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# Assuring aquaculture sustainability beyond the farm

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ABSTRACT

This paper explores the emergence of forms of 'beyond farm' assurance in the aquaculture sector, designed to increase the inclusion of smallholders and scale up environmental sustainability. The analysis reveals a 'spectrum of assurance', representing contrasting levels of trust in sustainable production and consumption. At one end of this spectrum attempts emerge to foster self-determined assurance models with internal verification that represent growing trust in the ability of subjects to organize sustainability improvements that extend beyond individual farms. The other, more dominant end of this spectrum, however, is populated with prescriptively and externally verified assurance models that demand high levels of control-driven assurance, demonstrating distrust in sustainability practices that extend beyond individual farms. The paper concludes that, to scale up sustainability, beyond farm assurance models must overcome the limitations of prescriptive assurance by finding fundamentally new ways of trusting farmers and their local counterparts in the global agro-food system.

## 1. Introduction

Assurance, defined as institutionalized trust and verification [1,2], in the aquaculture sector has traditionally been organized at the farm-level. Markets that exhibit demand for assurance over sustainably produced products, mainly in North America and Europe, are estimated to exceed US$11.5 billion in retail value and an estimated 56% of global aquaculture production is rated or certified [3,4]. Farm-level assurance is now well established through certification [5]. To be certified, individual farmers must demonstrate compliance to a set of standardized criteria. Products sold from their farm then carry a label that conveys assurance to buyers that they meet a predefined level of sustainability [1].

There is an emerging trend toward providing assurance for aquaculture performance beyond the farm [6,7]. This is taking on multiple forms and is driven by various factors. Farm-level certification, for instance, is relatively inaccessible to smallholders [8] and has not led to large volumes of certified product (3% of total production, see [4]). It has also had limited success in addressing production risks like disease or cumulative environmental risks like mangrove deforestation [9]. There is a need to ensure that the management of these shared risks effectively involves multiple actors and shared resources, and to create and organize assurance models that hold these actors accountable for setting, measuring and controlling sustainability outcomes [e.g. 10,11]. The critical challenge is to determine whether and how such assurance mechanisms beyond the farm can be applied at scale.

The attention practitioners give to novel 'beyond farm' assurance models has not been matched by any systematic academic reflection on their design and capacity to foster confidence that sustainability claims made at a scale beyond the farm are indeed verifiable. This paper fills this gap by exploring how assurance is organized in four emerging beyond farm assurance models with different designs and operating at a range of scales. It examines the organization of these assurance models by reviewing (1) the scale at which the claims are made and to which audiences, (2) how these claims are defined and (3) what approaches are used to verify these claims. The results provide insights into how these models can effectively scale up assurance.

The analysis is based on a structured comparison between four exemplary models of beyond farm assurance. First, group certification programs put in place by key third party certification standards - including Best Aquaculture Practices (BAP), Aquaculture Stewardship Council (ASC) and GLOBAL Good Agricultural Practices (GLOBALG.A.P.) - designed to overcome constraints in farm-level certification of smallholders [3]. Second, BAP's Biosecurity Area Management Standard (BAMS); the only third party certification standard that certifies 'areas' in the aquaculture sector [12]. Third, the Partnership Assurance Model (PAM); a collaborative model for aquaculture improvement and assurance that brings together local stakeholders to design, implement and verify improvements in a 'region' [7,13]. Fourth, Verified Sourcing Areas (VSAs); a new area-based mechanism designed to verify

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sustainability production and trade from a spatially defined 'jurisdiction' [14].

The following section outlines the analytical framework we use to understand how these four assurance models organize the definition and verification of credible sustainability claims beyond the farm. The methods used for data collection and analysis are then described, before comparing the four assurance models in section four. Section five reflects on this comparison and presents a new conceptual model for understanding the possibilities and constraints for assurance models to foster greater trust in, and therefore greater impact through, shared risk management. The paper concludes on the implications of beyond farm assurance for scaling up sustainability across the agro-food sector.

## 2. Organizing assurance beyond the farm

Variation in assurance models can be understood in two dimensions. First, they can be classified in terms of whether the sustainability claims they assure are 'externally' prescribed or self-determined by actors involved directly in the practice and governance of production [15,16]. Second, they can be classified in terms of whether these sustainability claims are externally verified by, for instance, third-party auditors, or internally, through internal monitoring systems [1,16,17]. These two dimensions together create four quadrants (see Fig. 1) that characterize the form of assurance buyers and regulators are willing to accept over the risk that 'sustainability risks' are not effectively managed by subjects involved in food production.

