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Finding Structure in Diversity: A Stepwise Small-N/Medium-N Qualitative Comparative Analysis Approach for Water Resources Management Research

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ABSTRACT: Drawing particularly on recent debates on, and development of, comparative methods in the field of comparative politics, the paper argues that stepwise small-N/medium-N qualitative comparative analysis (QCA) is a particularly suitable methodological approach for water resources studies because it can make use of the rich but fragmented water resources studies literature for accumulation of knowledge and development of theory. It is suggested that taking an explicit critical realist ontological and epistemological stance allows expansion of the scope of stepwise small-N/medium-N QCA beyond what is claimed for it in Ragin's 'configurational comparative methods (CCM)' perspective for analysing the complexity of causality as 'multiple conjunctural causation'. In addition to explanation of certain sets of 'outcomes' as in CCM's combinatorial, set-theoretic approach, embedding stepwise small-N/medium-N QCA in a critical realist ontology allows the method to contribute to development of theory on (qualitative differences between) the structures in society that shape water resources use, management and governance.

KEYWORDS: water resources, comparative method, critical realism

INTRODUCTION

The sphere of the natural and engineering sciences comprises a range of (sub-)disciplines dedicated to the study of water, including hydrology, the water focused parts of civil engineering, and agricultural water-use-related (sub-)disciplines.[1] Except for a long-standing connection with economics,[2] the natural and engineering sciences have had little connection with the social sciences and humanities till relatively recently. Though there are, to our knowledge, no long-standing (sub-)disciplines in the humanities and social sciences specifically dedicated to water, water resources have been central to the work of some influential social theorists. Notable examples are Clifford Geertz's work on the irrigation society of Bali, and Karl Wittfogel's theory of hydraulic societies and oriental despotism. History as a field has a long-standing interest in the study of water in societal development. It may be the only social

[1] The *Appendix* of Mollinga and Gondhalekar (2012) is a note on comparative water and health research by Prof. David Bradley.

[2] Functional since colonial times for calculating costs and benefits of the infrastructural works that water resources engineers were assigned to design and build by state governments and the corporate sector.

science and humanities subject field that has an organised international network focused on water resources.[3]

Since roughly the 1970s, connection of the two broad areas of policy-related and academic water scholarship has been sought explicitly through the combined mobilisation of technical and social sciences in international development programmes. The post-1945 'modernisation' development paradigm was conceived by its proponents as an economic and technical (infrastructure) project, with technological innovation releasing the growth potential. 'Water resources development' in this perspective meant the building of new (large-scale) infrastructure for agricultural and hydropower production and productivity enhancement. The perspective started to be questioned when 'planned development' produced manifest contradictions, in relation to equity/distributional justice, ecological sustainability and other aspects, and the implicit cultural, institutional, and political dimensions of 'modernisation' came to the fore and under critique. Notions like community development, participation, and later rights and governance became important dimensions of water resources development thinking and policy intervention as responses to these contradictions and implementation problems in water resources development.

What this has meant for water studies is that since the 1970s a large body of water research has been funded in close connection with national, regional (notably the European Union) and international development aid/assistance/cooperation programmes,[4] while quite a bit of the independent social science academic research on water resources takes these development efforts as its subject matter.[5] Part of this expanding body of water resources studies has been a current of comparative analysis, both in the social science academic domain and in the more instrumentalist policy domain, particularly in the 1970s, as will be briefly discussed below. Our review of that literature concludes that while comparison may have a long tradition in water resources management research, it has been mostly undertaken without much rigorous and explicit articulation of comparative method. Predominant is what we will call 'loose' or, following Wescoat (2009b), 'implicit' comparison. This paper aims to make a case for invigorating systematic comparative analysis in water resources management studies, particularly critical water studies (cf. Mollinga, 2008), and proposes a specific approach.

The paper is structured as follows. Following this introduction, in section two we discuss three narratives that underpin this advocacy of invigoration, and relate these water studies specific considerations to the debate in the field of comparative environmental politics. In section three we summarise our review of the comparative water studies literature. In section four we present our approach to stepwise small-N/medium-N qualitative comparative research, and present our main argument that current approaches aimed at explaining 'outcomes' can be pushed further in their capacity to contribute to theory development. Section five concludes.

NARRATIVES UNDERPINNING A RENEWED COMPARATIVE ENDEAVOUR

Before coming to our main argument about the specific comparative approach that we propose, we explain the concerns and considerations that drive our effort. The following three narratives underpin this paper's advocacy of systematic comparative analysis in water resources studies. The first narrative is related to the object of the research, the characteristics and challenges of contemporary water

[3] The International Water History Association, www.iwha.ewu.org, founded in 2001.

[4] To illustrate, Wescoat (2002: 322) writes that a generation of scholar-practitioners, such as Coward (1980), Freeman (1989), Lansing (1991), and Uphoff (1992), working for development organisations like the Ford Foundation and the US Agency for International Development (USAID 1992) advocated complete reform of water sector investment programmes in Asia.

