides examples of the Hub's strategic thinking practices.

In Conversation 1, 41% (54 out of 133) of the conversation moves were strategic thinking. In Conversation 2, this climbed to 62% (44 out of 71 moves). What this means is that more utterances directly contributed to the strategy content. Strategic thinking practices may have come naturally to the members, yet it appeared that they were amplified when Core Team leaders discussed the practice-transdisciplinarity of the Hub in Conversation 2. Table 4 sequences the strategic thinking practices by frequency in ten-move intervals.

In Conversation 1, the Core Team first focused on the broad landscape (systems perspective), channeled a shared direction (intent-focused), pulled in analogies and stories (thinking-in-time), surfaced strengths (intelligent opportunism), and then, finally, imagined data, options and evidence (hypothesis-driven). The Core Team set the stage for the next activity by emphasizing strengths (intelligent opportunism). Conversation 1 appeared to have few hypothesis-driven strategic thinking practices, in contrast to Conversation 2. In Conversation 2, we saw roughly equal amounts of strategic thinking moves that were related to practical knowledge: hypothesis-driven (data-driven proposals), intelligent opportunism (leaning into strengths), and thinking-in-time (sharing narratives, discussing peers). In Conversation 2, the Core Team generated options (hypothesis-driven) and shared references (thinking-in-time), and then narrowed the aperture to extrapolate forward with intelligent opportunism. We established that conversation analysis and strategic thinking analyses are complementary. During Conversation 1, thinking-in-time frequently was associated with the Courtesy discussion discipline. To bring each option to life, the Core Team used a one-page mock 'brochure' of the future-state Hub. These fleshed-out futures paid homage to peers and other industries, and focused the Core Team's imagination. Such a vibrant illustration of target customers, services, and partners also pushed them to ask, 'Could that work for us?' shifting to the hypothesis-driven strategic thinking practice.

Overall, intelligent opportunism dominated both conversations, at approximately twice the frequency of the other practices in Conversation 1, and 10% more than the next highest, thinking-in-time, in Conversation 2. Meanwhile, the systems perspective appeared in both conversations at a percentage lower than the other practices. In our research, the inclusion discussion discipline (acknowledgement) coincided with the systems perspective strategic thinking practice (interdependency). Just as the Core Team's inclusion share was below the benchmark data so, too, the systems perspective was the least frequent strategic thinking practice. Our conversation analytics research showed that inclusion can deepen intent-to-act as acknowledgement brings people more fully into the conversation (Pugh et al., 2023). We asked

ourselves, 'How might this relatively lower inclusion/systems perspective combination have affected the strategy process?' Was there too little inclusion (direct acknowledgement) and too much politeness? A Core Team member shed light on this conjecture. They responded to a graphic of 'sliders' for trade-offs (e.g., research, versus commercial focus) and remarked, 'For some of our organizations, we are on different sides [of that graphic]. But we are in the middle when we come together.' A systems perspective might have been avoided, lest it incite a tense discussion about those different sides. If well-managed, such a discussion might have also led to new learning and shared pride in having pushed through the argument together. In our data, it appeared that the low systems perspective was twinned with low intent-to-act, just as inclusion had been shown to be associated with intent-to-act in our parallel research (Pugh et al., 2023). One could interpret this to mean that including different perspectives, either through the act of systems thinking or the act of drawing in a person with a different view, builds participants' sense of responsibility.

We established that strategic thinking is a practice that is adaptive. Core Team members could see that their ability to think together and persevere through shared goals, while integrating context, shared narratives, options and strengths, armed them for more resilient, reflective (non-reactive) collaboration. Thus, having practiced strategic thinking would come in handy in the Hub's future strategy-development as tensions in the aquaculture sector were inevitable. We believe that this practice was valuable, even despite proportionately lower inclusion and systems perspective.

5. Discussion: strategy and the practice-transdisciplinarity throughline

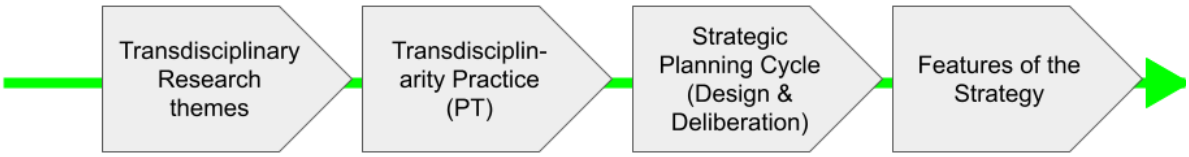
The practice-transdisciplinarity of the Hub provided the Core Team with evidence for considering bold changes. The practice-transdisciplinarity that surfaced in the Core Team during the strategy process enabled the Core Team to consider capitalizing on its network reach, breadth of (co)offerings, and diversity of constituents. Network now figures prominently in its model.

As researchers, we traced the Hub's operational boldness to having practice-transdisciplinarity inside the strategy-process, and then into the strategy itself (Figure 1). It appeared that novel strategic options came from:

- The confidence that comes with Hub's network mindset;
- The deliberativeness and transparency that comes from its productive conversation capacity; and
- The integration of analogies that comes from its strategic thinking capacity.

