

Identifying factors influencing water planning: Benefits of a capability approach?

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Abstract: Adaptive water planning aims to address challenges of societal and natural systems complexity and uncertainty to ensure sustainable outcomes for current and future generations. A main challenge for those responsible for designing and implementing water plans is to address conflicting perspectives in decision making, related to the diversity of visions and interests around water that could also evolve across time, space and governance scales. Navigating uncertainty and complexity in decision making requires institutions and organisations responsible for water planning and management to develop dynamic capabilities (i.e., capacity to purposefully adjust and achieve evolutionary fitness through adapting and/or shaping the external environment) in designing effective and adaptive strategies, so as to be able to achieve desirable objectives and eventually contribute to society's aspirational outcomes. Drawing on interviews, the purpose of this paper is to ascertain some key capabilities considered critical to enable good planning and management in the Australian decision-making context. We use a capability approach as a conceptual thinking framework to identify capabilities supportive of good planning and management and their conversion factors (i.e., barriers and enablers at individual, organisational and contextual levels). An inductive thematic analysis was applied to the comments of the interviewees to identify conversion factors and capabilities for different protagonists in water planning and management. The main contributions of the research are to provide a mapping of capabilities in water planning and management in Australia and an associated identification of their critical barriers and enablers. Such a mapping is expected to support reflection by researchers and decision-makers about (1) necessary capabilities to support the design and implementation of effective adaptive plans and (2) means to support them.

Results presented comprise a mapping of capabilities, contributing abilities from different stakeholders in water planning and management and their respective barriers. Three overarching capabilities were identified: 'enabling real and meaningful engagement to support fair and deliberative planning processes', 'information to ensure the identification of relevant trade-offs and investment priorities supported by all stakeholders, and able to address future challenges' and 'enabling environment to support resilient and thriving ecosystems and communities'. Among the main barriers to capabilities are: mindsets to knowledge inclusion and sharing and influential on knowledge creation and absorptive capacity; artificial decision-making processes influential on creativity, agility and resilience capabilities; legislation complexity and issues and leadership issues, influential on setting an enabling environment for expressing dynamic capabilities supporting adaptive planning and management. These were the principal drivers of water planning failures in identifying relevant investment priorities, addressing future challenges, supporting trust and enabling actionable decisions that could ultimately contribute to the achievement of sustainable and fair outcomes. Implications of our findings for dynamic capabilities are discussed, together with limitations of the research and considerations in regard to future capability needs and orientations.

Keywords: *Conversion factors, dynamic capabilities, adaptive planning, decision making*

1. INTRODUCTION

Water planning aims at ensuring sustainable outcomes for human-technical-ecological systems. However, various challenges of complexity and uncertainty need to be addressed to ensure good water planning, especially those related to rapid (bio)physical, technological, economic, socio-cultural and political drivers of change, unknown futures, and the diversity of worldviews around a problem of interest. A range of qualitative and quantitative decision-support tools can be exploited to inform planning and management decisions, the most used one being scenario planning (Wyborn et al., 2021). Additionally, anticipating and adapting to future changes requires developing dynamic capabilities to support knowledge creation and identifying relevant actions to adapt, cope and/or shape the external environment and ultimately contribute to achieving desirable outcomes (Dzhengiz & Niesten, 2020).

Dynamic capabilities build on the expression of a set of competencies and capabilities that high-level decision-makers need to leverage to respond timely and adequately to future changes while sustaining current needs (Nagarajan & Prabhy, 2015). As for these authors, we understand competencies as individual skills, knowledge and capacity to fulfil current needs (e.g., systems thinking skills or stakeholder networking competences), whereas capabilities consist of an individual or organisation's set of qualities, abilities, capacities and potential to develop and flex knowledge/skills/talent/ability for meeting future needs (e.g., ability to achieve ecological sustainability under climate change through ongoing resourcing of citizen science activities). Different conversion factors (i.e., barriers and enablers) at individual, societal/organisational and environmental/contextual levels could influence the achievement of dynamic capabilities. Therefore, understanding the nature of barriers assists in reflecting on opportunities to mitigate them and support good water planning.