Assurance models that fall under Type A (Fig. 1) typically exhibit weak trust in their target subjects as they focus on external verification of externally prescribed claims. Third-party sustainability certification, that is highly prevalent in the global agro-food sector, falls into this quadrant. As Auld et al. [18] argue, these models are based on a 'logic of control' that assumes activities necessary for advancing sustainability require institutions for controlling behavior to ensure compliance. Without prescriptive rules and external audits, these assurance models assume subjects will subscribe to sustainability claims but not change their behavior [18]. As such, mistrust and correspondingly high levels of external control are inherent to their design.

The imposition of prescriptive rules and external verification has several limitations. They can be exclusionary when subjects cannot carry the organizational, administrative and financial burden of assurance [19]. Subjects are also commonly excluded from defining the sustainability criteria upon which claims are made and designing the verification methodologies, both resulting in assurance models that do not reflect local conditions or interests [16,20]. Furthermore, externally verified models have been questioned in terms of their accountability, legitimacy and independence [21–24].

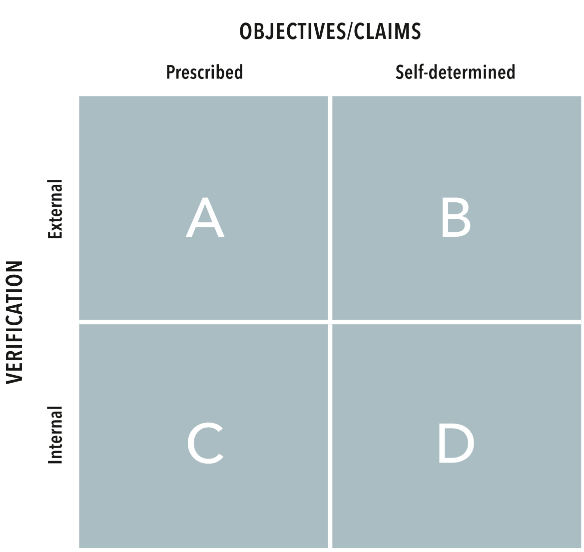


**Fig. 1.** Heuristic model for classifying types of assurance based on claim-making and verification.

In response to these limitations, alternative models have emerged that tend towards self-determined and internally verified assurance over sustainability claims (Type D). Examples vary in their specific design, but include participatory guarantee systems in organic agriculture and community supported agriculture and fisheries [17,25]. These assurance models are associated with stronger levels of trust in subjects by buyers and regulators. They are, as such, steered by what Auld et al. [18] refer to as a 'logic of empowerment'; promoting the participation of subjects, advocating a relational approach to addressing problems and questioning the value of assessment by external actors. This alternative logic then promotes monitoring methods that are accountable to those that are involved in the process and governance of production.

Fig. 1 offers two further alternatives for this logic of empowerment. First, assurance models in which claims are self-determined, but still verified by external actors (Type B). For example, the codification for organic agriculture in the U.S. was initiated by private growers that had an interest in creating uniform definitions and standards for organic agriculture [26]. However, external verification was deemed desirable to inspire confidence in consumers that the produce was separated from conventional produce and protected from contact with prohibited substances. Second, assurance in which claims are prescribed, but internally verified (Type C). For example, industry association codes of conduct that leave verification to their members and do not engage outside stakeholders [27], or first party certification where the subjects themselves declare conformity [1]. These three models demonstrate different degrees of letting go of external control.

To determine where different assurance models fall among the assurance types outlined above, characterized by prescribed or self-determined claim-making, and internal or external verification, three analytical dimensions are applied.

First, the scale at which claims are made and the audience that needs to be assured that these claims are met, are examined. Claims can be made about the mitigation of sustainability related risks at the farm-level [28], or at the area-level [29,30]. The combination of the scale of these claims and their audience are central to determining what form of verification and claim-making is acceptable for building trust amongst an 'assurance audience', which can include buyers, regulators, civil society actors and/or adjacent actors in a given landscape [31]. Thus, the audience of these assurance models and the way that conformity to the criteria used to support these claims is communicated to this audience, are identified.

