

Article Title: Dimensions of good water governance: a review and empirical study of public preferences for governance-related values in water governance

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Abstract

While many studies have investigated governance-related values such as sustainability, economic efficiency, or social justice as dimensions of good water governance, the concept of governance-related values as a separate category of values has received considerably less attention. The present paper reviews existing, mostly normative work on governance-related values and water governance from various disciplines, including policy-oriented and water ethics literature. The review points towards a lack of studies that seek to understand empirically how governance-related values are perceived and related in the mind of the public as well as among relevant stakeholders. The paper proceeds with an illustration of how quantitative research methods can be used to study these linkages in practice. It uses data from a large household survey on public preferences for governance-related values conducted in the Upper Paraguay River Basin, Mato Grosso, Brazil, and examines these with exploratory and confirmatory factor analysis techniques. The results suggest that there may be three relevant broad categories of governance-related values, namely democratic governance-related values, economic governance-related values, and scientific governance-related values. The article concludes by pointing out the need for further empirical research and academic debate on the fundamental ways in which governance-related values are interrelated as dimensions of good water governance, and environmental governance more broadly.

Graphical/Visual Abstract and Caption

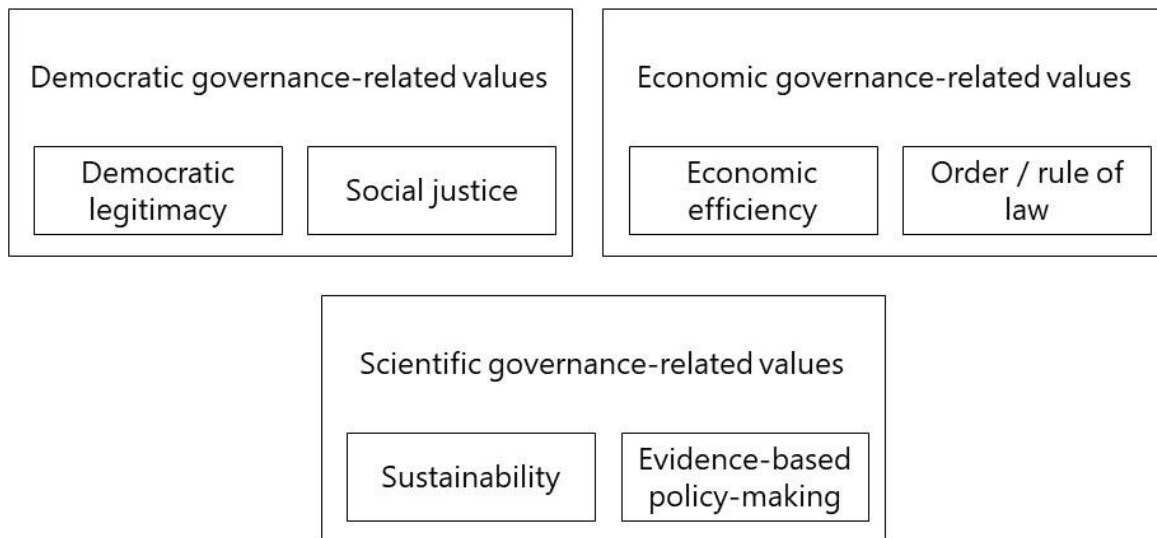


Figure 1: Dimensions of good water governance: The empirical structure of governance-related values

Introduction

Values implicitly guide human decision-making across many situations and contexts, especially, where alternative decisions would endorse opposing values. Values can be defined as abstract goals that people seek to uphold across decision-making situations (Schwartz, 2012). This includes actors within water governance who may have to decide whether they prefer to endorse sustainability, economic efficiency, or social justice as not always mutually compatible values, e.g. in the context of developing large water infrastructure projects (Grotenbreg & Altamirano, 2017; Schulz, Martin-Ortega, Glenk, & Ioris, 2017; Schulz, Martin-Ortega, Ioris, & Glenk, 2017). Schulz, Martin-Ortega, Glenk, et al. (2017: 245) define these governance-related values as “idealised characteristics of water governance [which] are expressed as desirable by individuals and groups with regard to water governance or governance in general.” As such, they are important dimensions of what makes good water governance (Ingram, 2011). Water governance, in turn, can be defined as the combination of i) water polity (the institutional framework); ii) water politics (power relations between political actors); and iii) water policy (the mechanisms and instruments used to achieve certain outcomes) (Schulz, Martin-Ortega, Glenk, et al., 2017; Treib, Bähr, & Falkner, 2007), and ‘good water governance’ would entail that certain values are addressed across all three domains.