This paper aims investigate how using a capability approach could help identify a set of capabilities supportive of dynamic capabilities in water planning and management. The novelty in the application of the approach is to go beyond normative questions exploring 'what people can do/be' and 'what lives they can lead', to integrate different perspectives in water planning and management and reflect on their implications for dynamic capabilities (Robeyns, 2017). We draw on interviews to identify capabilities necessary for enabling responsible adaptive planning and management. Although we focus on the Australian decision-making context, there is relevance to many other contexts. We use a capability approach as a conceptual thinking framework to identify capabilities supportive of good water planning and management. An inductive thematic analysis was applied to the comments of our interviewees to identify barriers and enablers in water planning and management and infer different capabilities supportive of good planning and management. The main contributions of the research are to provide a mapping of principal abilities and capabilities in water planning and management in Australia and of their associated critical barriers. Such a mapping is expected to support reflection by researchers and decision-makers about (1) necessary capabilities to support the design and implementation of effective adaptive plans and (2) means to support them. More from a modelling interest, it could support thinking about the implications of external factors influential on the quality of model outputs, their uses, contribution to inform effectively adaptive water planning, as well as on the development of information systems and interfaces able to address barriers to dynamic capabilities and contribute to actionable decisions (Robeyns, 2017).

2. METHODS

The following sections introduce the thinking framework and approach used to identify and map barriers, abilities for different stakeholders and capabilities supporting adaptive planning and management.

2.1. Capability approach framework

A capability approach aims at investigating 'what people want to be or do' (their capabilities) and 'what they are actually achieving in terms of being and doing' (their functionings) (Robeyns, 2017). Based on this author, it has been chiefly used in philosophy and social sciences to explore issues of justice, but also to discuss issues of ecological sustainability, identify social indicators of welfare/quality of life, describe social groups' living realities and challenges, or reflect about the contextual fitness of a field-related concepts and practices and potential requirements to ensure the development of critical capabilities.

We build on Biggeri & Ferrannini (2014)' capability approach framework to think about conversion factors influencing the enactment of capabilities at individual and organisational/societal levels. The framework considers individuals at the centre of the ability of organisations/societies to adjust to changes (dynamic capabilities). From an organisational perspective, it aims to support thinking about factors and system feedbacks that could affect the realisation of dynamic capabilities and organisational performance under changes. From

a planning perspective, it seeks to systematically assess opportunities and gaps for designing, implementing, monitoring and evaluating the performance of a planning strategy and its ability to achieve desirable outcomes. In regards to future needs, the approach helps reflection on current practices and limitations, as well as future capability needs to achieve desirable societal outcomes.

2.2. Approach to infer and map capabilities

We build on semi-structured interviews about qualitative scenario planning, in which scenario planning was described using PowerPoint slides and water planning and management discussed with 17 participants with different expertise and/or experience with water planning and management, especially in the contexts of Queensland and the Murray Darling Basin. Participants included community group, non-governmental organisation (NGO), water operators, local government, water planning and management consultants, water planners (Queensland, New South Wales, Victoria) and high-level decision makers at the Commonwealth level. An inductive thematic analysis was undertaken using the NVivo software to identify our participants' opinions about barriers, enablers and their consequences for different stakeholders (i.e. individuals/groups affected by or involved in decisions) and on their abilities to contribute to good water planning and management. We understand 'abilities' as capabilities - describing desirable functionings/capabilities from our participants' viewpoint. These abilities were formulated to reflect Tell's (2014) conceptual representation of what a capability is, that is, "a substantial possibility that source entity(ies) lead to a result" and organised, building on Dzhengiz & Niesten (2020), into four dimensions: domain (to know – e.g., responsibility for the environment), procedural (to do – e.g., systems thinking), social (to interact – stakeholder networking competences) and self (to be – e.g., future orientation, empathy). This categorisation allowed for the clarification of how different stakeholders were affected by different barriers. From the description of abilities, different themes related to sub-capabilities were identified. These themes were further organised into overarching themes representing overarching capabilities supported by our sub-capabilities and abilities. In addition, we consider the contributions of our abilities and capabilities to Musa & Enggarsyah (2021)'s four capabilities supportive of dynamic capabilities: absorptive capacity (capability to recognise, assimilate and use new information/knowledge from internal and external sources), creative capability (capability to create valuable new products, services, knowledge, among others, by individuals involved in complex social systems), agility capability (capability to adapt continuously to turbulent, complex and uncertain environments), and resilience capability (capability to withstand disruptions and shocks and recover from adverse impacts).

