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The Health of the Governance System for Australia's Great Barrier Reef 2050 Plan: A First Benchmark

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Abstract

The Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan) was crafted to protect, manage and enhance the resilience of Australia's Great Barrier Reef (GBR). It explicitly recognises that strengthening governance is key to achieving its targeted outcomes. To date, however, the lack of evaluation of the impact of GBR governance (including many complex policies, programmes and plans) under the Reef 2050 Plan has hindered its adaption. This paper presents a first benchmark of the health of the governance system associated with the Reef 2050 Plan. A novel analytical framework was built to do this. It was populated through the gathering of multiple lines of evidence, including global theory and evaluation practice and case studies and primary data from interviews and workshops with Traditional Owners, experts across government, industry, non-government organisations and other governance systems experts. Our assessment has found the health of governance system to be emergent to maturing, yet strong by global standards. Strengths include robust global engagement, the integrative nature of the Reef 2050 Plan, crisis response systems and GBR Marine Park management. Weaknesses include the increased need for (i) power sharing with Traditional Owners; (ii) rebuilding governmental trust with the farming and fishing sectors; (iii) more contemporary spatial planning for GBR and catchment resilience; and (iv) greater subsidiarity to deliver government programmes. In conclusions, we strongly recommend that regular benchmarking and informed refinement of Reef 2050 Plan governance arrangements would mature the system toward better outcomes.

Keywords: Great Barrier Reef; governance; governance system; Reef 2050 Plan; framework; health; management; monitoring; knowledge

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1. Introduction

Known globally as one of the planet's most treasured ecosystems, the Great Barrier Reef (GBR) contributes to the wellbeing of local, regional, state, national and international communities and plays a vital role in the lives of its Traditional Owners and adjacent coastal communities. The current trajectory of coral reefs across the globe, including the GBR, is one of intensifying loss. This is both an ecological and human rights issue and requires deep and systemic consideration of reef governance [1]. Outcomes for ecological, social and economic health in any environmental context are mediated by human actions, and most

of these occur within wider governance systems that drive individual and collective efforts and actions [2]. Such spatially based 'governance systems' comprise a wide range of both collective, institutional and individual arrangements that set the arena or context for who makes decisions and how decisions are made and applied [3]. Achieving desired ecological and social outcomes in complex 'governance ecosystems' [4] requires coordinated action across multiple layers of intersecting institutions, policies, plans and cultures [5,6] and collective action by institutional and non-institutional actors in intersecting spheres of policy and normative action [7].

For example, government and non-government organisations (NGOs), community members, Traditional Owners, industries and others with an interest in reefs across the globe, and they are increasingly concerned about the impact of climate change on reef health, and many agree that reducing these impacts will benefit social, cultural, economic and ecological outcomes [8]. In Australia's GBR and elsewhere, ways to reduce the impacts of climate change largely require a shift away from fossil fuels and increased energy efficiency, facilitated through government subsidies, tax incentives and research and development programs [9]. Such transitions are slow, however, and require major shifts in policy and decision-making processes to ensure just and equitable outcomes for all concerned. Without flexible, timely and coordinated governance arrangements in place, efforts to reduce climate change impacts on places like the GBR may be lost.

The health (or functionality) of any complex governance system is determined by the combined decision-making and implementation-delivery-related activities of different institutions and actors and is reflective of the power relations among these actors [10]. This includes state and polity entities, with roles and accountabilities for lawmaking, public policy and delivery. It also includes non-institutional actors such as political parties, corporations, business organisations, public interest groups, non-governmental organisations (NGOs), the mass media and individual citizens. All such actors apply diverse resources and strategies to influence public-policy outcomes [10–12].

As a global example, a recent study of the governance of 217 marine protected areas (MPAs) around the world used details of previously published International Union for Conservation of Nature (IUCN) governance classifications to compare the effectiveness of various governance arrangements. Their results indicated that MPAs with stable, shared and decentralised governance arrangements involving active participation by multiple government and non-government actors are 98% more likely to have higher fish biomass than MPAs governed more simply by government agencies alone [13]. In such instances, a governance system can be considered healthy when it provides the foundations, across different scales, for achieving shared societal goals, mediated across desired environmental, cultural, social and economic outcomes, that are associated with a specific spatial context.

Frameworks for analysing 'healthy or good governance systems' have emerged to measure whether public decision making and resources are achieving societal goals [14]. Measuring the 'good' of a governance system can identify areas for improvement against core evaluative principles such as transparency, accountability, equity and effectiveness [15]. The International Union for Conservation of Nature (IUCN) mentioned above, for example, applies principles of legitimacy and voice, subsidiarity, fairness and transparency in protected areas across four typologies of governance (e.g., government, shared, private, Indigenous Peoples and local communities) [16]. The United Nations Development Programme [17], World Bank and Council of Europe [18–20] have applied similar governance principles [13].

These global evaluative frameworks, however, often struggle to support improvements in highly adaptive governance in systems characterised by overlapping institutions, conflicting regulations and limited coherence across scales [21]. Typically top-down eval-

uative frameworks make it difficult to embed the principles of inclusive participation and responsiveness when adaptive governance demands greater recognition of the importance of power differentials within complex systems [22,23]. A lack of consensus on how to define and assess 'good governance' at the global level further constrains their practical application in guiding collective action toward locally tailored and planned outcomes [24]. Overcoming these limitations requires more systemic, context-sensitive and adaptive approaches to governance analysis [25].