First, the Hub's day-to-day activities had involved a vast network of diverse beneficiaries from restaurants, to regulators, to researchers. The network concept inspired business model options. For example, a Core Team member contemplated income streams from fees, advertising, badging, competitions, and subscriptions, all drawn from peer organizations' strategies. Second, productive conversation skills observed in the strategy sessions were not just the unique talent of the Core Team, but reflected trust cultivated among the Hub's constituents, which resulted in participants asking for programming for specific segments like women in aquaculture. Third, strategic thinking practices also appeared to grow out of reflexive discussions of the Hub's intent-focus and intelligent opportunism. This reflexive habit helped with strategic options-development. For example, thinking-in-time 'muscles' resulted in more robust storytelling.

Figure 1: Transdisciplinarity-practive throughline



PT Category	TR theme (Pugh, 2022)	Hub day-to-day practices	Hub Core Team's behavior	Strategy components
Network mindset	• Incorporation of civil society and researchers • Boundary-spanning • Operation on multiple scales	• Bridging the aquaculture sector, such as municipalities, farmers, researchers in the AQSW (training)	• Pulling in insight from outside the conversation • Pattern-finding • Referring to connections	• Network model • Democratized knowledge, including data as product
Productive conversation	• Shared language • Diversity in ways of knowing • Knowledge co-production	• Instructors from multiple disciplines, unique perspectives	• Open conversation reflected and reinforced cohesion, innovativeness, and responsibility	• Inclusive programming and DEI
Strategic thinking	• Systems thinking • Reflexivity • Intervention	• Robust storytellin • Systems perspective in programs design	• Collective intent • Hypothesis-testing • Stories/analogies • Leveraging experts	• Novel multiple business models

Source: Authors

The distribution and timing of the discussion disciplines and strategic thinking practices across the conversations revealed the effects of practice-transdisciplinarity on the Core Team's cohesion, innovativeness and sense of inclusion. We observed that it was not just that they had good conversation, but that their conversation buttressed strategic thinking and the Hub Core Team's effectiveness. Conversation analysis provided a window into strategic thinking capacity, and some discussion disciplines dominated. Translation moves (with an associated 'intelligent opportunism' strategic thinking practice), may have helped keep the conversation moving. On

the other hand, if inclusion moves had been more frequent (with an associated systems perspective strategic Thinking practice), there might have been an earlier intent-to-act outcome.

Liedtke (1998: 125) explains that strategic thinking capacity must be learned: '[W]e must recognize three discrete aspects of the *process*: repertoire-building, managing the strategic issues agenda, and programming.' Even before the strategy conversations, the Hub Core Team could claim both programming (e.g., the next cycle of aquaculture training) and a strategic-issues agenda (e.g., the aquaculture industry Roadmap report). Yet, what Liedke calls 'repertoire-building' was new to the Core Team. To build repertoire, Liedke argues, leaders should become aware of their strategic thinking, such as skepticism (hypothesis-driven statements), or confidence (frequency of intelligent opportunism statements), or history-sharing (thinking-in-time statements). Leaders may under- or over-advocate for the mission (high frequency of intent-focused statements) and can be stymied by blind spots (low frequency of systems perspective statements). Our study of the discussion disciplines provided indicators of such strategic thinking imbalances.

Practice-transdisciplinarity for the Hub included a network mindset, productive conversation capacity, and strategic thinking, which, in turn, were assets in strategy-making. We witnessed the practice-transdisciplinarity capacities on three scales: social capital was spread over time/space (network mindset), dialogue occurred across diverse parties and interactions (productive conversation capacity), and strategy deliberations were unfettered for the Core Team (strategic thinking). How might practice-transdisciplinarity contribute to other organizations? First, practice-transdisciplinarity may be a latent strength for any organization's day to day operations. Second, surfacing and showcasing the best of practice-transdisciplinarity could provide both a role-model and evidence for the strategic planning process and product, respectively. In addition, when the organization has the option of composing its planning team, a practice-transdisciplinarity framework of network mindset, productive conversation, and strategic thinking could be criteria for selecting members or outside contributors.

6. Conclusions

The Hub's practice-transdisciplinarity capabilities that were exposed during strategic planning, namely network mindset, productive conversation and strategic thinking, had a throughline from practice, through strategy deliberation, through strategic options. Transdisciplinarity as strategy can be a model for imaginative and inclusive decision-making for organizations in industries like

aquaculture, which bring communities sustainability, food security, livelihoods and economic resilience.

We assert that economic institutions embarking on strategy-development with governments, non-governmental organizations (NGOs) and commercial entities should incorporate the three practice-transdisciplinarity categories, even if those capabilities are not currently strengths of the entities involved. The integrity and reflexivity of the transdisciplinarity as strategy (with its practice-transdisciplinarity throughline) appears to make strategy more bold, explicit, collective and evidence-based.

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