Results were summarised as a matrix representing barriers, abilities for different stakeholders, identified sub- and overarching capabilities, and contributions to dynamic capabilities.

3. RESULTS

Our participants mentioned a total of 124 barriers to water planning and management. In addition, but not further discussed here due to text constraints, some 163 suggestions of enablers to capabilities were proposed to support identified capabilities. The number of barriers and enablers is explained by repetitions of similar themes by our participants when illustrating their comments. Barriers were affecting different stakeholders' abilities in water planning and management – these abilities themselves contributing to different sub-capabilities and overarching capabilities. For the latter, three overarching capabilities were identified: 'enabling real and meaningful engagement to support fair and deliberative planning processes' (real and meaningful engagement), 'ensuring the identification of relevant trade-offs and investment priorities supported by all stakeholders and being able to address future challenges' (actionable decisions), and 'setting an environment supporting resilient and thriving ecosystems and communities' (enabling environment). These overarching capabilities were supportive of polycentric decision-making processes ('real and meaningful engagement' capability), adaptive planning and management ('actionable decisions' capability) and adaptive governance ('enabling environment' capability). In addition, 'real and meaningful engagement' capability and 'actionable decisions' capability contributed to dynamic capabilities. The former capability to 'absorptive capacity' through improving learning and knowledge sharing. The latter capability to 'creativity capability', 'agility capability' and 'resilience capability' through enabling innovative thinking and identification of intervention fitted to contexts; supporting anticipation and rapid responses to future challenges; and influencing trust and joint responsibility among stakeholders in water planning and management, respectively. Enabling dynamic capabilities also requires supporting 'enabling environment' capability and addressing power and leadership barriers through achieving 'phronetic' leader capability. Figure 1 summarises our results and contribution of different barriers, abilities and capabilities to enabling dynamic capabilities and adaptive water planning.

CONTRIBUTION TO DYNAMIC CAPABILITIES	OVERARCHING CAPABILITIES	SUB CAPABILITIES	ACTIVITIES	BARRIERS
<div> <div>‘Phronetic’ leader capability</div> <div>Enabling environment Capability (Adaptive governance)</div> </div>		Having legislation supporting polycentric decision-making processes and adaptive planning and management	<ul style="list-style-type: none"> • COM, FN advocating for relevant values/objectives ; co-designing future pathways • ACA advocating for sustainable changes ; contributing to innovations • WP, WM understanding local contexts and needs ; advocating for relevant interventions • WP, WM considering holistic factors and connections beyond water ; considering different objectives across scales and mechanisms of alignment • COM, FN having their objectives and values included in decisions • WP, WM effectively managing shared water resources 	Risk attitudes preventing legislation sufficiently supportive of decisions with stakeholders Time, resources, expertise to address legislation complexity and legacy issues Legislation not suited to accounting for uneven contexts and non-stationary conditions Fragmentation of water
		Supporting effective management	<ul style="list-style-type: none"> • All anticipating future challenges without undermining current and future needs and values • HD, WP, WM appropriate timing of actions and alignment of commitments at scale 	Reactive approaches to planning Time-orientation issues
		Having good leadership	<ul style="list-style-type: none"> • WP, WM, ACA, COM, FN influencing investments in the right priority areas • HD committed to support effective and responsible (joint) management of shared water resources • WP, WM influencing cultural change within organisations • HD, WP, WM, ACA considering robust decisions against political cycles • COM, FN having continuous and effective support for relevant adaptive interventions 	Political interference, power relationships, vested interests, unethical behaviours Changes in priorities from the government of the day
		Including Stakeholder knowledge	<ul style="list-style-type: none"> • COM, FN expressing their voices in decisions • WP understanding local contexts and needs • WP, WM visibility of uneven impacts across scales • ACA, COM, FN advocating for relevant priorities • Humanities values to inform decisions • WP, WM identifying effective engagement levels according to capacity and context 	Inappropriate representation of inclusion of proper interfaces Paradigms and concepts influencing mindsets about credible sources and relevant approaches to inform decisions Lack of guidance for engaging with stakeholders
		Supporting symmetrical information flows	<ul style="list-style-type: none"> • WP, WM communicating effectively and transparently • COM, FN accessing clear and relevant information • WP, WM effectively engaging with stakeholders • COM, FN understanding information and contributing to decisions • WP, WM critically evaluating planning assumptions and implications of decisions 	Leadership/media interference with transparent information flows Inappropriate time and resources Differences in learning journey among stakeholders Misunderstanding of planning assumptions
<div> <div>Absorptive capacity</div> <div>Real and meaningful engagement Capability (Polycentric decision making)</div> </div>		Investing in the right priority areas and interventions	<ul style="list-style-type: none"> • WP, WM identifying/advocating for interventions without undermining ecological systems needs 	“Artificial” decision-making processes
		Being future ready	<ul style="list-style-type: none"> • WP effectively testing options against future challenges and selecting appropriate interventions ; effectively monitoring changes and performance across scales 	
		Having the license to operate	<ul style="list-style-type: none"> • WP timely and effectively implementing interventions • All feeling responsible and committed to effectively implement decisions 	
Creativity capability	<div> <div>Actionable decisions Capability (Adaptive planning and management)</div> </div>			
Agility capability				
Resilience capability				