To achieve better, more integrated societal outcomes from complex governance systems, more adaptive approaches to governance analysis need to be able to focus on positively guiding collective action for system improvement. Such approaches encompass dynamic processes that can enable institutional flexibility, learning and transformation. This is the case as key elements of adaptive governance systems include improved power sharing at all levels—from local to national and among all actors—and multilevel collaboration. Such effort is needed to enhance community resilience and reduce capacity gaps [26,27]. To support adaptive governance in and for complex spatially based governance systems, new frameworks are needed that can combine the application of theoretically informed evaluative criteria about good governance with more deliberative approaches to determining system strengths, weaknesses and opportunities for systemic improvement.

A healthy governance system must be coherent to ensure that wider societal priorities are well aligned across multiple institutional arrangements, enabling many diverse actors to cooperate toward common goals [28,29]. Systems must contain sufficient capacity, at institutional and actor levels, to address defined problems effectively and to avoid failure in the execution of decisions [4,30]. To avoid effort duplication and maximise efficiency, policies and delivery arrangements across these institutional arrangements must be well connected, integrated and coordinated [4,31]. Finally, diverse forms of knowledge (Indigenous, scientific, local expertise and policy knowledge) must be well-infused within policy development, planning and the shaping of delivery action [32–34].

Australia's GBR is a prominent global example of a complex governance system that operates within a defined spatial context. The governance system associated with the GBR aims to uplift targeted ecological, social and economic outcomes, particularly protecting and enhancing its globally important Outstanding Universal Value (OUV). Like other complex governance contexts, the GBR is impacted by intersecting and often overlapping policies, processes, agreements, entities and other mechanisms that influence decision making and action at multiple scales. Polycentric relationships and arrangements between various levels of government, community and industry effort are typical [4]. Nested decision-making systems influence the behaviour and outcomes of diverse institutions and actors [35]. Consequently, the environmental and social outcomes for the GBR are diverse, contributing to the achievement of globally important outcomes (such as World Heritage protection), as well as outcomes that are deeply significant to local users of the GBR [29]. The Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan) sets up a holistic, integrated and evolving framework for guiding actions on the GBR [36] and a healthy governance system is critical for achieving these outcomes.

As a consequence, the purpose of our research is to develop and implement a systematic, replicable approach that can be used to provide on-going longitudinal data to identify and to act upon analysis of the strengths, weaknesses and priorities for improvement in the GBR governance system. Our initial research question was: *how might we better understand, monitor and improve the health of the GBR governance system*?

In a global first, this paper presents a detailed benchmark assessment of the overall governance system associated with the development, delivery and review of the Reef 2050 Plan. We first outline the mixed methods approach used to develop an evaluation

framework. This is then applied in a detailed analysis of the contemporary nature of the Reef 2050 Plan governance system. We then present the results, as well as a summative outcome of the assessment and end by discussing implications of these findings for the adaptive governance of the GBR.

2. Methods

This benchmark assessment combined multiple lines of evidence (including qualitative and quantitative evidence) in a collaborative and deliberative action research methodology developed to build consensus with GBR actors on a fit-for-purpose evaluation framework. This was then collectively applied to benchmark governance health. While this deep methodological approach is described in significant detail by Vella et al. [37] (published in this special issue), to give context to the results in this paper, the following brief description summarises the multiple methods employed in two major phases of research action.

First, a fit-for purpose framework to monitor and evaluate governance system health was developed between 2022 and 2023 through:

- Literature review of governance theory to identify concepts, principles and frameworks for evaluating governance systems health;
- Twenty-one interviews conducted with actors from the Great Barrier Reef Marine Park Authority (the Reef Authority), the Australian and State governments, GBR industries and communities and scientific experts. A further seven interviews were undertaken with members of the Traditional Owner Steering Group for the Reef 2050 Traditional Owner Implementation Plan. These interviews were conducted online (using Zoom) and in person, transcribed and coded into themes;
- Two in-person workshops in different Queensland locations with sixteen diverse GBR actors and Traditional Owners to provide deeper perspectives on governance health and to generate feedback on an emerging evaluation framework. A third online workshop was held to accommodate participants who could not attend in person. A further six deeper conversations were held with members of the Traditional Owner Steering Group for the Reef 2050 Traditional Owner Implementation Plan to assist with framework development.
- The complex Reef 2050 Plan governance system was mapped using igraph and visNetwork software within the programme 'R', to define the scope of the policy and planning arrangements auspiced by the Reef 2050 Plan and identify connections between GBR actors and instruments (e.g., funding programmes, legislative actions and formal partnerships); and
- The research team developed and applied a clear a theory of change, drawing on Funnell and Rogers [38], Reinholz and Andrews [39] and Thornton, et al. [40]. This was used in concert with multiple lines of evidence to establish causal links and sequences of action impacting on governance outcomes in the Reef 2050 Plan system.

Rich insights into the knowledge needs of rights holders and governance system actors resulted in a novel framework of 20 attributes across four clusters for evaluating the Reef 2050 Plan system (Table 1), and a rating scheme framed by appreciative inquiry, an approach that facilitated an analytical focus on the strengths rather than deficits of the governance system [41] (Table 2).

Table 1. Overview of the 20 identified attributes of governance system health applied to an assessment of the governance system underpinning the Reef 2050 Plan.