[5] As, for example, in analyses of Community Based Natural Resources Management programmes, which in the water sector have taken the form of (donor-supported) participatory irrigation management, watershed development, and community based/led total sanitation, amongst others.

resources management; the second to the knowledge on that object, the characteristics and potentialities of (critical) water resources studies; and the third to the potential application or practical usefulness of comparative water research as critical engagement with 'mainstream' water policy and practice, to support the development of more contextualised approaches to water policy formulation and implementation. We subsequently relate these considerations to debate in the field of comparative environmental politics, where very similar concerns and emphases are found.

Characteristics and challenges of contemporary water resources management

One characteristic of water resources management is that its globalisation has intensified in recent decades, particularly since the early 1990s. The 1990s saw, with the end of the Cold War and the coming of age of environmental critiques in the 1992 Rio Earth Summit, the alignment of three 'big ideas' in a global discourse on water resources management.[6] These are the idea of the market, the idea of democracy (often phrased as 'good governance')[7] and the idea of sustainability. These ideas were assembled in the concept of IWRM (Integrated Water Resources Management), whose conceptual closure as a 'sanctioned discourse' happened around 2000.[8] The 'new paradigm' that emerged at the global level is supported by a set of global organisations, notably the GWP (Global Water Partnership) and several UN organisations, and elements of the paradigm are actively propagated through international development funding agencies and, for instance, knowledge organisations involved in capacity building (e.g. CapNet).[9] The process has generated a variety of global civil society and professional networks responses through organisations as diverse in orientation as International Rivers and the International Network of Basin Organizations.[10] The recent surge in attention to climate change, in debates on which water resources play a central role, has added to the perceived global nature of the 'water question', most recently popularly framed as a 'water security' question.[11]

This process of the globalisation of water policy and water governance discourse is complex on several counts. The global discursive space is inhabited by many different actors, moving on and across different levels, deploying different strategies, triggering different mechanisms of change, with causalities running in multiple directions. For instance, local water controversies have sparked and shaped global rule-making (in the form of treaties, covenants, standards, and other forms) through mechanisms like the WCD (World Commission on Dams) whose principles and guidelines are now (partly) incorporated at regional and local levels;[12] global water governance frameworks can shape local policy and action through loan conditionalities, but such 'imposition' may also be appropriated by domestic interest groups for their own purposes; lateral relations of nation-states in hydropolitical

[6] With water resources management we refer to freshwater management, for agriculture, drinking water and sanitation, industrial use, hydropower, navigation, and ecosystem services related to the ecological sustainability of wetlands, lakes, rivers and other waterscapes. We do not refer to the management of the seas. For detailed discussion of the argument summarised here, see Mollinga (2008).

[7] See Sending and Neumann (2006) on 'human rights as a normative master discourse' in the post-1990 period.

[8] The second World Water Forum was held in 2000, and is a convenient point in time for pinpointing the institutional consolidation of the IWRM discourse in this period.

[9] For an account of this globalisation process see Conca (2006); on transnational corporations and water privatisation see Robbins (2003).

[10] See www.internationalrivers.org/ and www.inbo-news.org/.

[11] On water security, see Zeitoun (2007) and Allouche et al. (2011).

[12] See the special issue of *Water Alternatives* on the WCD 3(2) June 2010 www.water-alternatives.org.

negotiations can be shaped by global mediation, law and policy paradigms, but often perhaps depend more on regional political and economic conjunctures; and so forth.[13]

The global water discourse is full of contradictions – a second instance of complexity. The alignment of the three 'big ideas' in one concept or framework as mentioned above is problematic because the individual ideas as well as their connection are intensely contested. This is evident for instance in the competing overall framings of the 'water question': as a question of scarcity and (in)efficiency, as a question of governance, as a question of security, as a question of equity and justice, and/or as a question of imminent ecological disaster. In this sense, the global water discourse is a typical instance of the broader process of emerging global environmental governance frameworks, and the debates and controversies associated with these.[14] As such, it is an entry point for interrogating the nature of contemporary development.

A third source of complexity is that the globalisation of water policy, governance and discourse is associated with other aspects of globalisation, notably economic globalisation, one of whose dimensions is the declining and/or changing role of the state in fostering, leading and regulating economic development.[15] Water resources management is an inherently localised practice. Concrete water use takes places within the physical context of basins, aquifers and landscape units, whose scale is only limitedly extended by inter-basin transfers. Water is not a commodity that is traded or transported globally on a significant scale.[16] Economic globalisation of water use, management and governance is mostly associated with the commoditisation of water services of different kinds, for example management contracts in urban drinking water supply, rather than with the water itself becoming an actively traded commodity.[17] Though the 'problemsheds' of water resources management usually extend well beyond the physical boundaries of water use, water resources management is a terrestrially and territorially grounded, but thus not bounded, practice. Historically, water resources management has played an important role in nation building,[18] and the nation-state remains the major institutional framework for water resources management, also when that is increasingly embedded in processes of globalisation.

This incomplete sketch of different aspects of the globalisation of water resources management suffices to suggest that there is a puzzle to unravel. It is not self-evident what the seemingly forceful process of globalisation means for water resources management, in different places, and at different levels, and what its attributes, modalities, effects and impacts are. Thus, comparative analysis seems a logical and necessary way forward to address challenges of contemporary water resources management.