Figure 1. Identified barriers, abilities for different stakeholders, overarching and dynamic capabilities. Arrows indicate enabling relationships between overarching capabilities and contribution of ‘phronetic’ leader capability to ‘enabling environment’ capability and, ultimately, dynamic capabilities.

ACA= academics, COM = communities, FN = First Nations, HD = high decision makers, WP = water planning professionals, WM= water management professionals, All = all stakeholder groups.

Two main sub-capabilities were identified to contribute to ‘real and meaningful engagement’ capability: ‘including stakeholder knowledge’ and ‘supporting symmetrical information flows’ (i.e., transparent, clear and mutual exchange of information at all decision-making levels). A main barrier to ‘including stakeholder knowledge’ sub-capability was the limited influence of humanities, and social sciences in particular, to inform decisions. This was seen to prevent the effective inclusion of people’s voices in decisions - reducing understanding about local contexts, connections and values. The reliance on data to inform decisions was seen as a reflection of disciplinary imbalance, mainly explained to provide a sense of certainty in decision-making and potentially to avoid facing people’s discontent. The other two most mentioned barriers to stakeholder knowledge inclusion were related to 1) the absence of proper representatives or interfaces to support understanding about stakeholders’ concerns, values and needs, as well as represent groups as a whole (e.g., First Nations as a Nation as a whole) and 2) the influence of planning and management paradigms and concepts on the definition of high-level objectives and utilitarian assumptions about stakeholder behaviours - preventing the consideration of uneven contexts and impacts across scales and ability for scientists and local stakeholders

to advocate for relevant priorities (e.g., water requirements for ecological systems). Other barriers and issues mainly relate to the lack of guidance for water planning and management professionals to engage and communicate effectively with stakeholders and to methodological challenges for water planning professionals and researchers to account for all voices and related to contexts (e.g., large population and/or catchment size). Regarding ‘supporting symmetrical information flows’ sub-capability, one main barrier was the limited access to transparent and clear information, mainly affecting water planning and management professionals’ understanding of local contexts and reflection about the implications of changes and decisions for local communities. Three reasons for that limited access were: 1) leadership and media interferences preventing transparent communication of information to stakeholders, 2) limited time and resources for water planning and management professionals to communicate effectively with stakeholders, and 3) stakeholders’ capacity to understand adequately the information provided. Another main barrier to symmetrical information flows was the lack of clarity about assumptions underpinning planning and management decisions, mostly limiting water planning and management professionals’ ability to critically evaluate decisions’ feasibility and desirability.

Our second capability (actionable decisions) builds on enabling ‘real and meaningful engagement’ capability, especially on the ability to support collaborative networks to inform decisions and actions. A primary barrier to all three sub-capabilities supportive of ‘actionable decisions’ was the risk of setting “artificial” decision-making processes, mainly in terms of exacerbating trust issues between all stakeholder groups and preventing reaching a shared agreement about how to address changes and support sustainable water uses. Among the main implications related to “artificial” decision-making processes and reduced trust in particular were the ability for 1) water planning and management professionals to better account for environmental water needs by considering appropriate interventions and operational rules and 2) for all stakeholder groups to influence responsible behaviours by enabling transparent decision-making processes. Setting “artificial” processes was also described as impairing water planners’ ability to evaluate the effectiveness of interventions to address future challenges and identify relevant indicators and thresholds to track changes and implement relevant actions. It was also described as limiting water planning and management professionals’ ability to identify and advocate investments for appropriate priority areas and interventions.