Coherence	Connectivity and Capacity	Knowledge	Operational Governance
Shared vision	Process transparency and trust among actors	Knowledge quality, availability and access	Efforts deliver effective and efficient outcomes
Integrated legal framework	Actor capacities and skills	Informed consent about knowledge use	Sustainability of actions taken
Integrated legal framework	Equity in collaboration and genuine partnerships	Diversity of knowledge	Application of risk management
Cohesive implementation	Open and diverse communication flows	Knowledge integration and decision support	Timeliness of effort
Monitoring, evaluation, reporting and improvement (MERI) systems	System subsidiarity	Knowledge storage and management systems	Adequacy of resources

Table 2. The rating scale applied to assessment of all governance system attributes.

Rating Scale	Definition
Healthy	The attribute is functioning effectively and consistently across the Reef 2050 Plan governance system, with strong coordination, implementation and continuous improvement evident at all levels.
Maturing	The attribute is generally working well within the Reef 2050 Plan governance system, though some areas show room for enhancement in consistency, integration or effectiveness.
Emergent	The attribute is only partially functional across the Reef 2050 Plan governance system, with limited application, coordination gaps or inconsistent implementation undermining overall performance.
Underdeveloped	The attribute is largely absent or ineffective within the Reef 2050 Plan governance system, with significant deficiencies in structure, coordination or practical application.

In the second main phase, multiple lines of evidence gathered across 2023–2024 were combined into a benchmark assessment of governance system health. Methods included the following:

- A thematic analysis of academic and grey literature (reports, evaluations) that provided perspectives and data points on aspects of attribute health;
- In depth qualitative analysis of case materials leading to a detailed governance case study for of each attribute;
- Key actor interviews (n = 20) in which participants used a Likert scale (based on Table 2) to rate each attribute and provided narratives to support their scores; and

- A series of three workshops with GBR governance experts in multiple Queensland locations to consider and respond to a consolidated evaluation (interviews + case studies + literature) and discuss findings of the benchmark. Separate conversations were held with members of the Traditional Owner Steering Group for the Reef 2050 Traditional Owner Implementation Plan

The entire process was guided and supported by an independently chaired Steering Committee and a Technical Working Group

3. Results

We begin with a brief overview of the Reef 2050 Plan context and its adaptive governance needs. This is followed by the summative results of the first benchmark assessment.

3.1. The Reef 2050 Plan and Adaptive Governance Needs

GBR planning and 'institutional layering' through regulatory and policy arrangements has occurred since the 1970s on land, water and coastal areas of the GBR by the Australian and Queensland Governments [4,42]. Over time, this has led to complex, multi-scalar and interacting networks of actors (state and non-state), institutions and instruments across multiple 'domains' and 'subdomains' of governance in what is best characterised as a 'polycentric' or 'nested' (non-hierarchical) governance system [4,29,43]. Consequently communities, Traditional Owners, non-government organisations, research institutions, industry (tourism, mining, fishing and agriculture), the Australian and Queensland Governments, the Reef Authority, councils and local governments and regional bodies, who are all important actors in the GBR governance space. Collectively, they all work together to develop and implement instruments (policies, plans and programmes, as well as regulatory and compliance tools) to address activities that impact on GBR health.

In 2012, concerns about the protection of the OUV led to a joint monitoring mission by the World Heritage Commission (WHC) and International Union for Conservation of Nature (IUCN) [44]. This sparked the Australian government to undertake a strategic assessment of management in the GBR World Heritage Area, and the Queensland government to progress a strategic assessment of the management of the GBR coast and its multiple catchments. Though disconnected, the assessments, together with the 2014 Reef Outlook Report, culminated in the development and financing of a joint Reef 2050 Long-Term Sustainability Plan by both governments in 2015 [36,45]. This Plan provided the first overarching framework to guide actions for the GBR across the catchment and marine environment [36]. It was supported by the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP), which was established in 2014 to tracks progress toward achieving the Plan's goals and objectives and support the adaptive management of the Plan [46,47]. It informed the five-yearly 'Outlook' Reports of the state, health and trend in GBR health and management [48].

In 2021, the second version of the Reef 2050 Plan newly included a key governance-oriented objective, namely that 'governance systems are inclusive, coherent and adaptive' [36]. However, at this time, there was no explicit monitoring system in RIMReP's monitoring programme to assess the health of governance underpinning the development, delivery and review of the Reef 2050 Plan [49].

To inform ongoing adaptive governance of the Reef 2050 Plan in the longer term, a benchmarking and monitoring system suitable for inclusion in RIMReP and Outlook Reporting was needed. The literature review, interviews and mapping identified four key dimensions for monitoring and measuring governance, namely, the strategic focus and flow of the governance system surrounding the Reef 2050 Plan (**coherence**); the extent to which the system is equitable, inclusive and fosters the development and maintenance

of partnerships within and across sectors (**connectivity and capacity**); considerations of how the system manages knowledge from its creation and retention, through to its sharing via appropriate channels to its translation to drive innovation and change (**knowledge**); and the governance system's accountability, effectiveness, sustainability and efficiency (**operational governance**). This formed the basis of the evaluation framework of twenty attributes across the following four clusters: (i) coherence; (ii) connectivity and capacity; (iii) knowledge; and (iv) operational governance.

3.2. A First Benchmark of GBR Governance Health

Overall, the assessment (combining four descriptive clusters of governance system attributes) found that the health of the Reef 2050 governance system could be classed as *emergent* to *maturing*. Back down at the cluster level, however, the health of the **coherence cluster** was found to be *maturing*, reflecting improvements in shared vision making, the development of more integrated legal frameworks, and adaptive monitoring evaluation and reporting under the Reef 2050 Plan. This suggested that governance system health related to this cluster would be further strengthened by improving strategic partnerships underpinning the development of programmes between government and key actors (e.g., regional NRM bodies and catchment organisations, local governments, industry and Traditional Owners).