Characteristics and potentialities of (critical) water resources studies

The second narrative that aims to justify the relevance of more systematic comparative research on water resources management starts from the state of the art of water studies and the question of

[13] The phenomenon of 'glocalisation' has attracted much academic attention, in water studies as elsewhere (Swyngedouw, 2004). On the 'politics of scale', see Lebel et al. (2005).

[14] See Stone (2008) on the 'disjointed' and 'order and chaos' character of global environmental governance.

[15] See Newell (2008) on the institutional and statist 'fix' of a lot of analysis of the (politics of) global environmental governance, and an argument for explicit embedding institutional/policy/governance analysis in a political economy framework that takes global(ising) economic relations seriously.

[16] The trade in bottled mineral water is a miniscule part of global freshwater use. Virtual water trade is indeed virtual.

[17] On the complexities of the commoditisation of water, see for instance Molle and Berkoff (2007) on water pricing, Moore (1989) on irrigation, Bakker (2003) on water supply privatisation; on 'water grabbing' see the special issue of *Water Alternatives* 5(2) June 2012 www.water-alternatives.org.

[18] A few examples are Blackbourn (2006) for Germany; Worster (1985) for the USA; and Whitcombe (1972) and Stone (1984) on the colonial experience of India. For grand theory, see Wittfogel (1957).

accumulation of knowledge. The inherently localised nature of water resources management has produced a series of localised literatures on water. In the European languages sphere, the English, French and Spanish literatures are large with quite distinct bodies of water scholarship, reflecting their situatedness, notwithstanding increasing interaction between them, which itself is one aspect of globalisation. There are many other smaller literatures adding to the diversity. Other sources of the compartmentalisation of water studies are the different academic disciplines/subject fields in which water is studied, the different scientific paradigms through which it is approached, and the different purposes of water studies (say the instrumental, intervention-oriented purpose versus the reflexive, critique-oriented purpose).[19] Despite the richness of these various sets of literatures, there is relatively little learning happening across the boundaries of the compartments, even in the tradition of comparative water studies (see Mollinga and Gondhalekar, 2012 for a detailed review; a summary is given in section three).

In our assessment, water studies are characterised by both overgeneralisation and over-contextualisation. With the former we have in mind positivist approaches like those prevalent in the economic and engineering sciences (but by no means limited to these) that look for 'Humean constant conjunctions' allowing generalised explanation.[20] An example of over-contextualisation constitutes ethnographic studies of local water management situations as prevalent in anthropology (but by no means limited to that field) that argue, explicitly or implicitly, for contextual uniqueness, against positivism. Like most dichotomies, this depiction caricaturises, but does serve to illustrate the puzzle of how, in research, to take contextuality and situatedness seriously, while maintaining the prospect of accumulation of knowledge and development of theory without succumbing to ahistorical universalisation.

The two polar forms of research sketched are accompanied by quite a bit of 'loose comparison' undertaken to learn from the diversity of experiences. The most sophisticated and rigorous attempt at identifying 'Humean constant conjunctions' is probably Ostrom's work on farmer-managed irrigation that led to identification of a set of 'design principles' for self-governing irrigation institutions (Ostrom, 1990, 1992). Very common in water studies are collections of case studies in edited volumes with an introduction and/or conclusion aiming to derive general insights or set comprehensive agendas, usually without an explicit and rigorous methodological framework for comparison. We conclude that there is, apparently, a strong desire for practical as well as conceptual learning, a lot of 'implicit comparison' (Wescoat, 2009b), but little in the way of explicit, rigorous comparative methods to facilitate such learning.

The accumulation of knowledge, development of theory and learning puzzle just sketched is by no means unique to water studies, as we will show below, and neither is the suggestion that a comparative approach to research may help to resolve it an idea that originates from the water resources domain. We do want to suggest that the inherently localised nature of water resources management as now set in a context of intensifying globalisation provides excellent ground for growing a new branch of comparative analysis. We are tempted to propose that the nature of the object demands it, while the rapidly increasing volume and the diversity and richness of water studies allow it.

[19] The analysis of 'compartmentalisation' can be further developed from philosophy of science and sociology of knowledge perspectives, but that is beyond the scope of this paper. On the logic of advocating *interdisciplinary* water studies, see Mollinga (2008, 2010a). The instrumental/reflexive distinction refers to Burawoy (2005).

[20] Constant conjunction is "Hume's term for the relation that exists when the occurrence of an event of one kind A is invariably attended by the occurrence of an event of another kind B. (...) The experience of constant conjunction between two or more kinds of event conveys to our mind the idea of a necessity connection between these events, and leads us to label the precedent events as causes and the attendant events as effects. On the basis of such an experience, when we observe A, we infer the existence of B. Thus Hume claimed that our idea of causation is derived from constant conjunction" (Blackwell Reference Online www.blackwellreference.com/public/tocnode?id=g9781405106795_chunk_g97814051067954_ss1-183).