Our last overarching capability (enabling environment) influences the achievement of our two other ones, and ultimately achieving dynamic capabilities. Three sub-capabilities were identified, addressing legislation, effective management and leadership capabilities. ‘Having legislation supporting polycentric decision-making processes and adaptive planning and management’ sub-capability was necessary to enable polycentric and democratic decision-making processes and influential on ‘real and meaningful engagement’ capability. A primary barrier was related to high-decision makers’ willingness to change legislative/institutional frameworks, undermining the ability for water planning and management professionals and researchers to design effective engagement and co-design processes and for all stakeholders (aside from high decision-makers) to negotiate for relevant priority areas and future pathways. Another barrier, also hindering ‘actionable decisions’ capability, was related to time and resources to address legislation complexity and legacy issues and to check for the adequacy of policy objectives, rules, indicators, targets, and decisions. High-level objectives were also seen as providing a false sense of holistic thinking, limiting the ability of water planning and management professionals to understand local contexts and identify relevant interventions. ‘Supporting effective management’ sub-capability also contributed to ‘actionable decisions’ capability through influencing (joint) management of shared water resources, alignment of commitments at scale and supporting intergenerational equity (equitable decisions for current and future generations). As for ‘actionable decisions’ capability, ‘artificial’ decision-making processes were also described to impact this sub-capability, especially related to effectively managing shared water resources. Other barriers were related to leadership and management issues. Management barriers were related to reactive approaches to planning, mainly explained by limitations in high decision-makers/CEOs vision, affecting responsible management and the ability to ensure intergenerational equity. Time-orientation was also considered an issue to support ‘actionable decisions’ capability and to affect high decision makers’ ability to ensure the alignment of plans and commitments at scales and for water planning and management professionals to effectively and timely implement key interventions to address future challenges. Regarding ‘having good leadership’ sub-capability, barriers related to political cycles were seen as a source to be accounted for as affecting decisions when diverging from the government of the day’s objectives. As for power issues, they were reflected by vested interests, unethical practices, political interferences, and uneven power relationships around shared water. Political interferences, in particular, were described as hindering democratic planning processes and preventing changes in legislation and the implementation of adequate interventions.

4. DISCUSSION AND CONCLUSIONS

Using a capability approach allowed for identifying three main capabilities ('enabling real and meaningful', 'actionable decisions' and 'enabling environment') and their sub-capabilities, abilities for different stakeholders and barriers. These overarching capabilities are expected to contribute to dynamic capabilities and support adaptive planning and management. Our findings present many similarities with Head (2014), explaining why our discussion strongly builds on this author. The following sections discuss our findings and their implications for building dynamic capabilities in water planning and management.

Enabling 'real and meaningful engagement' capability and three sub-capabilities reflect the need for polycentric decision-making processes to enable "local adaptive initiatives" and support integrated and adaptive water management (Head, 2014). Consistent with Head (2014), the reliance on data to inform decisions translates barriers to knowledge inclusion related to organisational mindsets and beliefs around credible sources of information to inform decisions. High-level objectives, reflective of a decision level, and assumptions about stakeholders' behaviour were also a source of exclusion and could lead to maladaptation as potentially failing to recognise uneven impacts of changes at different scales (Head, 2014). In addition to addressing mindsets and beliefs, supporting knowledge inclusion was described to require guidance for adequately identifying relevant interfaces and finding the right engagement balance to represent all voices, according to water planning and management professionals' capacity (Hui et al., 2020). Consistent with these authors, including voices also requires the setting of collaborative networks and mechanisms to address accountability issues and support symmetrical information flows. Such symmetrical information flows are expected to contribute to effective communication and coordination of activities by addressing issues of uncertainty in complex policy contexts (Head, 2014). Barriers to symmetrical information flows were seen to reduce understanding and quality information to inform judgements and decisions, and call for education and clarification of planning and management assumptions and challenges (Dzhengiz & Niesten, 2020). Ensuring real and meaningful engagement also requires addressing mindsets issues to embrace pluralistic worldviews and enable legislation supporting decisions with stakeholders (Head, 2014). Overall, our sub-capabilities, together with having legislation supporting polycentric decision-making processes and decisions with stakeholders, contribute to what Head (2014) describes as 'cognitive' (i.e., supporting knowledge, science and ideas), 'communicative' (i.e., means to communicate and ensure information flows and quality) and 'organisational/institutional' (i.e., embedded practices and viewpoints within organisations/institutions influencing mindsets around good practices) dimensions, argued necessary for the framing of policies and programs to support climate change adaptation. In addition, it sets the scene for enabling dynamic capabilities through supporting knowledge creation and organisational absorptive capacity (Musa & Enggarsyah, 2021).