The health of the **connectivity and capacity cluster** was also found to be *emergent to maturing*, reflecting growing actor capacities and skills, open and diverse communication which together support plan implementation. This cluster would be strengthened by a stronger approach to building subsidiarity within the system, as well as processes to further build transparency, trust, equity and genuine partnerships with key actors.

The health of the **knowledge cluster** was also found to be *emergent to maturing*, reflecting recent improvements in the development of knowledge quality, availability and access, informed consent, knowledge diversity, integration and decision support. This also reflects the improved development of knowledge storage and management systems in recent years. In relation to this cluster, it was considered that the incorporation of more diverse biocultural and human dimensions knowledge sets in decision making would also further mature the health of this cluster. In this context, biocultural knowledge refers to the type of knowledge that sheds light on the interconnectedness among people, their language and cultures, as well as their relationship with the environment [50].

Finally, the health of the **operational governance** cluster was found to be only *emergent to maturing*. In this respect, although the overall governance system is nicely positioned to respond quickly and more effectively to short-term problems, our assessment has found that it not well positioned to address emerging and more urgent problems such as those associated with climate change and, to a lesser extent, water quality. Our study suggested the importance of processes aimed at strengthening operational governance structures within the system to support more effective, timely and, perhaps, more sustainable responses to changing environmental conditions in impacting the GBR.

Table 3 summarises the more detailed assessment for each of the 20 attributes in each of the four clusters with some examples to illustrate the findings.

Table 3. Attribute-level findings from the first Reef 2050 Plan governance system benchmark.

Coherence: Is the Governance System Cohesive Across Vision and Goal Setting, Strategy Development, Implementation and Monitoring and Review?			
Attribute	Assessment	Case Study	Some Examples of Key Findings
Shared vision: All actors involved in development and implementation of the Reef 2050 Plan share complementary visions for the GBR.	Maturing	The Reef 2050 Traditional Owner Implementation Plan [51]	More efforts are needed to strengthen partnerships between governments and key industries, Traditional Owners and others to enable collective vision setting, especially at smaller scales within the whole of GBR scale.
Integrated legal framework: From the global to the state scale, there is an impactful set of legislative and policy instruments integrated across key issues affecting the GBR and across global, national, state and local scales.	Maturing	The GBRMP Act and the Reef Authority [52]	GBR-related legislative frameworks need to be updated and better integrated to reflect the current magnitude of stressors on GBR health, including links between policies developed under the GBRMP Act (1975), the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) and those pertaining to emissions reduction. Greater legislative linkage is needed across multiple legislative instruments that contribute to the Reef 2050 Plan.
Aligned multi-scale and prioritised strategies: Reef 2050 Plan strategies and associated delivery arrangements are diverse and well targeted enough to achieve the plan's goals.	Emergent/ maturing	The Reef Credit Scheme [53]	Transparent and rigorous processes are needed to prioritise investment in strategies and actions implemented under the Reef 2050 Plan to reduce siloed decision making and fragmentation of multi-scalar efforts.
Cohesive implementation: Strategies are effectively coordinated, delivered and maintained on the ground.	Emergent	Project 25 [54]	This assessment detected a general decline in the consistency and coordination of wide-scale implementation efforts, despite evidence of some programmes showing consistent long-term benefits for GBR health.
Monitoring, Evaluation, Reporting & Improvement (MERI) systems: Active monitoring, evaluation and review of Reef 2050 Plan efforts across scales, resulting in continuous improvement.	Maturing	Reef Water Quality Report Cards [55]	There is strong commitment to multi-scale MERI frameworks across the system, although some GBR-project-delivery partners have concerns about their complexity. RIMReP, designed to coordinate all monitoring and evaluation efforts underpinning progress toward Reef 2050 Plan, represents sound practice, but there are major timeline delays.
Connectivity and Capacity: Are Governance System Components Deeply Connected Both Vertically and Horizontally, with Equitable Capacity Present Across All Actors?			
Attribute	Assessment	Case Study	Some Examples of Key Findings
Process transparency and trust among actors: Across scales, decision making processes are transparent and accountable, and there are high levels of trust between the actors involved.	Emergent/ maturing	Cane Changer [56]	There are reasonable levels of public trust in key agencies involved in GBR governance, although some industries and local governments within the GBR catchment have lower levels of trust in Commonwealth and state-government management agencies. There has, however, been some recent progress in relation to enhanced transparency and trust between Traditional Owners and lead GBR agencies.