There are many different conceptualisations of the term ‘value’, and a number of different bodies of literature on values have emerged, each using the concept in slightly different ways and for different purposes. For example, there is abundant research on people’s personal values (Schwartz, 2012; Schwartz et al., 2012), public values (Beck Jørgensen & Bozeman, 2007; Hartley, Alford, Knies, & Douglas, 2017), shared and social values (Ives & Kendal, 2014; Kenter et al., 2015), values of water (Ioris, 2013; Seymour, Curtis, Pannell, Roberts, & Allan, 2011), water ecosystem services (Gordon, Martin-Ortega, & Ferrier, 2015; Hackbart, de Lima, & dos Santos, 2017) or more recently, culturally specific so-called relational values (Chan et al., 2016; Pascual et al., 2017). In contrast to these well-established fields of research, governance-related values are not yet recognised as a separate field

within the current water governance research agenda (Glenk & Fischer, 2010; Schulz, Martin-Ortega, Glenk, et al., 2017).

Nevertheless, the present focus article seeks to review existing research on governance-related values with a particular focus on water governance, and aims to demonstrate the relevance of the concept (as defined by Schulz, Martin-Ortega, Glenk, et al., 2017; cited above) for deepening our understanding of water governance. A special emphasis is placed on the idea of studying multiple governance-related values and their trade-offs simultaneously, rather than focussing on a single governance-related value (for example social justice), as is typically done.

Beyond the brief review of existing literature, this focus article also illustrates how governance-related values can be studied empirically with quantitative techniques, using data on public preferences in water governance from a household survey that was carried out in the Upper Paraguay River Basin in Mato Grosso, Brazil. An exploratory and confirmatory factor analysis of several survey items on governance-related values demonstrates how certain governance-related values may be related in the mind of the public, i.e. what structure the dimensions of good water governance may take. This empirical approach that emphasises the relational component of values represents an important contribution of this article, addressing research gaps outlined by Beck Jørgensen and Bozeman (2007) and Hartley et al. (2017) on governance-related values more generally. It also opens up questions for further empirical research.

Governance-related values and water governance

Governance-related values are those specific values and principles that describe idealised properties of governance, as expressed by individuals and groups of people, such as stakeholders, and members of the general public. Existing research on governance-related values and water governance can be divided into at least three separate branches: (1) in-depth case studies on individual governance-related values; (2) policy-oriented literature, including lists of guiding principles; and (3) water ethics.

In-depth case studies on individual governance-related values

The first branch is probably the largest, as it comprises those studies that seek to identify to what degree a certain governance scenario or management strategy addresses a specific governance-related value, such as sustainability, social justice, or economic efficiency. While these studies deal with individual governance-related values, they may still be very complex, as individual values may be highly multi-dimensional. Mehta and Movik (2014: 369), for example, suggest that sustainability (as an example of a governance-related value) in the water domain should encompass “issues of uncertainty, complexity, local knowledge, equity, gender, and power relations.” Patrick (2014) outlines the multiple dimensions of social justice in water governance, which she structures along the binaries of global-local, individual-group, and situational-universal, again pointing to the potential complexity of individual governance-related values such as social justice.

For further examples of literature on individual governance-related values in water governance see Kuzdas, Wiek, Warner, Vignola, and Morataya (2014) or Schneider et al. (2015) for sustainability;

Neal, Lukaszewicz, and Syme (2014) or Wutich, Brewis, York, and Stotts (2013) for social justice; da Silva e Souza, Coelho de Faria, and Moreira (2007) or Rodrigues and Tavares (2017) for economic efficiency; Grassini (2017) or Musembi (2014) for participation; Empinotti, Jacobi, and Fracalanza, (2016) or Roncoli, Dowd-Urbe, Orlove, West, and Sanon (2016) for transparency and accountability; and Tucker (2014) or Udas, Roth, and Zwartveen (2014) for equity (also often incorporated into social justice studies). The goal here is not to list all governance-related values that have been studied in relation to water governance, which would be beyond the scope of this review. Nevertheless, the listed case studies discuss some of the most frequently investigated governance-related values, i.e. what they have in common is that they investigate the relationship between a specific governance-related value and water governance, asking questions such as “how can we achieve good (or better) water governance by focussing on governance-related value X?”, “what are the challenges and barriers to enhancing governance-related value X?” or “to what degree is governance-related value X already realised or not in a specific case study context?”.