Standardisation and contextuality in water policy approaches

A third narrative to justify a comparative approach to water research addresses a recurrent dilemma and dichotomy in water policy theory and practice. Characteristic of water resources policy approaches is that they (implicitly or explicitly) adopt linear, rational planning conceptions of formulation, implementation and evaluation of policy interventions (see Mollinga et al., 2007). The concrete consequence of this is standardisation in policy models and approaches. One of many examples is how the Government of Andhra Pradesh, India enacted the establishment of Water Users Associations (WUAs) in irrigation systems through the Andhra Pradesh Farmer Management of Irrigation Systems (APFMIS) Act, under which about 10,000 WUAs were established with a single format of bye-laws and regulations (Oblitas and Peter, 1999). Linearity was further evident in the top-down, centralised nature of the implementation of the irrigation reform policy.

An example in the policy sphere of generalising as a means to learn from a diversity of experiences is the 'IWRM toolbox' as a learning instrument for water resources decision makers (www.gwptoolbox.org). This is basically a set of generalised descriptions of specific experiences deemed to be 'successful' and an effort to make that 'success' transferable to other places. Another example in the context of policy development is efforts to identify 'conditions for success', say for establishing effective WUAs, by deriving such conditions from a comparison of a series of cases (Subramaniam et al., 1997).

On the other side of the policy/intervention/change spectrum we find the highly localised approaches of, for example, NGOs focusing on village development. Critiques of standardised policy approaches are often cast in terms of their neglect of 'contextual factors', calling for more local specificity and flexibility in implementation approaches (for a review of issues, see, e.g. Menon et al., 2007). Debates on what would be a 'right level' of specificity and contextuality in water policy, to the extent that it exists, are caught in a deadlock of polarised positions, notwithstanding convincing critiques of both standardisation and the glorification of 'community' (cf. Mosse, 2003, 2005). The deadlock is consolidated by institutional, political and other interests in maintaining dichotomous positions (Mollinga et al., 2007; Mollinga, 2010b). What we propose is that comparative research may be an avenue for supporting attempts at contextualising policy approaches and policy instruments in a way that avoids either extreme. Comparative research aims to identify significant differences (qualitative differences in structural configuration, as we phrase below) of different situations. Thereby comparative research can potentially help to define 'relevance domains' for specific policy interventions, or, in reverse, help to design relevant policy approaches and instruments for given situations, when the structural specificities of such situations are better understood.

Comparative environmental politics

To conclude this section and to reinforce the argument presented through the three narratives above, we briefly discuss recent thinking on the comparative method in the field of environmental politics as a way to academically contextualise our own approach. Steinberg and VanDeveer (2012) in their introductory chapter to the edited volume *Comparative Environmental Politics, Theory Practice, and Prospects* address themselves to both academics and practitioners when they state that "[t]o better understand the political forces shaping social responses to industrial chemicals, forest management, and numerous other environmental problems surely counts among the most important intellectual challenges of our time" (ibid: 5).[21] They argue that "comparative inquiry expands the political imagination" (ibid: 8) bringing into view new possibilities. In the concluding chapter of the collection the editors position comparative environmental politics as, using Skocpol's (2003) term, a 'doubly engaged

[21] Their discussion of the fragmented nature of the field of environmental politics research identifies very similar sources of fragmentation to those we identified for water studies.

social science': "the pursuit of theoretically informed research that stays in close conversation with real-world problems" (Steinberg and VanDeveer, 2012: 372).[22] Analytically, "[s]ystematic cross-national comparison helps us to understand the importance of *political context*" (ibid: 8). On this contextualisation the authors take a position very similar to the critical realist ontology that will be discussed below when they state that "[c]omparative research, at its best, occupies [a] position between theoretical generalization and an appreciation for the importance of context" (ibid: 9), and refer to Rose's (1991) notion of 'bounded variability'. "Neither sweeping generalizations nor an endless stream of unique descriptive case studies will produce accurate or useful knowledge about environmental politics around the globe" (Steinberg and VanDeveer, 2012: 9). Steinberg and VanDeveer emphasise causal analysis for getting a handle on 'complexity' by developing appropriate theoretical tools,[23] and they note the enduring relevance of domestic (national) policy under globalisation (ibid: 13-15). "As a window into broader processes of globalization, the global spread of environmental concerns demonstrates that declining national insularity implies something infinitely more nuanced than homogeneity" (ibid: 4-5).

Methodologically, Steinberg and VanDeveer's volume is pluralist, with the contributing authors giving more or less attention to explicit specification of the comparative method used. De Meur and Berg-Schlosser (1994: 193-4, referenced in Levi-Faur, 2004: 196) suggest that disregard for methodological issues seems to be too frequent in comparative research. This is partially indicated by repeated references to methodological studies from the early 1970s in current comparative research, and can be partly attributed to the fact that methodological training in the political sciences and sociology is primarily oriented to statistical training (Levi-Faur, 2004: 196). However, with the recent development and formalisation of 'configurational comparative methods' (Rihoux and Ragin, 2009; see section four below), this may have become too harsh an assessment.