Table 3. *Cont.*

Connectivity and Capacity: Are Governance System Components Deeply Connected Both Vertically and Horizontally, with Equitable Capacity Present Across All Actors?			
Attribute	Assessment	Case Study	Some Examples of Key Findings
Actor capacities and skills: All key actors in the GBR have the capacities and skills needed to fulfil their responsibilities and they are actively supported.	Maturing	Regional NRM: The Australian Business Excellence Framework for NRM [57]	Core capacities of government agencies appear to be reasonable, but there are poor capacities for building long-term relationships for subsidiarity, especially in community, industry and Traditional Owner sectors.
Equity in collaboration and genuine partnerships: There is demonstrable power sharing across all GBR actors leading to genuine partnership effort.	Emergent/ maturing	Girringun TUMRA [58,59]	Although there are strengthening collaborations between the Commonwealth, the State and the Reef Authority and stronger partnerships with GBR Traditional Owners, more genuine partnerships are needed with industry, local government and regional NRM bodies.
Open and diverse communication flows: Policies, plans, information and progress is freely shared across all actors and the broader community.	Maturing	GBR Representative Areas Program [60]	There is a need to improve two-way communication between GBR management agencies, key actors and wider society. Large-scale surveys such as SELTMP, social research, rich conversations and independent moderators can facilitate knowledge exchange and deepen understanding between people and institutions.
System subsidiarity: The power to make the right decisions rests with those actors closest to the policy, planning or delivery problem being addressed.	Underdeveloped/emergent	Burdekin Major Integrated Project [61]	Subsidiarity is poorly recognised, understood and conceptualised within the Reef 2050 Plan governance system. Targeted investment in the capacity of regional and localised groups is needed to increase the chances of success for major policies and programmes emerging from the Reef 2050 Plan.
Knowledge: Are Diverse Forms of Knowledge, Data, Research, Development and Innovation Appropriately Considered in Decision Making?			
Attribute	Assessment	Case Study	Some Examples of Key Findings
Knowledge quality, availability and access: The knowledge needed in decision making at all scales has high integrity, is readily available and can be accessed.	Maturing	Social and Economic Long-Term Monitoring Program (SELTMP) for the GBR [62]	GBR agencies have access to a wide variety of data through sophisticated systems for knowledge generation and real-time information sharing. This enables rapid management responses. However, significant gaps remain in understanding cumulative impacts on GBR health.
Informed consent about knowledge use: Free, prior informed consent is well negotiated when collecting and using knowledge and data from human sources.	Emergent/ maturing	Establishment of Free Prior and Informed Consent (FPIC) [63]	The increasing use of Free Prior Informed Consent (FPIC) agreements is empowering Traditional Owners with right of veto on sea country, significantly changing GBR long-term management arrangements. Many farmers in the catchment, however, remain concerned about GBR managers' increased use of high-tech tools for data that may be collected without informed consent.

Table 3. *Cont.*

Knowledge: Are Diverse Forms of Knowledge, Data, Research, Development and Innovation Appropriately Considered in Decision Making?			
Attribute	Assessment	Case Study	Some Examples of Key Findings
Diversity of knowledge: Decision making in the governance system uses a diverse range of social, cultural, economic, biophysical, traditional, historical and industry knowledge.	Emergent/ maturing	Reef Restoration and Adaptation Program (RRAP) Collaborative Monitoring Project [64]	Biophysical knowledge about the GBR is ever-expanding and is used effectively to inform management. Even so, more effort is needed to include knowledge and perspectives of farmers, Traditional Owners, fishers and citizen scientists into GBR decision making.
Knowledge integration and decision support: Data and knowledge are well integrated in effective modelling and decision support systems.	Emergent/ maturing	Reef Integrated Monitoring and Reporting Program (RIMReP)'s Human Dimensions Monitoring [65]	Varying degrees of knowledge integration for collective decision making occurs across the GBR for a variety of purposes, but knowledge gaps remain. These gaps hamper decision making and limit negotiations with GBR actors about options for the future.
Knowledge storage and management systems: There are strong knowledge management and sharing platforms in place, enabling effective decision making.	Emergent/ maturing	Summer Snapshot for the GBR [66]	Sophisticated knowledge storage and management systems are in place within GBR agencies. However a lack of trust and few inter-linked knowledge management systems have created institutional silos, which prevent access within and among management organisations.
Operational Governance: Operationally, Is the Governance System Adaptive and Robust Enough to Achieve Its Intended Vision?			
Attribute	Some Key Examples of Findings	Case Study	Assessment
Efforts deliver effective and efficient outcomes: The Reef 2050 Plan governance system delivers the right (effective) interventions well (efficiently), delivering intended Plan outcomes.	Underdeveloped/emergent	Cost-Effective Measures to Improve Water Quality in GBR Catchments [67]	Some programmes within the Reef 2050 Plan can demonstrate progress toward targets, such as the Crown-of-Thorns Starfish (COTS) control initiative. For other initiatives (e.g., water quality improvement) it has been much harder to demonstrate effective and efficient outcomes.
Sustainability of actions taken: Reef 2050 Plan actions can be continued adaptively until they achieve their goals and targets.	Underdeveloped/emergent	Evolution of NRM arrangements and plans in Queensland [68]	Effective GBR governance requires long-term, coordinated and sustained efforts based on trade-offs and priorities; however, in the Reef 2050 Plan governance system, many strategic actions have not been consistently maintained and sustained in the longer-term.
Application of risk management: Risks are adequately considered and managed across scales within the design and implementation of GBR interventions.	Emergent/ maturing	Framework for Governance Systems Analysis (GSA) [69]	Within the Reef 2050 Plan governance system, several specific applications of risk analysis exist, including risk assessment, response and monitoring. Consideration of the social, ecological, cultural and economic dimensions of risk is evident in some areas, however in general, the social and cultural dimensions do not appear to be routinely included.