Policy-oriented literature and lists of guiding principles

Some studies on particularly broad governance-related values, such as sustainability, social justice or water security could also be listed under the second branch of existing literature on governance-related values and water governance. This branch seeks to list principles that policy-makers should commit to and implement to achieve good water governance. For example, Wiek and Larson (2012) suggest that sustainability of water governance systems consists of seven principles (social-ecological system integrity; resource efficiency and maintenance; livelihood sufficiency and economic opportunity; socio-ecological civility and democratic governance; inter-generational and intra-generational equity; interconnectivity from local to global scales; precaution (mitigation) and adaptability); van Leeuwen, Frijns, van Wezel, and van de Ven (2012) identify 24 indicators that can be used to assess the sustainability of urban water supply. In these cases rather than speaking of *sustainable* water governance, it might be more appropriate to simply reframe these principles and indicators as principles of *good* water governance, given the extensive scope of principles listed. There is a general tendency nowadays to refer to sustainability to anything that is 'good' or 'desirable' as it is losing the original connotation of safeguarding natural resources for future generations (Daly, 1990). Such a reframing would then mean that each of the listed principles above could be a governance-related value in its own right, e.g. social-ecological integrity or efficiency.

Lists of governance principles are especially popular in the policy arena, as they can serve as mission statements or guidance for collaboration between governmental and non-governmental partners, see e.g. Akhmouch and Correia (2016) for the OECD's 12 principles on water governance. Beyond water governance specifically, Kooiman and Jentoft (2009) or Lockwood, Davidson, Curtis, Stratford, and Griffith (2010) have also published lists of desirable governance-related values for environmental governance, the former listing transparency, efficiency, accountability, respect, equity, inclusion, effectiveness, responsiveness, and moral responsibility as values that should apply in different contexts and situations within environmental governance, whereas the latter mention legitimacy, transparency, accountability, inclusiveness, fairness, integration, capability and adaptability.

What all lists of governance principles seem to have in common is that they are written from a normative perspective, i.e. authors try to structure their expectations and recommendations for

good water governance (or environmental governance). In the present paper, these normative considerations are not made by the researcher. Instead, here the objective is to understand how governance-related values are related in the mind of the public, and whether we can identify relations between them based on empirical data. Normative decisions are thus made by the members of the general public who participated in this study (see empirical study below). Similarly, Beck Jørgensen and Bozeman (2007: 377) contend for the closely related field of public values research that “if there is any single item for a public values research agenda, it is developing approaches to sorting out values and making sense of their relationships” whereas Hartley et al. (2017: 670) suggest that “most publications are [...] theoretical, conceptual, scholarly, synthetic or descriptive” and equally call for more empirical research.

Water ethics

To conclude this brief review of existing literature on governance-related values and water governance, the small but growing field of water ethics should be mentioned, which aims at identifying moral values that could guide water governance, typically from a normative and policy-oriented perspective (Falkenmark & Folke, 2002; Groenfeldt, 2013; Liu et al., 2011; Schmidt & Shrubsole, 2013). While there is some overlap with the first and second branch of literature on governance-related values and water governance, this third branch does not focus as much on prescriptive lists of values (but see Liu et al., 2011) or in-depth case studies of individual values.

Instead, the water ethics literature tends to start off from a problem-based perspective, emphasising concrete, practical, and context-specific applications. Especially Groenfeldt's (2013) book offers numerous examples of how water governance should take into account multiple values, e.g. where indigenous groups require higher water quality standards than the rest of the population to perform traditional ceremonies in a river, which may justify more stringent regulations locally. In contrast to Schulz, Martin-Ortega, Glenk, et al. (2017), however, Groenfeldt (2013) structures his analysis of governance-related values along substantive dimensions as environmental, social, cultural and economic values, which could more readily be conceptualised as assigned values (i.e. tangible or intangible values assigned to water), rather than governance-related values (Schulz, Martin-Ortega, loris, et al., 2017). On the whole, the water ethics literature is very explicit in its normative standpoint, too (Falkenmark & Folke, 2002), and by asking “what is the right thing to do?” it inevitably touches upon issues of governance-related values and water governance, although not necessarily using the language or structured categorisation of governance-related values, which is proposed and applied in the present paper (see empirical study below).

Synthesis and discussion of literature review: the need for quantitative empirical research on governance-related values

Summing up, all three branches of the literature (case studies on individual governance-related values; policy-oriented lists of governance principles; water ethics) evidently concern the connection between governance-related values and water governance, and boundaries between branches may be fluid. Their joint message is that values are important for understanding and guiding water governance, a message which has been readily accepted. In almost all cases, studies are conducted from an explicitly or implicitly normative perspective, which seeks to improve water governance through enhancing certain governance-related values, or at least discusses the absence or inadequacy of certain governance-related values. This means that it is primarily the researcher or

professional organisation (e.g. Akhmouch & Correia, 2016) who decides about the relevance of certain governance-related values for water governance.