Steinberg and VanDeveer (2012: 395) note that comparative environmental politics has a huge geographical gap as regards studies of countries and processes in the South. Thus the recent advances in methods for qualitative comparative analysis (QCA) still need to be brought into fields like resource geography and water studies, which this paper aims to contribute to.

COMPARATIVE ANALYSIS IN WATER RESOURCES MANAGEMENT RESEARCH

This section highlights some of the main features of the extended review of comparative approaches in water studies as presented in Mollinga and Gondhalekar (2012). In that review we distinguish between the following debates on comparative method in the social sciences generally: qualitative and quantitative comparative approaches, small-N and large-N comparative approaches, and combined methods approaches. Though a useful device for organising the discussion, as each of these types has strong proponents (and opponents), in practice much comparative research has features of both qualitative and quantitative approaches, and a combination of small-N and large-N approaches is commonly and actively sought to make use of the benefits of both.

Much *qualitative research* is based on the idea of 'comparison by contrast' where cases are chosen by researchers specifically for the purpose of illustrating a particular issue. This may be a rigorous form

[22] What theory can offer practice and what practice can offer theory is discussed on pp. 377-391.

[23] "To be theoretical in orientation therefore means two things: to draw on and contribute an identifiable conversation in the research literature, and to attempt to project beyond the data at hand, crafting solutions that can be tested in other settings. (...) This approach allows us to ask, 'What is this a case of?'" (Steinberg and VanDeveer, 2012: 7). On pp. 393-394 the editors advocate, referring to Charles Tilly's work, mechanism-oriented scholarship: "an emphasis on recurrent causal mechanisms – cause-and-effect relationships that appear with frequency in diverse political settings – promotes the growth of a cumulative research program without resorting to simplistic, one-size-fits-all explanations" (ibid: 394). We develop this perspective further in our discussion of stepwise small-N/medium-N QCA below.

of qualitative comparison in the sense of the purpose of comparison being clear and explicit, and attributes of cases to be compared defined (forming the basis of their selection, as well as informing the mode of analysis). An example of this is Kissling-Naef and Kuks' (2004) analysis of the evolution of national water regimes in Europe, including the Netherlands, Belgium, France, Italy, Spain and Switzerland.

The choice of cases in qualitative approaches is, however, also often relatively arbitrary depending on data availability, feasibility of fieldwork, or the experience and preference of the researchers rather than clearly explicated selection frameworks. For instance, Mollinga and Bolding (2004) collect a number of national cases of irrigation reform to illustrate contestation in the politics of water. In trying to deduce common processes and questions, the editors collect case studies from South Africa, the Philippines, Indonesia, Zimbabwe, Pakistan, and one Indian State, which, according to them, form a reasonable cross-section of irrigation reform processes, but is also a selection that is clearly constrained by available case analyses and authors' 'willingness to write'. Despite contestation (of irrigation reform policy) being demonstrated in all the collected cases, this type of study constitutes a simple juxtaposition of cases. It is this type of 'loose' comparison that characterises a large part of comparative water studies.

Quantitative studies in the water sector tend to take a statistical analysis and econometrics-oriented approach, often based on numerical data or socio-economic data captured by questionnaire surveys. The quantitative approach may use a small or a large number of cases. There are various ways of case study selection, with varying degrees of rigour of the analytical framework. As in the qualitative approach, in the quantitative approach cases may be chosen on the basis of illustrating contrast, for example using a limited number of cases, but with a large number of samples within this limited number of cases in order to warrant a quantitative approach.[24] Another method is to collect a large number of similar cases and compare all of these to each other.[25,26]

Small-N analyses of two to three cases tend to be qualitative in nature as a statistical analysis is not viable without a larger number of cases or samples.[27] In the early period of policy-related research of the 1970s and 1980s, the first comparative works that emerged in water resources management research tended to be small-N, in order to seek out similarities and differences between specific cases to enable the deduction of policy implications. Comparative analysis on the basis of contrast in socio-economic contexts may illustrate socio-cultural,[28] East-West,[29] geographical,[30] or other contrasts.[31] The objectives of such studies are thus not 'generalisation' as conventionally understood in the positivist perspective.

[24] Kloezen and Garcés-Restrepo (1998) compare two sub-districts of the Alto Rio Lerma Irrigation District in Mexico at different system levels, to assess hydrological, agronomic, economic, financial, and environmental performances of irrigation systems.

[25] Bardhan (2000) conducts a quantitative analysis of the physical, institutional, and socio-economic determinants of cooperation in irrigation communities in South India.

[26] Ostrom (2001) conducts an empirical study of collective action in 150 Nepali Farmer-Managed Irrigation Systems.

[27] But note that quantitative is not the same as statistical – small and medium-N quantitative (case) studies without statistical analysis are quite possible (see for instance Meinzen-Dick et al., 2000).

[28] Radosevich and Kirkwood (1975, in Wescoat, 2002: 323) explore organisational alternatives for on-farm water management by compiling examples from the United States, Spain, Argentina, Turkey, and Taiwan.

[29] Wescoat elaborates several East-West comparisons: see Wescoat (1995) on Islamic water law, Wescoat (1997) on the Muslim contribution to water ethics, Wescoat (2002) on water rights, and Wescoat (2009a) on urban water access.