Second, the extent to which the sustainability claims being assured are prescribed by external actors or self-determined by the subjects is examined. This entails identifying the actor that is defining sustainability claims, and how subjects are organized as a result of these claims. For instance, are sustainability criteria prescribed by external actors like standard owners (e.g. the ASC or Seafood Watch), or are local actors empowered to define their own sustainability criteria [32–34]? The manner in which local actors are organized in response to these claims (whether prescribed or self-determined), to foster credibility of the assurance process for the different audiences being addressed [22], is also examined. This includes decisions about who is included in the assurance process, how trust between subjects is institutionalized and how accountability between subjects and assurance audiences is organized.

Third, the organization of verification is examined, identifying whether this is organized by external actors or internally, by assurance subjects. This entails determining who verifies non-conformity and how this is organized, who is responsible for addressing non-conformity, and at what level (farm or area) information is collected for verification. For example, verification of farm-level third party certification involves independent external audits on either metrics of sustainability performance or on information systems a farm has in place to monitor sustainability performance [2,33]. Farmers are then left with a prescribed workplan on how to deal with any non-conformities. In contrast, internal systems of control enable subjects, for example farmer groups, to measure and assess sustainability performance, and in some instances identify and address non-conformities [2,17,35]. The manner in which information collected pertains to performance of individual farmers against farm-level indicators, or to performance at an area-level against area-level indicators [28,36], is also identified. Finally, the manner in which this information is organized for the purpose of verification is determined.

## 3. Methods

Data was collected from July to November 2019, with respondents sampled and interviewed in three steps.

First, seven scoping interviews were conducted with aquaculture assurance experts representing international NGOs, digital technology companies, certification standards and auditing bodies, and with independent consultants. These interviews informed the identification of fourteen emerging initiatives that appeared to provide beyond farm assurance (see Table S1 in Supplementary Material for the initial sample of potential beyond farm assurance models).

Second, twenty semi-structured interviews were then conducted with respondents involved with launching or managing these initiatives, and with actors involved with designing their auditing and verification methods. Respondents were found through snowball sampling and were employed with NGOs, digital technology companies, certification standards and auditing bodies. The framework in section two guided the operationalization of the three analytical dimensions into interview questions, used to understand the scale of claims, the audience, how claims were defined and how verification was organized. Secondary data in the form of websites, standards and reports were examined to verify information from interviews. All data was coded and analyzed using ATLAS.ti software, using codes that corresponded with the three analytical dimensions outlined above.

Finally, six initiatives were selected, as relevant cases of beyond farm assurance, and eight were excluded (see Supplementary Material for details about case selection process). Primary criteria for case selection, to demonstrate that initiatives could indeed be classified as assurance models, were that they both defined *and* verified claims. A secondary criterium was that initiatives were already implemented or piloted. Three of the six selected cases were grouped as models of group certification, so from the six selected cases, four assurance models were then inductively identified. These models and their implementation status are described in Table 1.

The design of the four case models was then analyzed using the three analytical dimensions outlined above - audience, definition of claims and verification. The design of these initiatives was studied, not their implementation or effectiveness. This was because the initiatives studied were either still being piloted or recently established, with the exception of GLOBALG.A.P.'s program for certifying farmer groups. Studying their actual implementation and effectiveness would provide additional insights, but this is beyond the scope of this research mainly because of the varied extent to which they are implemented.

## 4. Variation of assurance models

### *4.1. Group certification*

Group certification programs represent prescriptive and externally verified assurance models. (Type A, see Fig. 2). Individual farmers must comply to farm-level certification standards but are certified collectively with other farmers to reduce auditing costs. Like farm-level certification, group certification claims are communicated to buyers through a single certification code and/or eco-label. These programs were established to increase the overall accessibility, compliance and impact of certification

**Table 1**
Status of implementation of four cases of assurance beyond the farm.

| Case | Status of implementation |
|---|---|
| Group certification | GLOBALG.A.P. certified their first farmer group, which produced non-aquaculture commodities, in 2001 [37]. BAP issued their Farm and Hatchery Group Certification program in 2018 [38] and ASC issued their Group Certification program in 2019 [39]. |
| Biosecurity Area Management Standard | The Global Aquaculture Alliance issued the BAP Biosecurity Area Management Standard in 2019. Co-initiators included other third party certification standards and NGOs. After several pilots, the first certification was announced in 2019 for Clew Bay in Ireland [40]. |
| Partnership Assurance Model | A group of experts, including ASIC, IDH, Monterey Bay Aquarium, Resonance, SGS, Seagreen Research, TCS and Thai Union are collaborating to develop the Partnership Assurance Model. The first pilots to test this approach were announced in 2018 and 2019, both located in the Mekong Delta, Vietnam [13]. |
| Verified Sourcing Areas | Verified Sourcing Areas were initiated by IDH. The first pilot was launched in 2018 in Mato Grosso, Brazil, with beef as the lead commodity. There were six VSA pilots at the time of data collection, all applied with non-aquaculture commodities [14]. |