In contrast to that, in the present paper, these normative decisions are taken by research participants (see empirical study below), i.e. the objective is to identify governance-related values and their interrelations empirically, making use of the techniques and methods available from social psychology. Overall, this offers a more analytical perspective on the concept of water governance (in line with e.g. Zwarteveen et al., 2017). Here, the goal is not to ask “what should be done?”, but to ask “which governance-related values exist 'out there', and how are they related with each other?” Answering these questions may ultimately result in a list or map of governance-related values which would encompass the values listed above, but from an empirical and analytical perspective (as opposed to an extensive mission statement consisting of values that the public sector should commit to).

To understand whether there are universal aspects in people's preferences for governance-related values and their interrelationships is not least an interesting academic question that would explain why people across cultures and countries value certain characteristics within governance (Beck Jørgensen & Bozeman, 2007). This perspective is very similar to Schwartz' (2012) framework for the study of personal values, which lists 19 (originally 10) basic human values that have been mapped onto a circular structure according to their respective conceptual closeness, based on the findings of hundreds of empirical studies. In the following section, a first attempt to study public preferences for governance-related values based on findings from survey research is presented. Little conceptual guidance existed for the development of an empirical research approach towards governance-related values and most evidence that certain governance-related values can be grouped into clusters or 'value landscapes' (i.e. groups of closely related values) (Schulz, Martin-Ortega, Ioris, et al., 2017) seems to originate from conceptual considerations.

Hood (1991) may be considered an early precursor of a comprehensive theory of governance-related values from an analytical rather than normative perspective as he grouped 'administrative values' into three families, namely sigma-type values (frugality, competence); theta-type values (honesty, fairness, mutuality); and lambda-type values (reliability, adaptivity, robustness). However, his selection of values was very much influenced by his particular field of research (New Public Management), has not been adapted into a quantitative empirical research agenda, and only very rarely been applied to the field of water governance (Grotenbreg & Altamirano, 2017).

The related field of public values (i.e. values of public organisations/government), which may have some conceptual overlap with governance-related values, is equally struggling with a lack of empirical research (Hartley et al., 2017), although Tsanga Tabi and Verdon (2015) have investigated public managers' values in the water sector of the city of Nantes, France (such as social justice, professionalism, participation, efficiency); yet their definition of values goes beyond governance-related values, given that for example, they include “the good taste of water” as a separate value. Finally, Glenk and Fischer (2010) conducted a survey on public preferences in water governance, including governance-related values; however, their selection of values (naturalness, safety, sustainability, solidarity, and efficiency) was embedded in a wider structural equation model that also included fundamental values, threat and coping appraisal, attitudes towards policy options, and preferences. In the present paper, a specific focus is placed on governance-related values as such,

while it is certainly addressing Glenk and Fischer's (2010: 2281) concern that “little empirical work has been done so far [...] to understand how people make sense of and value different approaches to governance, i.e. the processes and mechanisms implied in policies rather than merely the intended outcomes.”

An empirical application in the Upper Paraguay River Basin, Mato Grosso, Brazil

In contrast to the significant body of work taking normative and conceptual perspectives towards governance-related values and water governance, the present paper is the first with an exclusive focus on how quantitative survey methodology can enhance our understanding of the structure and interrelationships of governance-related values as a distinct concept from a quantitative empirical basis. It is based on the findings from a household survey (n=1067) that was conducted by the author with the assistance of local interviewers in the Upper Paraguay River Basin in the state of Mato Grosso, Brazil, between April and June 2016.

While the area is of global interest due to hosting both Brazil's agribusiness frontier and the Pantanal wetland (Schulz, Martin-Ortega, Ioris, et al., 2017; Vinten, 2012), the objective of the present study was not to produce locally specific knowledge unique to the case study area; rather, insights that are potentially universally relevant, independent of the concrete governance context. Ideally, results would be replicable across cultures and regions around the globe, analogous to social psychological work on personal basic values (Schwartz et al., 2012), but further empirical research in other geographical areas would be needed to ascertain whether that it is indeed the case. The survey had multiple objectives related to values and public preferences in water governance more generally; in the present paper, the focus is placed on one section of the survey which analysed public perceptions and preferences for governance-related values.

Sampling

Following Turner (2003), household selection was fully randomised using probability proportionate to size sampling at two stages: first, at the level of census tracts (i.e. small geographical units typically equivalent of one neighbourhood, or part of a neighbourhood), and second, at the household level, producing a random selection of 40 census tracts, and 30 addresses within each census tract, using sample frames from the 2010 census of the Brazilian Institute for Geography and Statistics (IBGE, 2011). Within-household respondent selection was determined by households themselves, due to practical considerations as is established practice in survey research (Gaziano, 2005). A comparison of the proportions of selected socio-demographic variables within the sample and the general population in the area indicated that the sample approximated representativeness of important socio-demographic variables (see Table 1).