[30] Maass and Anderson, in *… and the Desert Shall Rejoice* (1978), seek to draw generalisation from a comparison of case studies of irrigation systems in Spain and the United States.

[31] Wescoat cites Jacobs' comparison (1999) of modern development of the Mekong and Mississippi rivers, both of which had strong involvement of the US Army Corps of Engineers (Wescoat, 2003: 286-293).

Whilst *large-N* studies do not necessarily always address a *very* large number of cases, they do tend to use a form of quantification in order to capture the significant features of the similarities and differences between the selected cases and tend to search for overarching patterns. Many large-N studies aim to capture as comprehensive a picture as possible by using the maximum available number of cases and amount of data, often by utilising or expanding large existing data sets. As a large amount of data is required for quantitative studies, choice of cases is also often relatively arbitrary as it depends on availability of, or access to, existing data sets. An example of a study using large existing data sets and extending them for the purposes of the study is the work of Gleditsch et al. (2006) on water wars/conflicts which uses a database covering 251 river basins in the Middle East, North Africa and sub-Saharan Africa for the time span 1880-2001.

Studies that *combine qualitative and quantitative methods* seem to depart from either one or the other of the two approaches. An example of a study which starts from a qualitative perspective and adds quantification, is the study of Bressers and Kuks (2005). Examples of studies starting from a quantitative perspective and adding qualitative data are Ostrom (1990) and Van Koppen et al. (2002). In the former seminal work, a quantitative analysis, where data are translated into indicators, is coupled with a clear theory formation and policy significance objective. Based on this and other work Ostrom developed her Institutional Analysis and Development (IAD) framework (Ostrom, 2005).

The varied references in this section illustrate that comparative analysis methodology is used in a number of different types of water resources management research. It is applied to a number of academic disciplines' studies ranging very broadly in scale and methodology, from very small-scale studies comparing two villages to very large-scale studies comparing a large number of countries, using empirical or statistical data covering long time periods. However, the phrasing that water studies 'use comparative analysis' is often a bit of an overstatement. Many studies using comparison do not employ clearly articulated and operationalised comparative analytical frameworks, neither for case selection nor for analysis. It is only in a very few studies that there is clear evidence that the rigour of the comparison has been a major factor in the development of theory. We share Wescoat's conclusion that most comparative water research uses 'implicit comparison' rather than 'explicit comparison'. A sign of this is perhaps that there seems to be no collective and explicit reflection on the use of comparison and the comparative method in water studies.

With this assessment we now proceed to explicate an approach to comparative water studies that allows enhancement of comparative rigour and mobilisation of the rich diversity of water studies.

SMALL-N/MEDIUM-N STEPWISE QUALITATIVE COMPARATIVE ANALYSIS

In this section we discuss how Levi-Faur's approach to stepwise small-N/medium-N comparative research may be a useful approach to adopt for comparative (critical) water studies. As Levi-Faur (2005) reminds us, "methodologies are derivatives of ontologies", though not in a simplistic one-to-one derivation. Referring to Hall (2003) he argues that "[t]he deep divide in social and political inquiry is ontological rather than technical or instrumental" (Levi-Faur, 2005), and elaborates as follows:

> [t]o suggest, like Przeworski and Teune, that generality and parsimony of theories should have primacy over their accuracy is to assume that social reality is driven by only a few '*shakers and movers*' that are responsible for most visible outcomes in the political and social world. Consequently we might end up with ontology of 'simple' theories for a 'simple' world. But if one adopts a more complex ontology, and perceives social reality as a product of conjectural causality, then accuracy and intimate knowledge of one's case might be elevated to the same importance as the search for generalization. (…) Generalizations tend to fade when we look at the particular case (…) yet case analysis without an attempt at generalization is a mere anecdote (Levi-Faur, 2006: 371).

Levi-Faur's small-N/medium-N comparative analysis neatly fits the critical realist ontological and epistemological position which is our point of departure (Sayer, 1992; Archer, 1995; Mollinga, 2008).

However, apart from reasons of theoretical and philosophical preference and position, a pragmatic argument informs our choice of method. Three characteristics of the knowledge base provide a logic for a stepwise approach to theory formation and methodological development in comparative (critical) water studies. Firstly, for the themes and questions we are interested in focusing on, say, globalisation-localisation dynamics, no comparable data set is available (independent of whether the unit chosen would be nation states, river basins, policy processes, water sub-sectors, agro-ecological zones, or anything else). Secondly, given the multitude of literatures, developed in relatively self-contained ways, a high level of theoretical and methodological diversity exists, on top of the socio-material diversity of the multitude of grounded water resources management situations. Thirdly, in the more reflexive branches of water studies, from which this paper originates, (individual) case studies make up a significant part of the body of research. Critically minded water scholars have favoured case studies as a preferred method, while positivist approaches with large-N methodologies are looked upon with suspicion.[32]

We now proceed to discuss how the type of work required in stepwise small-N/medium-N qualitative comparative research approaches is suited to address fundamental questions of method in concrete terms, and can thus help to profile the 'methodological question' in comparative water studies – something that, we have argued, is not happening sufficiently at present.