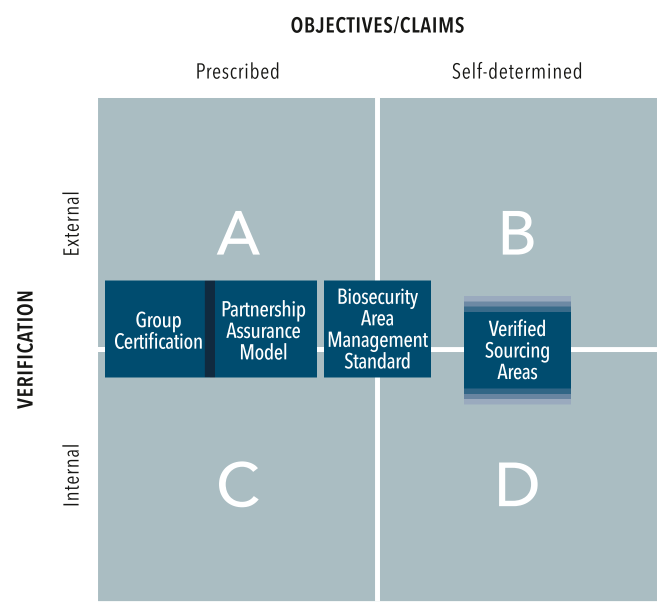


**Fig. 2.** Classification of four case study assurance models based on claim-making and verification. Note: The Verified Sources box is blurred as no verification methods have been developed yet. The Group Certification, PAM and BAMS models involve both internal and external verification, which is why they are positioned on the border between the upper and lower quadrants.

standards. Because of their continued farm-level focus, however, no explicit claims are made pertaining to the management of shared (beyond farm) risks.

Sustainability claims made through group certification are prescribed by the standard owner and these claims are codified through the standard's criteria. In all the group certification models reviewed, standards remain focused on individual farm-level performance [12,39, 41]. All of the group certification models also prescribe an Internal Control System (ICS), or Quality Management System [41], to enable the collective capability of farmers in these groups to demonstrate standard compliance. Farmers have no influence on the standards or claims made.

Membership to certified groups across all three programs is selective. In some cases buyers funding group certification screen individuals on the basis of their capacity to successfully comply [42]. In other cases, membership is based on a farmer's own technical and organizational capabilities to join a group and comply to the individual farm standards. If farmers do not conform to the certification standards and/or refrain from taking the necessary corrective action in the manner prescribed by the audit, they can be removed from the unit of certification [12,39,41]. In all instances groups are made up of spatially non-contiguous members and are located in areas interspersed with non-members.

Accountability of group members is prescribed through three types of written agreements designed to formalize trust through binding commitments, with the 'group' as the unit of certification. First, individual farmers sign a written agreement to conform to the farm-level standards. Second, the 'group' signs a written agreement with the standard owner (ASC, GAA or GLOBALG.A.P.). Third, the 'group' signs a written agreement with the certification body, responsible for conducting the conformity assessments [12,39,41]. The 'group' then has the authority to exercise control, to ensure compliance, and is accountable for the collective performance of its members toward the standard owner.

Verification in the programs reviewed is organized through both internal and external conformity assessment. First, internal verification is conducted through an audit of the ICS and inspection of farms by qualified inspectors officially appointed by the group [12,39,41]. External verification consists of an ICS audit, an on-site assessment of the group management office and farm inspections, all carried out by a third-party certification auditor. For the internal verification process, all members are audited annually. However, for the external verification process, only a sample of farmers is audited. For BAP and GLOBALG.A.P., the square root of all farmers in the group plus one must be inspected, so that 100% of the farms are externally inspected over a period of five years [12,41]. For ASC, the auditor scores groups on the maturity of their ICS, which feeds into the calculation of the audits sample size [39].