Table 1: Representativeness of sample

		Sample	Upper Paraguay River Basin (UPRB)
Location	Urban	92.9%	89.3%

	Rural	7.1%	10.7%
Gender	Male	40.6%	49.7%
	Female	59.4%	50.3%
Age	18-19	3.9%	5.2%
	20-24	8.6%	13.7%
	25-29	8.3%	13.4%
	30-34	11.5%	12.6%
	35-39	9.4%	11.1%
	40-44	9.7%	10.0%
	45-49	9.9%	8.7%
	50-54	8.6%	7.3%
	55-59	9.7%	5.6%
	60-64	6.6%	4.3%
	65-69	6.7%	3.1%
	70-74	4.0%	2.2%
	75 or more	2.9%	2.8%
	Refused	0.1%	-
	Household size	1 resident	7.6%
2 residents		23.0%	21.7%
3 residents		25.1%	24.2%
4 residents		21.0%	22.1%
5 residents		12.7%	11.3%
6 or more residents		10.6%	7.9%
Formal education	No formal schooling / incomplete primary school	28.6%	42.2%
	Primary school complete / incomplete high school	17.6%	17.0%
	High school complete / incomplete higher education	38.0%	29.5%

	Complete higher education	15.8%	11.4%
Occupational status	Economically active	50.8%	69.3%
	Not economically active	49.2%	30.7%
Monthly household income	Up to 1 minimum salary	8.6%	16.7%
	1-2 minimum salaries	34.7%	20.5%
	2-5 minimum salaries	33.8%	36.5%
	5-10 minimum salaries	10.0%	16.4%
	10-20 minimum salaries	5.2%	6.8%
	More than 20 minimum salaries	1.1%	3.1%
	Refused	4.8%	-
	Don't know	1.7%	-

Survey design and application

No generally established survey instruments for eliciting the public's views on governance-related values exist. Thus, a new instrument was developed for the purposes of this study, which should be considered as a first step towards developing more standardised survey instruments as they already readily exist e.g. for people's environmental values (e.g. Katz-Gerro, Greenspan, Handy, & Lee, 2017) or are being developed for public values, i.e. people's expectations regarding the behaviour of government officials (e.g. Witesman & Walters, 2016).

The formulation of suitable survey items to elicit people's governance-related values was inspired by qualitative data on governance-related values originating from 24 semi-structured interviews with stakeholders from the water sector in the same study area (analysed in Schulz, Martin-Ortega, Ioris, et al., 2017). Respondents there highly valued e.g. social justice or order/rule of law, whereas other governance-related values were considered much less important, e.g. transparency. Consequently, the list of survey items below seeks to operationalise the most prevalent governance-related values as identified in the previous qualitative study (Schulz, Martin-Ortega, Ioris, et al., 2017). It also underwent several rounds of revisions, following multiple tests with members of the public in the case study area. Table 2 presents seven survey items that represent one governance-related value each. Due to time constraints regarding overall interview length, only seven items were used. Moreover, due to the fully exploratory nature of the research, the items were not formulated in view of a particular existing theory. The elicited data was instead intended to serve as input into an exploratory factor analysis.

Table 2: Survey items used to measure governance-related values

Governance-related value	Survey item
Sustainability	Think about the impact for future generations.
Economic efficiency	Not to waste public money.
Democratic legitimacy	Follow the opinion of the majority of the population.
Evidence-based policy-making	Consult studies and experts.
Social justice	Care about the poor and minorities.
Public participation	Ensure the political participation of those that are affected.
Order/rule of law	Everyone follows the law.

In practice, survey items of Table 2 were introduced to survey respondents as follows: “Now I would like to know your opinions about some principles that could guide the authorities when they take decisions about water. Please tell me which of the following principles should be the most important for the authorities, in your opinion?” This initial question mainly served to familiarise respondents with the survey items. Table 3 shows how often each survey item was selected as 'most important'. The item labelled 'sustainability' was the most popular one, followed by 'economic efficiency', 'order/rule of law' and 'social justice'.

Table 3: Most important governance-related values (frequency of selection; n=1067; refused 0.1%)

Sustainability	Economic efficiency	Democratic legitimacy	Evidence-based policy-making	Social justice	Public participation	Order/rule of law
35.4%	23.1%	7.7%	6.0%	10.4%	2.1%	15.2%

In a second step, respondents were asked to rate the respective importance of principles (i.e. governance-related values) on a scale from 1 (not important) to 5 (equally important as most important principle). Respondents were deliberately asked to consider *relative* importance of survey items, rather than absolute importance, to avoid that they would simply assign maximum importance to all principles (which would be a legitimate answering strategy, considering that all principles characterise good governance). While the context of water governance was mentioned to all respondents and was evident from other sections of the survey not analysed here, it can be assumed that many respondents instead expressed their views about governance in general. Also, it should be noted that all governance-related values are of course much more complex and multi-faceted than can be described in a single sentence, this oversimplification being an unavoidable consequence of survey research.