Our second capability (actionable decisions) results partly from the achievement of 'real and meaningful engagement' capability and preventing "artificial" decision-making processes. Through supporting knowledge inclusion and the development of collaborative networks, processes of learning and reframing of mental models could occur. Under the right setting and facilitation conditions, they could lead to questioning planning and management assumptions around the systems to be managed, objectives and means to achieve them, and the identification of relevant investment priorities (Pahl-Wostl et al., 2011). Effective knowledge sharing and communication also contribute to innovative thinking and actionable knowledge influencing adaptation and resilience to future challenges (Wyborn et al., 2021). Identifying relevant interventions and being future-ready also reflect the contribution of absorptive capacity to creativity and agility capabilities (Musa & Enggarsyah, 2021). According to these authors, creativity capability influences the performance of interventions and systems under future changes and contributes to agility and resilience capabilities. In contrast, agility capability influences the ability to adapt to rapid changes and contribute to resilience capability and more significantly to systems performance under changes. Trust issues are a significant challenge to enable 'actionable decisions' capability and require addressing governance and political challenges to ensure the development and implementation of adaptation strategies (Head, 2014).

Our 'enabling environment' capability influences the realisation of our two previous capabilities and, consequently, dynamic capabilities. Our sub-capabilities address legislation, effective management and leadership and influence different outcomes of adaptive governance in terms of supporting 1) polycentric and democratic decision-making processes, 2) the implementation of relevant interventions, alignment of plans and commitments at scale, and effective (joint) management of shared water resources, and 3) intergenerational equity through effective monitoring and evaluation (Sharma- Wallace et al., 2018). The main barriers were related to legislation and leadership and reflect what Head (2014) identified as 'organisational/institutional' and 'political' (i.e., management of power, crisis, and political action to protect or change policies and practices). These barriers could be partly explained by risk attitudes and willingness to implement changes due to complex and wicked problems and related uncertainties (Head, 2014). Other possible reasons involved power issues,

especially unethical practices and political interferences, that could undermine the setting of an enabling environment and adaptive frameworks supportive of broad governance and knowledge inclusion (Head, 2014). They call for more ethics at all levels of decision-making and the development of ‘phronetic’ leader capability (i.e., knowing how to realise the right goals); such a capability being paramount to enable dynamic capabilities (Scalzo, 2019).

Applying a capability approach present promises to support adaptation and resilience outcomes as identifying dynamic capabilities and barriers to be addressed that cover Head (2014)’s four dimensions to support the framing of adaptive strategies able to address future challenges. Also, the approach suggests the need for addressing unethical behaviours to enable dynamic capabilities, consistent with different authors, including Scalzo (2019). Limitations of this research are related to several factors. One is the subjectivity of inferences based on deriving capabilities from participants’ descriptions of barriers and enablers to water planning and management. A second is the representativity of findings based on the number and demography of the participants interviewed. Finally, an underlying limitation is the method used to elicit knowledge with semi-structured questions not initially designed to identify capabilities for water planning and management. However, for the latter, we argue that visual media, when used as a boundary object, may have facilitated deeper discussions about challenges faced in water planning and management. Future research will refine the present analysis to identify more finely capabilities for actors in water planning and management and the means to enable them according to contexts. It will also explore ‘phronetic’ leader capability-building methodologies and demonstrate their contribution to good planning in practice.

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