All the programs reviewed include guidelines and checklists for operating and auditing the ICS, as well as for imposing sanctions on farmers for non-conformity [12,39,41]. By prescribing these guidelines, the ultimate control over the non-conformity is kept under the external control of the standard holder. This also reinforces a rigid system of control over verification and indicates limited trust in farmers to organize verification themselves.

Verification takes place largely at farm-level, within a sample of farmers that are selected to represent the group. Only for the Biodiversity Environmental Impact Assessment and participatory Social Impact Assessments required for some ASC farm standards [43], and the biodiversity-inclusive Environmental Impact Assessment and Environmental Risk Assessment for GLOBALG.A.P.'s farm standard [44], is data also collected beyond individual farms.

### *4.2. BAP's Biosecurity Area Management Standard*

The BAMS represents a partially self-determined but externally verified assurance model (bridging Types A and B, see Fig. 2). It is a multi-species certification standard that verifies groups of farmers in a defined area collectively managing pathogenic organisms through the implementation of area-wide biosecurity measures [12]. The standard does not focus on management performance of individual farms and, unlike group certification programs, farmer members are not individually certified. BAMS certified groups use their certified status to demonstrate 'good practice' to institutional investors, government agencies and insurance bodies. While at an early stage of uptake, there is no plan to use a label or product-based claim.

Though the overall claim of biosecurity management is prescribed by the standard owner, a group applying for BAMS certification has the freedom to specify its own objectives [12]. The standard requires farmers to conduct an Area Risk Assessment that identifies potential internal and external biosecurity threats and rates their potential impact. Based on this assessment, an Area Plan is written outlining measures for coordinated disease prevention, treatment and mitigation. Because these risks are commonly context-specific, the standard is not highly prescriptive on the content of the assessment and the plan. Instead the standard requires negotiation over collective risk management practices amongst constituent farmers and the definition of specific risk management objectives and corresponding Key Performance Indicators (KPIs).

BAMS certification is dependent on inclusivity. Farmer groups, as the unit of certification, are defined geographically in a 'biosecurity area'. Within the area, the group must invite 'non-committed' aquaculture facilities to participate in the Area Plan and actively engage non-aquaculture parties that are affected by biosecurity issues [12]. Exclusion of any aquaculture facility must be explained and during the application, an associated risk assessment must be provided outlining the consequences of their non-participation [12]. Non-participation of any of these parties is problematic because they may not be part of the unit of certification, but they *are* part of the unit of assessment. It remains unclear how unassociated parties can be held accountable should their actions increase the shared biosecurity risk of farmers in a given area.

The accountability of group members is formalized through non-binding agreements, under the assumption that they have an intrinsic motivation to manage shared biosecurity risks. Evidence of member commitment is given through a signed Memorandum of Understanding (MoU) (or equivalent) [12]. The MoU does not, however, hold individual farmers formally accountable. Instead, by stipulating the conditions of cooperation, BAMS attempts to foster trust between participants. The applicant must provide evidence that the disease management approach adopted is based on (1) a dialogue among all participant farmers, (2) a clear area communication protocol, and (3) a rapid information-sharing system among members in the event of a disease outbreak [12].

While BAMS allows farmers to develop and monitor their own Area Plan, it still requires a mix of internal and external assessment procedures. First, the Area Plan sets performance targets (based on guidance from the BAMS standard) that are internally monitored at least annually [12]. Since disease is context-specific, the program leaves it up to the applicant to define biosecurity targets and indicators. However, the Risk Assessment and the Area Plan are externally monitored by public veterinary services. Second, an external auditor assesses the Area Plan in consultation with the group to determine how shared biosecurity risks are managed before certification is awarded. Third, surveillance audits evaluate ongoing consistency, implementation of improvements and major changes to the Area Plan.

The certified farmer group is free to define how they deal with non-conformity of individual farmers. Measures for disciplining a non-compliant participant have to be outlined in the Area Plan [12]. However, informal peer pressure is likely to be an important mechanism to deal with non-conformity; under the assumption that farmers are intrinsically motivated to organize themselves to manage disease.

Claims are verified through the collection of information about processes of collective disease management and performance at an area-level. The standard's criteria focus on aquatic health status and controls at an area-level, over and above those controls required as part of existing farm-level certification systems [12]. This means that the evidence of competent aquaculture husbandry at the individual farm-level is subordinate to that of the Area Plan.