Exploratory factor analysis (EFA)

The analysis of selection frequencies represents of course only a brief snapshot of public preferences for governance-related values. Responses from the relative ranking exercise that followed the initial question about the most important governance-related value were analysed with exploratory factor analysis (EFA) techniques. This statistical method serves to establish whether answers to groups of survey items are the result of certain latent variables that characterise the respondent (the most well-known example being answers to IQ tests that measure the latent variable intelligence) (Fabrigar, Wegener, MacCallum, & Strahan, 1999; Spearman, 1904). In the present case, the objective of this fully exploratory procedure was to verify whether the listed survey items could be grouped into several latent variables, which could be interpreted as governance-related values. The item labelled 'public participation' above was eliminated from the analysis as interviewers reported some confusion among survey respondents about its meaning (which may also explain why it received the lowest approval, see Table 3).

To perform the EFA, IBM SPSS (v.22) was used, with principal axis factoring (also known as principal factors) as a factor extraction method. This extraction method is less prone to improper solutions and does not require distributional assumptions regarding the data (Brown, 2006; Fabrigar et al., 1999). It is also more sensitive in the extraction of weaker factors and everything else being equal, almost always outperforms other extraction methods (de Winter & Dodou, 2012). To determine the number of factors, the scree test was employed (Brown, 2006). It requires evaluating a plot of initial eigenvalues against the number of factors, to determine the last substantial decline in the magnitude of eigenvalues. In the present case, this was the case at around 0.9, which produced three latent variables. Table 4 shows the pattern matrix (rotated with 'promax' with Kaiser Normalisation, i.e. simplifying the interpretation of the matrix using oblique rotation that allows factors to intercorrelate).

While there is a never-ending debate about appropriate cut-off points for factor loadings (Peterson, 2000), it appears appropriate to assume that two items each measured one latent variable, as factor loadings are reasonably high for two survey items each, and low for remaining items. Factor 1 was named 'democratic governance-related values' as the constituting survey items emphasise the role of members of the public in governance. Factor 2 was named 'scientific governance-related values'. It emphasises intergenerational aspects/the longer term, as well as the role of experts. Sustainable governance typically relies on some form of expert input to determine long-term impacts of decisions, so the label 'scientific governance-related values' seeks to capture this common element between the two survey items, even if caring for future generations (as per the 'sustainability' survey item) may evidently also often be independent of expert input. Factor 3 was named 'economic governance-related values' as the respective survey items are of relevance to business and the economically active (not wasting funds, and maintaining the rule of law/order). The labels are given for convenience only and are not expected to represent a perfect fit, which is normal in EFA as one cannot anticipate which items are going to jointly form latent factors (hence 'exploratory' as opposed to 'confirmatory' factor analysis).

Table 4: Exploratory factor analysis (EFA) of survey items

Governance-related value items	Extracted factors		
	1 (Democratic governance-related values)	2 (Scientific governance-related values)	3 (Economic governance-related values)
Sustainability	.020	.423	-.051
Economic efficiency	.053	-.057	.350
Democratic legitimacy	.547	.092	-.089
Evidence-based policy-making	.029	.345	.107
Social justice	.448	-.086	.191
Order/rule of law	-.053	.137	.389

The structure resulting from the performed EFA is presented in Figure 1. The statistical robustness of this structure was further assessed with confirmatory factor analysis (CFA) techniques (see appendix). Results of the CFA suggested that the six statements do indeed measure three different factors (i.e. democratic, economic, and scientific governance-related values) with two statements each, as visualised in Figure 1.