Table 3. *Cont.*

Operational Governance: Operationally, Is the Governance System Adaptive and Robust Enough to Achieve Its Intended Vision?			
Attribute	Some Key Examples of Findings	Case Study	Assessment
Timeliness of effort: Interventions across the Reef 2050 Plan are timed to maximise successful goal achievement.	Emergent/ maturing	Response to Extreme Weather: The Wet Season 2010–2011 [70]	Flexible management arrangements and new technologies that generate near real-time data enable rapid responses to disasters such as cyclones, COTS outbreaks, flooding and bleaching. However, these responses must be bolstered by increased system subsidiarity involving local actors together with urgent global efforts to address the impacts of climate change on GBR health.
Adequacy of resources: Sufficient resources are allocated to enable the success of all Reef 2050 Plan interventions.	Underdeveloped/emergent	The regional NRM sector in the GBR [71]	There has been significant growth in investment in GBR programmes over the past twenty years, resulting in some progress toward securing more equitable and enduring funding. There are, however, serious funding short-falls to deliver on the Reef 2050 Plan outcomes.

Overall, the findings reveal that the governance system health of the Reef 2050 Plan is undergoing a transition toward maturation. Given our extensive review of other reef governance systems across the globe, we consider that the GBR is, indeed, well governed by global standards. While significant strategic actions and associated delivery infrastructures and are currently in place, the health of the overall governance system is, however, weakened by consistently identified issues of fragmented implementation, weak programme integration, limited local capacity building, resource and knowledge gaps and a resistance to application of subsidiarity principles. We now discuss these more synthesised findings and suggest a pathway forward for the use and replication of the monitoring framework that has been developed.

4. Discussion

Through our research, we co-designed and implemented a novel method to identify and act upon strengths and weaknesses in the governance system underpinning the Reef 2050 Plan. Using mixed methods including a comprehensive literature review, interviews, group discussions and the creation of governance maps, we engaged GBR actors in deliberation about the development and application of an assessment framework that could be utilised over time to provide reliable, consistent measures of governance system health. Our inclusive approach, involving the same individuals in the process throughout the life of the project, provided a robust, replicable method that is readily transferrable to other governance systems. There were, however, some limitations. For example, there was some initial confusion about the definition of 'governance' among participants, despite long-term involvement in the management of marine park activities. This, in turn, led to some difficulties for some individuals in conceptualising and visualising relationships and networks within the Reef 2050 Plan governance system. The specific issue was resolved through deliberation about the concept of 'governance' and resulted in the collective agreement to adopt a broader definition of governance than many were familiar with, e.g., to include relationships and networks along with policies, procedures, agreements and other formal arrangements. Other potential obstacles and limitations, apart from the limited resources

available to undertake this analysis, included how to accurately represent measures of governance system health were mediated through the project's Steering Committee and Technical Working Group.

As mentioned above, overall, the findings reveal that the governance system health of the Reef 2050 Plan is undergoing a transition toward maturation. While significant strategic actions and associated delivery infrastructures are currently in place, the health of the overall governance system is weakened by consistently identified issues of fragmented implementation, weak programme integration, limited local capacity building, resource and knowledge gaps and a resistance to application of subsidiarity principles. We now discuss these more synthesised findings and suggest a pathway forward for the use and replication of the governance monitoring framework that has been developed.

Broad strengths characterising the Reef 2050 Plan governance system suggest that efforts to build a governance framework are, so far, generating positive outcomes for the GBR. Overall, we found that healthy aspects of the system worth continuing to strengthen include the following:

1. **Global Leadership in Emissions Reduction and Climate Adaptation**. A significant area of new national policy strength of importance to the Reef 2050 Plan governance system is demonstrated through Australia now playing an increasingly strong global leadership role in emissions reduction and climate adaptation. This is a feature of both state and federal policy efforts nationally in relation to making progress toward a greater decarbonisation of the economy. If Australia was not playing a significant role in climate change mitigation and adaptation on a global scale, then the GBR governance system could have increasingly become viewed as not being robust in the global context. A growing national policy focus on emissions reduction signals positive change. The GBR's status as a World Heritage property of Outstanding Universal Value also galvanises the national appetite for the development of strong alliances between the tourism industry, public sector and national and international organisations that lead to the development of climate stewardship programmes, all built on shared values of protecting the GBR [72–74];
2. **The Emerging Reef 2050 Planning Process**. Supported by both Commonwealth and state governments, the Reef 2050 Planning system itself provides the overarching mechanism for the articulation of a collective vision for the GBR; an integrated legal framework; and aligned, multi-scale and prioritised strategies that are evaluated and reviewed periodically. Thus, the Reef 2050 Planning process should be maintained and enhanced into the future;
3. **Crisis Monitoring and Response Systems**. There is evidence for the stronger emergence of more adaptive and real-time monitoring and response systems for specific forms of crisis and disaster response, including bleaching events, and the application of strong risk-oriented approaches in a wide range of GBR-related activities. Adaptive approaches are developing across the GBR through the emerging Reef Restoration and Adaptation Program (RRAP), which globally leads the development of new coral-reef restoration and adaptation solutions [75,76]. As adaptive governance approaches are crucial to respond to emerging climate crises, the establishment of the RRAP represents an innovative and holistic focus of GBR management toward long-term outcomes [77,78];
4. **A Durable Focus on Fisheries, Marine Park Management and Compliance**. Queensland has an established fisheries planning and management system. Similarly, GBR management agencies have a sound track record of innovation and success in GBR management. Nevertheless, ongoing effort is still needed to make sure that strong

industry-based and co-managed approaches enhance these arrangements to enable continuous improvement;

5. **Progress on Integrated Monitoring and Reporting**. Until the Reef 2050 Plan was established and implemented, there was no integrated approach to monitoring the social, cultural, economic and ecological dimensions of the GBR system, although some programmes, such as the Long-Term Monitoring Program, have been well established for decades. While development of the RIMReP framework has been slow, progress in this direction is progressing and is much needed to ensure the health of the Reef 2050 Plan governance system. As argued by Dale et al. [79], while the development of GBR-wide monitoring frameworks is progressing, less effort has been made at the regional levels, weakening the ability of regions to influence GBR-wide policy making [80]. In alignment with the literature highlighting improved GBR management through zoning and land-use regulations, our findings also identified significant progress in the governance and management of the marine park itself [81–83].