### *4.3. Partnership Assurance Model*

The PAM represents a prescriptive and internally verified assurance model (Type A in Fig. 2). It brings together local stakeholders to design, implement and verify improvement in aquaculture production in a defined 'region' [13]. Improvement is defined in terms of Monterey Bay Aquarium's non-voluntary and publicly shared Seafood Watch traffic light ratings [7]. These ratings are based on a range of farm-level sustainability metrics which allow for claims about 'ideal' farm-level performance in a given region or jurisdiction.

The PAM enables direct rather than desk-based verification of the Seafood Watch standards. The PAM, as such, does not have a separate claim associated with it, and remains highly prescriptive. It allows Seafood Watch to adapt global sustainability goals to a local context, while at the same time providing greater assurance to buyers and consumers in the United States on their rating of targeted aquaculture species [7].

The PAM membership is defined through partnerships between a sub-set of aquaculture farmers and processors in a given region, designed to mitigate cumulative environmental impacts from aquaculture production. In its first pilot project, the PAM fostered a partnership between Seafood Watch, an auditor, a Vietnamese processor and the Vietnamese government to improve the performance of that processor's shrimp suppliers. In the second pilot project, this partnership was extended to include scientific institutions, NGOs, credit institutions, banks, certification evaluation organizations, and organizations representing the entire supply chain to improve the environmental sustainability of the shrimp aquaculture sector across an entire province [13].

Partners are held accountable through a non-binding MoU, based on the assumption they are intrinsically motivated to work toward their common goal of a yellow or green Seafood Watch rating which gives access to the US market. By signing the MoU, partners give their commitment to achieve shared sustainability improvement goals for the region. For example, to improve all shrimp production in a province to a level of performance equivalent to a yellow "Good Alternative" or green "Best Choice" rating by 2030 in addition to more tailored goals of prohibiting antibiotics use, implementing traceability and/or demonstrating social responsibility [13]. While these commitments are transparently documented, no formal accountability mechanism is in place for non-compliant partners.

National and local governments play a critical role in the development, implementation and enforcement of specific sustainability measures at an area-level, such as water pollution and disease management [7]. Their participation in the PAM is suggested to provide external oversight and legitimacy to projects, but is not a hard requirement. Additionally, the inclusion of NGOs is encouraged to further legitimize the verification process in addition to creating links in consumer markets and support the on the ground implementation [7].

Verification is prescribed through direct assessment by one internal and two external actors. The PAM is testing a digital verification platform to verify compliance of sub-sets of shrimp farms in a region against the Seafood Watch standard. As such, the PAM enables ground-based assessments to verify compliance, introducing a level of compliance to a model previously based on assessments through desk research. The goal of this platform is to reduce costs and increase credibility through three layers of verification; first, by the processing company, second, by a collaborating NGO, and third, by a third-party auditor. To incentivize compliance action by farmers and processors alike, the next layer of verification only commences when all farmers sampled are found to comply. All assessments are uploaded to the digital platform to increase efficiency and transparency and to eventually provide shared, beyond-farm-level information, enhance the accuracy of the improvements and enhance transparency within the value chain, which is likely to increase the confidence of end buyers [7].

By adopting a sampling regime, the PAM verifies the performance of the average farm in a given region. This means that the PAM does not yet enable the identification of cumulative environmental impacts of multiple farms across regions. Initially, every farmer in a group is assessed to determine the variance in groups and the sample needed to capture the non-conformities in an average farm. This will differ for varying production systems, species and regions.

### 4.4. Verified Sourcing Areas

VSAs are a self-determined assurance model (either Type B or D in Fig. 2) that aim to accelerate the uptake of sustainability by bringing together local stakeholders to determine shared goals for an entire 'jurisdiction' (e.g. municipality, district or province). In addition, VSAs connect entire sectors in these jurisdictions to markets and, in contrast with farm-level assurance models, enable end-buyers to source volumes in line with their sustainability commitments [45]. By securing commitments from multiple buyers, landscape-level sustainability can be integrated into sourcing strategies. Farmers are, in response to these commitments, assumed to make pre-competitive decisions around shared risk management with both aquaculture and non-aquaculture related actors.