Basic characteristics of stepwise small-N/medium-N qualitative comparative research

Levi-Faur advocates a 'medium-N' comparative research approach, which he defines as more than two and less than ca. 100 (given this range we prefer to refer to it as small-N/medium-N, but the exact terminology is obviously not the essential point). In developing his approach to comparative analysis, Levi-Faur (2004: 196) acknowledges a) the work of Ragin (1987, 1994, 2000) in striving to improve urgently needed methodological training in comparative strategies, b) the *Compasss*[33] research network's stress on the use of a configurational logic, the existence of multiple causality, and the importance of a careful construction of research populations, and c) the efforts for example by Bennett (2002) and Liebermann (2005) to promote multi-method research. Levi-Faur seeks to contribute to the search for techniques that strike a useful balance between 'depth and breadth' (Ragin, 2000: 22, referenced in Levi-Faur, 2004: 178) through a careful process of increasing the number of observations while staying in the framework of case-oriented research (Ragin, 1987, 1994, 2000 and King et al., 1994; referenced in Levi-Faur, 2004: 178), that is without compromising the strengths of case-oriented analysis.

The two interconnected key elements of Levi-Faur's small-N/medium-N approach are: 1) emphasis on the process of case definition and redefinition (as against simply case selection, as cases are not

[32] The strong presence of interpretative forms of anthropology, and social-anthropological method more broadly, and strong influence of 'constructivist' perspectives in critical academic water research, which is often conducted as counterpoint to (and critique of) more positivist and instrumentalist water policy and decision-making-affiliated research exercises, have made for some degree of qualitative/quantitative, small-N/large-N binarism. There seems to exist a stacking of paradigmatic, methodological, political and other dichotomies that do not necessarily neatly map onto each other. However, once such simplifications are taken for what they are and understood as cases of 'antagonistic interdependence' (Burawoy, 2005) opportunities for innovative research abound, or so we suggest. For instance, Veronica Strang (2005: 92), a *pur sang* (water) ethnographer suggests that in ethnographic analysis there is "a need for anthropological theory to recall its comparative foundations". She further states that "[i]t (...) seems remiss – and indeed irrational – to ignore [the] accumulated evidence [of numerous water related ethnographies from around the world] and cling to the political safety of culturally specific ethnography" (ibid: 93).

[33] 'Compasss' stands for Comparative Methods for the Advancement of Systematic Cross-case Analysis and Small-N Studies, see http://www.compasss.org/ .

'given'), and 2) the stepwise and systematic development (by adding and redefining) of cases in multiple ways, and thereby theoretically informed expansion of the scope of comparison.[34]

Research starts from one or more 'primary cases' on which in-depth knowledge and analysis are available. On the basis of this comparative research questions are formulated and comparisons carefully designed (as secondary and tertiary cases).

> In-depth analysis is a *sine qua non* for the *primary* cases on which theory was generated and where the primary purpose of the inquiry is to increase internal validity. Yet this in-depth knowledge is impossible, and even not desirable, for the *secondary and tertiary cases* against which the theory is examined in order to increase generalization. The element of explanatory surprise in one's research cannot be realized without imbalance in our knowledge, namely knowing more about one case than about another. Inference is a process of the examination of one case, which we know intimately, against another, about which we know much less. In this process we trade depth for breadth and dilute one type of knowledge for another. This also implies that cases vary in their 'inferential status' and that comparative analysis that rests on varying degrees of in-depth analysis is a legitimate scientific enterprise (Levi-Faur, 2005).[35]

'Careful design' of cases refers to the use of a four-box matrix as depicted in Figure 1, based on John Stuart Mill's methods for identifying causes (horizontal axis) and work on the logic of comparative analysis (vertical axis) by Przeworki and Teune (1970). Innovative is the idea that the matrix does not present a suite of approaches to be chosen from, but that the most fruitful approach to comparison is systematic 'travelling' through it. 'Systematic' here refers to a reasoned sequence in which first internal validity (stage 1) and then the external validity (stage 2) are increased, as depicted in Figure 2.

Figure 1. Four inferential strategies.

	Mill's Method of Difference	Mill's Method of Agreement
Most-Similar System Research Design	MDSD+MMD *(dealing with differences in similar cases)* Minimise variance of the control variables, maximise variance in the dependent variable	MDSD+MMA *(dealing with similarities in similar cases)* Minimise variance of the control and dependent variables
Most-Different System Research Design	MDSD+MMD *(dealing with differences in different cases)* Maximise variance of the control and dependent variables	MDSD+MMA *(dealing with similarities in different cases)* Maximise variance of the control, minimise variance in the dependent variable

Source: Levi-Faur (2005). Note: 'Variance' is to be read here as 'variation' or 'diversity in the values of', not as a technical statistical term.

As a first illustration of what this might entail practically, Figure 2 provides two examples: one drawn from Levi-Faur's work (on economic reform), the other being the reconstruction, within this framework,

[34] Though Levi-Faur does not make reference to Burawoy's work on the 'extended case method', Levi-Faur's framework could be considered a comparative analysis version of the 'extended case method' way of conducting theoretically informed case studies, thereby, arguably, significantly increasing the analytical depth of such case analyses.