Overall, our findings align with broader discussions in the governance literature focused on stakeholder trust, participatory governance and adaptive management for sustainable environmental outcomes. The contemporary strengths of the GBR system highlight successful adoption of adaptive governance principles, especially in relation to crisis response and monitoring and reporting systems. Continuous improvement approaches within the Reef 2050 Plan governance system should continue to build on these system strengths.

Our analysis also revealed several priorities important for system improvement and reform, including matters related to power sharing among key GBR actors, poor levels of programme coordination and a lack of commitment to principles of subsidiarity and poorly integrated knowledge systems. Our more detailed synthesis of weaknesses and priority areas for improvement include the need for the following:

1. **Genuine power sharing with key GBR actors.** While there is an emerging appetite for improvement, there remains a lack of genuine power sharing with Traditional Owners, local government and industry [84,85] in the GBR. Healthy governance systems, however, require the inclusive participation of many diverse actors to foster a genuine sense of co-management of the GBR. It is therefore a priority for the Queensland and Australian governments to rebuild subsidiary systems, trust and stronger partnerships, not just with Traditional Owners but also with the farming, agricultural and fishing sectors and local governments across the GBR catchment;
2. **Improved trilateral relations between federal, state and local governments**. Poor coordination of efforts across different governance levels has also been a long-standing issue for the GBR, particularly at the lower scales [86,87]. In this regard, our results have highlighted continued fragmentation in programme implementation and the weak application of trilateral approaches (combining the efforts of federal, state and local governments). This is particularly the case in relation to land-based action and community-based education. An opportunity for reform these approaches lies in prioritising the strengthening of more trilateral approaches to GBR governance, particularly with more support being provided to local governments across the GBR [88]. More trilateral approaches would facilitate improved co-design of delivery effort, including at regional, catchment, local, traditional owner and farm scales;
3. **Building a culture of subsidiarity.** It is a priority for the GBR to foster a stronger culture of subsidiarity to improve cohesive implementation of multi-scale strategies, which are currently problematic due to fragmented and short-term funding, and limited integration of place-based strategies [89]. If subsidiarity issues are not addressed, they will impact on the strength of those key organisations involved in catchment

scale action, including regional NRM bodies, farming, fishing and research bodies, community-based land-care groups and traditional owner institutions. Unfortunately, the strength of regional NRM bodies has been declining, impacting the effective implementation of aligned and multi-scale Reef 2050 Plan strategies, and particularly those related to water quality improvement. Some improvement in this sense could occur through emerging reforms that the federal *Environment Protection and Biodiversity Conservation (EPBC) Act* that explore bioregional planning and more strategic offsetting approaches to protecting catchment value and facilitating large-scale restoration.

4. **Toward integrated knowledge systems.** Greater integration between Australian and state government knowledge systems is also needed to improve decision making across the region and to improve trust in data storage and management [90]. Communication issues were similarly highlighted by Traditional Owner communities, which emphasised the need for developing culturally appropriate knowledge systems at the sea-country estate scale [91];
5. **Collaborative approaches to decarbonised regional development**. A significant governance challenge identified through our analysis is the lack of integrated management of the various social, economic, cultural and environmental values of the GBR and its catchments. As climate change is one of the greatest threats facing the GBR's future, it will become increasingly important that the Reef 2050 planning process becomes increasingly supportive of, and engaged in, regional development within GBR catchments. To substitute its deep reliance on coal royalties, Queensland must undertake a major social and economic transition over the next 30 years. Several key economic reports of importance in recent years have stressed that this will specifically need to involve a significant increase in the development of higher value manufacturing and agriculture in GBR catchments, major progress in the decarbonisation of the state's economy, and more diversified energy production. This could be conducted in highly integrated ways that massively increase the economic productivity of these catchments while at the same time scaling up the greenhouse gas emission reductions and improving GBR water quality. Doing so, however, will require research and development rich and innovative Australian, state and local government cooperation, more effective land-use and infrastructure planning, and the infusion of new science and technologies;
6. **Communicating Positive Government and GBR Resilience Successes**. More work needs to be dedicated to communicating positive governance and GBR resilience outcomes to prevent misleading narratives which heavily impact on the tourism sector [92,93].

As shown in Figure 1 below, regular and adaptive benchmarking has the potential now to be integrated within future Outlook reporting by 2029, and with the coming cycles of Reef 2050 Plan review to evaluate the health of this spatially based governance system and to monitor progress toward the achievement of desired outcomes for a more resilient GBR by 2050 Plan and beyond. Such an approach can be applied for informing and guiding effective governance system improvement in complex ecosystems across the globe.