Sustainability objectives are formulated in VSAs through a public private partnership, referred to as a 'Compact'. These specify sustainability topics and goals as well as the actions and monitoring needed to attain them [46]. IDH has developed a Compact Transparency Tool, that specifies the themes within which these goals must be set. This tool is subsequently used to score progress towards these goals using global references to sustainability [46]. Although minimum requirements for the themes are prescribed in this tool, partners still identify and prioritize the interventions needed to achieve these goals in their given jurisdiction [46].

VSA membership aims to include multiple users across different sectors in a given jurisdiction. The Compact must include local government, private sector actors with strong local presence like farmers and traders, indigenous communities and civil society organizations [46]. VSAs have a single 'lead commodity' which brings together partners within a supply chain. However, given the diversity of products sourced from any given jurisdiction, VSAs also aspire to allow for Compacts to cover multiple commodities.

Distinct from the other assurance models, the role of government is seen as crucial to the effectiveness of VSAs. The participation and oversight of government provides legitimacy to the Compact given that the state, strengthened by the Compact, can enforce local regulations. NGOs are engaged because their recognition and acceptance provides legitimacy to the VSA model as they represent civil society. Currently, there are a number of large NGOs in the VSA Global Steering Committee [7], where there are discussions about how to engage NGOs in the consultation process for the development of VSAs.

The accountability of partners in a VSA is formalized through the Compact in non-binding agreements, under the assumption that partners receive intrinsic benefits by fulfilling their commitments towards the shared goals and are thus motivated to do so. The Compact is used to institutionalize and strengthen local collaboration by providing transparency and building trust. It is also used to stimulate the involvement and contribution of end-buyers, though they are not required to sign the Compact [45]. The commitments these buyers make to support the Compact by sourcing product from a jurisdiction is assumed to create direct incentives for partners to fulfill their commitments.

There is currently no prescribed framework for verification available for VSAs, although it is clear that VSAs will verify the progress of an entire jurisdiction against the goals set out in the Compact [47]. There are ongoing discussions about whether IDH will prescribe a generic verification tool for all VSAs. A generic tool would suggest monitoring methods and indicators for the pre-defined themes in the Compact and perhaps even define different levels of assurance for each issue. However, it is also possible that the verification method will remain unique for each VSA, given the specific nature of initiatives designed to reach the goals set out for each Compact.

## 5. Discussion and conclusion

This comparison reveals an apparent tension around the degree of trust that beyond farm assurance models place in farmers to define and verify shared sustainability claims. Two contrasting observations can be drawn from the analysis, in support of Auld et al. [18], that illustrate this tension. On the one hand, there is a tendency for beyond farm aquaculture assurance models to move toward a greater degree of empowerment through self-determination. They do so by devolving claim-making and verification to collaborations of farmers and other actors in a given area, based on the recognition that prescribed standards do not match specific local conditions of area-level risks. On the other hand, there appears to be a persistent tendency to retain external control over claims and verification. As illustrated in Fig. 3, while new assurance models aspire to empower assurance subjects by allowing increased self-determined claim-making and verification, they continue to be pulled towards prescribed and externally verified forms of assurance.

The identification of this tension between empowerment and control is based on three key challenges synthesized from the assurance models reviewed. First, it remains unclear to what extent assurance audiences will accept the self-determination of claims and verification. The results demonstrate that while attempts are being made to innovate away from Type A assurance models, with prescribed claims and external verification, none of the models reviewed can be classified yet as Type D – i.e. with self-determined claims and verification. The cases that represent the greatest shift away from Type A, the BAMS and VSA models, are both based on a core assumption that when subjects demonstrate intrinsic motivation to cooperatively address risks, both control over sustainability criteria and the organization of internal verification can be devolved. However, even in these two 'extreme' models, such devolution remains only partial. Both continue to maintain a degree of control over how criteria are identified and the methodologies used to verify them, in order to satisfy the degree of assurance considered to be demanded by their target market audiences.

Second, the more actors involved in area-level assurance, the more difficult it becomes to create effective accountability and therefore trust between them. For example, the BAMS, PAM and VSA models all rely on non-binding agreements between subjects to work towards the management of shared sustainability risks and abide by the conditions of either internal or external verification. However, as seen in other governance contexts [48], it remains unclear who among the different actors can be held accountable for performance of the area as a whole.