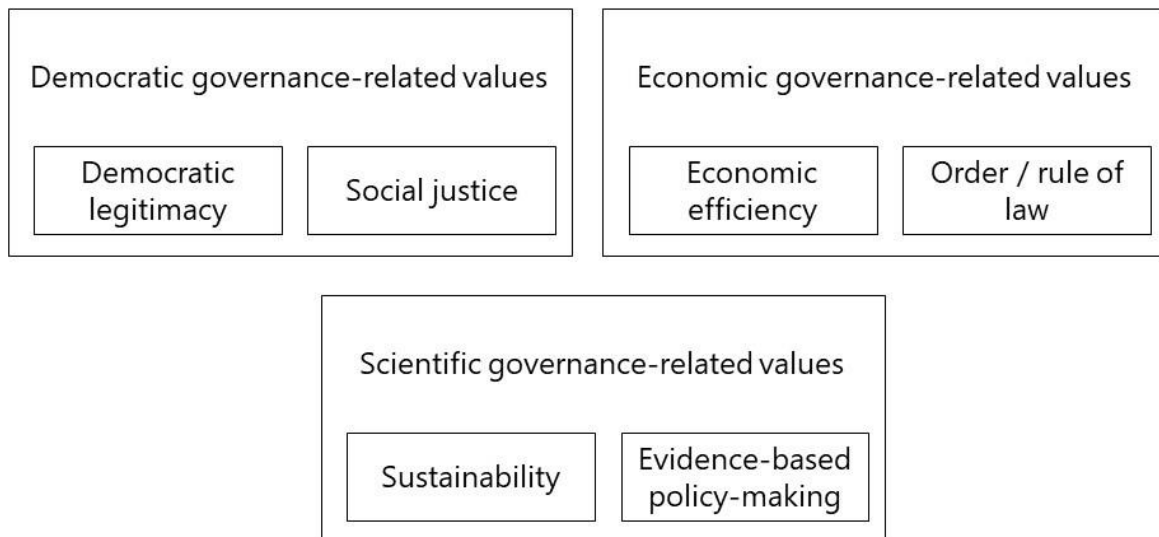


Figure 1: Dimensions of good water governance: The empirical structure of governance-related values

Discussion

Are there universals in the content and structure of governance-related values, i.e. in the dimensions of good water governance? The EFA (and CFA) presented here represent an important first step towards developing a measurement instrument for the quantitative empirical study of governance-related values. Given that all fit indexes signal good model fit, one can have reasonable confidence that in the mind of the public, indeed certain values are more closely related to each other than others, even if the findings are evidently bounded by the selection of survey items, and further empirical research on the topic is needed before any 'final' conclusions can be made.

The grouping that emerged from the empirical study presented here suggests the existence of three types of governance-related values, namely democratic, economic, and scientific governance-related values (other labels are of course conceivable). This is a remarkable finding in the sense that it is conceptually close to Hood's early (1991) classification of administrative values into three groups (listed in the literature review above). Democratic governance-related values are conceptually close to Hood's (1991) theta-type values, economic governance-related values are close to sigma-type values, and scientific governance-related values are close to lambda-type values. Hood (1991) had developed his value classification based on the available public management literature of his time, whereas the findings here are the result of empirical fieldwork with members of the general public in a region in the interior of Brazil in 2016. With some caution, one could thus indeed hypothesise that there are universal aspects to governance-related values beyond good water governance, just as they have been identified for people's personal values already (Schwartz et al., 2012).

There are some methodological limitations to the empirical example shown here, not least the fact that a larger set of survey items would have been desirable to increase statistical robustness. Furthermore, empirical measurement via quantitative survey instruments unavoidably goes along with a simplification of concepts. Here, for example, democratic legitimacy as a component of democratic governance was measured with a statement on majority rule, but while this is one key element of democratic legitimacy, other strategies are conceivable, such as the introduction of checks and balances into the political system or free deliberation as Bekkers and Edwards (2007) point out. Also, finding governance-related values to have a similar structure to the values Hood (1991) had identified is a mixed blessing: on the one hand, it gives relevance to the findings far beyond water governance; on the other hand, it is unclear whether there are any specific differences for governance-related values within the water sector. Further empirical research with a sample of water professionals only would help address these questions.

Some scholars distinguish between values related to substantive choices and those values that characterise the process aspect of governance (e.g. Kooiman & Jentoft, 2009); Weihe (2008) calls these material and procedural values. In a similar vein, it would be conceivable to divide governance-related values into process-based values (such as democratic legitimacy) and outcome-based values (such as sustainability), where the emphasis is placed either on the ways decisions are taken, or on the actual results of those decisions. Some conceptual parallels may be drawn e.g. to moral philosophy, where deontologists give moral priority to processes and consequentialists favour a focus on outcomes (O'Neill, Holland, & Light, 2008). However, such a distinction does not apply to the empirical grouping found above, as e.g. sustainability as an outcome-based governance-related value and evidence-based policy-making as a process-based governance-related value fall into one

category. This suggests that relations between various governance-related values depend on a different set of commonalities.

Conclusion

Research on governance-related values in water governance is often written from an implicitly or explicitly normative perspective. This includes case studies on individual governance-related values such as sustainability, social justice, or economic efficiency; lists of governance principles that organisations from the water sector should ideally adhere to; and the small, but growing field of water ethics. The joint message of these literatures is that governance-related values are a highly relevant concept to enhance our understanding of what makes good water governance. However, there is a lack of systematic, empirical research on the values that characterise good water governance from a more analytical perspective. This could seek to identify which governance-related values are held by members of the public in the first place (i.e. which normative positions they prefer), and whether there is a universal structure of governance-related values, analogous to the universal structure of personal values that was found by social psychologists across cultures (Schwartz et al., 2012). To do so, quantitative research methods and statistical analyses are necessary.