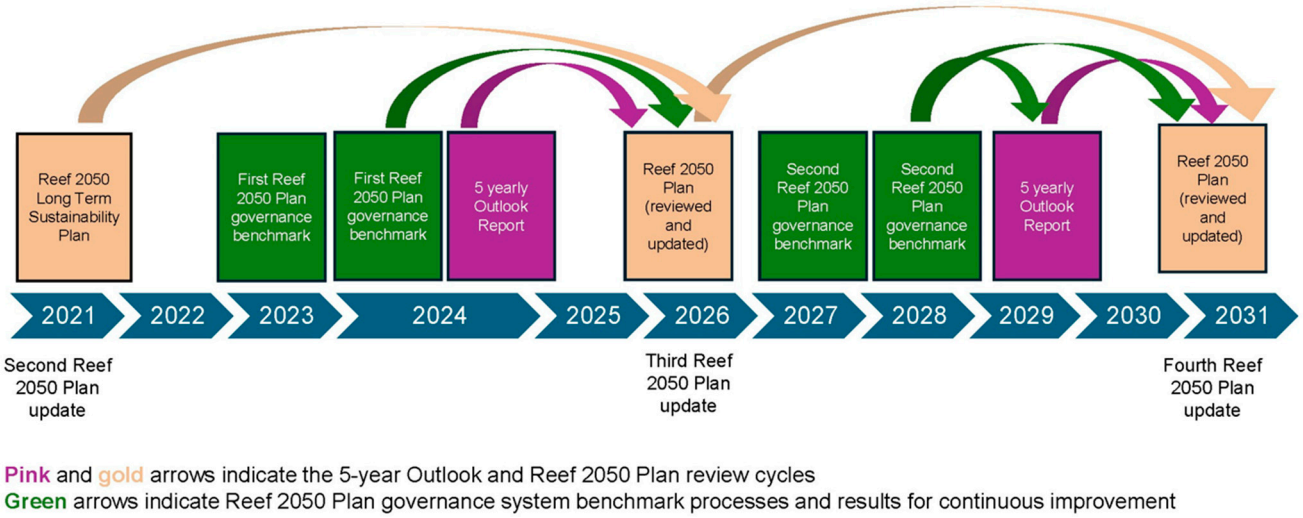

Figure 1. A conceptual cycle of regular and adaptive benchmarking for monitoring the health of the governance system supporting development, delivery and review of the Reef 2050 Plan.

5. Conclusions

Our goal in this work has been to create a replicable framework to assess governance-system health underpinning the Reef 2050 Plan. We did this to allow progress toward monitoring the achievement of the Plan's goals and objectives related to governance for a more resilient GBR. Our exploration of 20 attributes (across four attribute clusters) highlighted broad system strengths worth maintaining, as well as key priorities for improvement. We found whole-of-system strengths form a strong foundation upon which the governance system can continue to improve, fostering both a collaborative and adaptive approach essential for the long-term resilience and health of the GBR.

Overall, our assessment found the health of the governance system underpinning the Reef 2050 Plan is 'emerging to maturing', reflecting more recent progress in policy and plan development and capacity-building efforts. This aligns to the wider GBR governance literature which identifies specific areas for system improvement, such as weak coordination of multi-scalar effort and limited partnership building with key community and industry sectors. However, while several studies focus on governance failures, our study was framed within an appreciative inquiry approach and provides a more balanced perspective of governance system strengths, weaknesses and progress in the GBR. We suggest that this more balanced picture is key to understanding governance of the GBR and identify pathways for further improvement and reform.

Our findings suggest that there are major opportunities to devise and deliver improved governance efforts to ensure the long-term sustainability of the GBR, especially in the light of emerging climate risks. As these challenges can only be resolved through healthy and effective governance at global, national and local scales, overall, our assessment of the health of the Reef 2050 Plan's governance system is rated as 'emerging to maturing'. Our assessment reflects the concerted efforts of governments, Traditional Owners and other important actors in collectively developing policies, programmes and capacity enhancing initiatives; all better contextualised against the scale of the contemporary challenges facing the GBR's future. As a research team, as a pathway to secure implementation of our findings, we will continue to work with Reef 2050 Plan stakeholders, particularly the Commonwealth and state governments and the Reef Authority, in progressing further interpretation and implementation of our findings.

To conclude, this theoretically grounded, actor-engaged framework and approach to benchmarking and monitoring of the health of the Reef 2050 Plan governance system

has enabled dialogue about the governance components of the GBR as an independent exercise embedded within the overall governance system. This first round of benchmarking has established an important asset of global significance for governance assessment; it provided a practical approach to governance assessment based on theoretical strength and analytical depth, one that could be repeated and maintained at a relatively low cost. Through regular and adaptive benchmarking of this kind, upcoming cycles of the Reef 2050 Plan review can be used to evaluate the health of this globally important, spatially based governance system. Of more significance, however, is that such deliberative and evidence-based approaches could be applied to effective governance-system improvement in complex ecosystems across the globe.

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Abbreviations

The following abbreviations are used in this manuscript:

COTS	Crown-of-Thorns Starfish
EPBC Act	Environment Protection and Biodiversity Act
FPIC	Free, Prior and Informed Consent
GBR	Great Barrier Reef
GBRF	Great Barrier Reef Foundation
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GSA	Governance Systems Analysis
IUCN	International Union for the Conservation of Nature

JCU	James Cook University
MERI	Monitoring Evaluation Reporting and Improvement
NGOs	Non-Governmental Organisations
OUV	Outstanding Universal Value
RRAP	Reef Restoration and Adaptation Program
Reef 2050 Plan	Reef 2050 Long-Term Sustainability Plan
RIMReP	Reef 2050 Integrated Monitoring and Reporting
QUT	Queensland University of Technology
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WH	World Heritage
WHC	World Heritage Commission

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