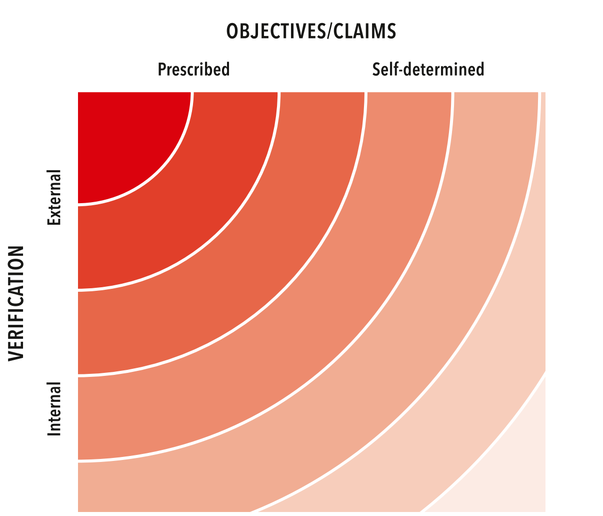


**Fig. 3.** A spectrum of assurance models that define and verify claims about aquaculture performance beyond the farm.

The cases present contrasting approaches to address accountability issues, which have varied implications for moving toward a Type D assurance model. If we assume that transparency leads to greater accountability, recognizing that many scholars remain skeptical about the ability of transparency to foster accountability and therefore improved performance [48–50], the promotion of informational transparency in the case of BAMS aligns with principles behind a Type D approach. In contrast, increased surveillance by external state and NGO actors in the case of the PAM and VSAs, constrains these models to move further towards a fully devolved Type D assurance model.

Third, despite attempting to move beyond the farm, the more prescriptive an assurance model is, the greater the tendency to focus on farm-level verification. This challenge was especially observed in the group certification programs and the PAM model, given they both verify claims at farm-level. While also being focused on the structure of farmers and partners, and scaling up their respective impact of certification standards and ratings, they both place emphasis on prescriptive, farm-level and performance-based criteria. The effect of this is again a constraint on moving away from a Type A assurance model. The effect, in contrast to other assurance types enabling greater self-determined and group-based assurance (as seen in both the VSA and BAMS models), is that they risk being less responsive to the variation within areas and among farms [36], and may fail to stimulate collaborative management of shared risks.

The overall tendency to favor control over empowerment holds consequences for the design of beyond farm assurance models aimed at scaling up sustainability improvements through collaboration between often disparate actors. While new assurance models aspire to empower assurance subjects by allowing increased self-determined claim-making and/or self-verification, they continue to be pulled towards prescribed and externally verified forms of assurance (Fig. 3). In doing so they risk reinforcing rather than overcoming assumptions of distrust and weak tolerance of uncertainty that underlie sustainability assurance in the global agro-food system [2,18,51]. This distrust, and the desire for control that it fosters, risks reifying the same limitations faced by farm-level assurance – including high levels of surveillance, requiring high reporting capabilities and high associated costs. The ultimate consequence is that the ability of new assurance models to fulfil their ambitions to enroll a larger number of farmers in order to manage shared aquaculture risks [29,52–54] and scale up sustainability improvements beyond the farm scale, may be undermined.

As the initiatives studied here are in an early stage of implementation, a future review of their experiences can generate valuable lessons for addressing these three challenges. Next to exploring the creation of trust and the development of effective accountability and assurance mechanisms, such a future study could also analyze the environmental impact of the different models [9,10], to better understand the dynamics between scaling up assurance and addressing area-level production risks such as disease.

There appears to be a trade-off between the continued use of prescriptive assurance models stemming from distrust and attaining large-scale improvement. Thus, to scale up sustainability, new approaches are needed that can transcend currently dominant models of assurance in the agro-food sector. Moving forward, further research is needed to better understand the trade-offs and implications associated with opening up claims and verification involving stakeholders. Furthermore, a deeper understanding of what the audiences of assurance models really demand and the conditions they require in order to trust, is imperative to develop alternative approaches that facilitate new ways of trusting within a globalized market. Ultimately, attention should also be given to the degree to which beyond farm assurance models can enable cumulative social and environmental impacts.

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## CRediT authorship contribution statement

**Mariska Bottema:** Conceptualization, Data collection and Analysis, Writing - original draft & final editing. **Simon Bush:** Conceptualization, Writing - review & editing. **Peter Oosterveer:** Conceptualization, Writing - review & editing.

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*Declarations of interest*

None.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2021.104658.

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