Using data from a household survey from Brazil as an example, the present paper illustrates how such a measurement instrument for governance-related values in water governance could look like. It presents some first insights into the potentially universal structure of governance-related values as three groups of governance-related values were identified using exploratory and confirmatory factor analysis (EFA and CFA), namely democratic, economic, and scientific governance-related values. The findings should be seen as a starting point for further empirical research and academic debate on governance-related values as dimensions of good water governance, as well as their interrelationships and structure in the mind of stakeholders and the general public. They may also be potentially relevant and apply to environmental governance more generally.

While at this stage, the findings presented here are primarily of academic interest, they do also have important policy implications, not least for the water governance agenda. As noted by Ingram (2011), the global water governance sector has a history of endorsing various 'panaceas', such as Integrated Water Resource Management (IWRM) (or nowadays nexus-thinking), which entails the risk of losing sight of those value dimensions that are not represented in the dominant paradigm at any given time. The results of the present study echo Ingram's (2011) comments, as they suggest that there are several distinct dimensions to what makes good water governance, and a focus on any single paradigm would likely overemphasise some values, and overlook others. Taking into account value pluralism with integrated valuation approaches (Jacobs et al., 2016) thus appears to be a promising way forward to incorporate the multiple dimensions of value that underpin water governance in practice.

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Appendix: Confirmatory factor analysis (CFA)

To evaluate the quality of the measurement instrument obtained via the exploratory factor analysis (EFA), a confirmatory factor analysis (CFA) was performed using the lavaan package in R (v. 0.5-23.1097). A CFA allows to establish construct validity (Brown, 2006), i.e. one can determine whether a number of survey items do represent separate latent variables (in the present case the three types of governance-related values listed in Table 4). Missing cases were deleted listwise, which affected less than the 5% threshold that Garson (2015) recommends. Having ordinal data, polychoric correlations were employed for the analysis, which assume that an underlying continuous variable is measured in a number of discrete categories (Garson, 2015), a plausible assumption for people's values. Diagonally weighted least squares was used as a model estimation method, which is appropriate for ordinal data with sample sizes of around 1000 (Bandalos, 2014).

To evaluate fit of the measurement model (i.e. the survey instrument tested here), a combination of absolute and incremental fit indexes (model chi square, CFI, TLI, RMSEA, SRMR) was compiled as is widely recommended in the CFA literature (Brown, 2006; Garson, 2015; Kline, 2011). Table 5 shows resulting fit measures. All measures indicate good model fit (according to the widely used cut-off criteria by Hu & Bentler, 1999): chi square is significant (p-value above 0.05); CFI and TLI are above 0.95; RMSEA is below 0.06 (reported here with a 90% confidence interval following the recommendations of Kline, 2011); and SRMR is below 0.08. Given that RMSEA values are often falsely inflated with low numbers of degrees of freedom (even with large sample sizes) (Kenny, Kaniskan, & McCoach, 2015), an RMSEA as low as 0.009 should indicate that the measurement model is indeed appropriate. All factor loadings are above the recommended cut-off value of 0.4 (Stevens, 2009), and are statistically significant with a p-value of 0.000. Overall, the quality of the measurement instrument for governance-related values is thus acceptable, especially considering the exploratory nature of the research.

Table 5: CFA governance-related values

N (used)	χ^2	df (degrees of freedom)	p-value (χ^2)	CFI	TLI	RMSEA	90% conf. interv. (RMSEA)	SRMR
1055	6.480	6	.372	.999	.997	.009	.000 .042	.032
Latent variables								
Latent variable	Item/indicator	Estimate	Std. Err.	z-value	$P(> z)$	Std. Est.		
Democratic	Democratic	1 (fixed)						.561

governance	legitimacy					
	Social justice	1.263	.202	6.242	.000	.709
Economic governance	Economic efficiency	1 (fixed)				.584
	Order/rule of law	.891	.135	6.590	.000	.520
Scientific governance	Sustainability	1 (fixed)				.475
	Evidence-based policy-making	1.260	.338	3.725	.000	.598

Covariances

<i>Latent variable 1</i>	<i>Latent variable 2</i>	<i>Estimate</i>	<i>Std. Err.</i>	<i>z-value</i>	<i>P(> z)</i>	<i>Std. Est.</i>
Democratic governance	Economic governance	.244	.039	6.226	.000	.744
	Scientific governance	.123	.033	3.741	.000	.463
Economic governance	Scientific governance	.165	.044	3.739	.000	.596

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