[35] Use has been made of the online Word version of this chapter, and hence no page numbers are given.

of the first author's 20+ years research trajectory on (the political economy of) unequal water distribution in irrigation management.[36]

Figure 2. Case development in a small-N/medium-N comparative research strategy.

Internal validity ---------->

<---------- External validity	Mill's Method of Difference (MMD)	Mill's Method of Agreement (MMA)
Most-Similar System Research Design (MSSD)	**MDSD + MDD** *(dealing with differences in similar cases)* Unequal water distribution: three secondary canals from one South Indian system, one water-abundant (head), two water-scarce (tail), all exhibiting unequal water distribution. Economic reform: Anglo Saxon countries, opting for either liberalisation or nationalisation, with assumedly different outcomes. PRIMARY CASE	**MDSD + MMA** *(dealing with similarities in similar cases)* Unequal water distribution: additional canals from the same and similar South Indian system, across degrees of scarcity, all with patterns of unequal distribution as outcome. Economic reform: Anglo Saxon countries, all liberalising, with assumedly similar outcomes. PRIMARY CASE – extended
Most-Different System Research Design (MDSD)	**MDSD + MMD** *(dealing with differences in different cases)* Unequal water distribution: 1) Secondary canals from a South Indian, a North Indian and a Western Indian system with different water rationing rules, and different attempts at irrigation reform, with different patterns of inequality/differential access. 2) Secondary canals from a South Indian and a Khorezmian (Uzbekistan) system, with different infrastructure designs and different governance regimes, with different patterns of inequality/differential access. Economic reform: Anglo Saxon and continental European countries, with dissimilar educational policies, having assumedly different outcomes. SECONDARY/TERTIARY etc. CASES	**MDSD + MMA** *(dealing with similarities in different cases)* Unequal water distribution: 1) Secondary canals from an Indian and a Mexican system, with similar time-share based rationing rules, with similar patterns of inequality/differential access. 2) Secondary canals from a water-scarce system (Pakistan) and from a water-abundant system (Indonesia, Philippines), with similar irrigation reform programmes implemented, reproducing similar patterns of inequality/differential access. Economic reform: Anglo Saxon and continental European countries, with similar monetary policies, having assumedly similar outcomes. SECONDARY/TERTIARY etc. CASES

Source: Authors' compilation, based on Levi-Faur, 2004, 2005, 2006.

The top left box is the 'primary case', the intensive research that produced insight and conceptual modelling of a particular situation. In subsequent research the insight and model thus developed was tested in similar (concretely existing) situations (top right box) – is it robust across situations that one would expect it to be robust across, because they are of the same kind? If confirmed, the next step is to test the model in explicitly different (concretely existing) situations (lower left box and lower right box) by varying and keeping similar a variety of situational attributes. The strategy is to travel 'smartly': by strategically choosing similarities and differences and analysing them sequentially, more sophisticated

[36] One realisation of this exercise was that with a systematic method in hand, that irrigation research could have been done a lot faster. The method is presently applied in water governance PhD research – implying a time frame of three to four years. The time frame required strongly depends on what 'primary case' documentation is already available. We have suggested above that water studies are replete with well-documented 'primary cases'.

explanations can be generated (more sophisticated in terms of unravelling causal mechanisms and their interrelations), and coverage of certain explanations/conceptual models assessed better.[37]

Beyond explaining outcomes

Levi-Faur develops his approach as an effort at bridging the divide between the ontologies underpinning positivist generalisation and in-depth case study research – a long-standing dichotomy in the social sciences. He phrases the challenge to address as how to increase the number of cases while maintaining the advantages of in-depth case studies. This is basically a strategy to 'get the best of both worlds' (see, e.g. Levi-Faur, 2006: 371, and section 2 of Levi-Faur (2005) where he sketches how he came to develop his approach). Instead of positing the approach as a form of combination or mediation of two perspectives, as Levi-Faur does, we suggest that it can more assertively, and more fruitfully, be regarded as a methodological approach fitting a specific ontology (and related epistemology) different from the two approaches that constitute the dichotomy.

Ragin (2008) and Rihoux and Ragin (2009) also present their 'configurational comparative methods (CCM)' approach as a third position, rather than a compromise between two existing approaches. The set-theoretic perspective they adopt means that 'configurations of conditions' explain outcomes rather than independent conditions/causes each making their own (weighted) contribution to explanation. "Simply said, a configuration is a specific combination of factors (or stimuli, causal variables, ingredients, determinants, etc – we call these *conditions* in CCM terminology) that produces a given *outcome* of interest" (Rihoux and Ragin, 2009: xix). The notion of 'configuration' is combinatorial – "the conditions will be envisaged in a combinatorial way" – while the key question of the analysis is "[w]hich conditions (or combinations thereof) are 'necessary' or 'sufficient' (or possibly both necessary *and* sufficient) to produce the outcome?" (ibid: xix). In this way the complexity of causality is addressed as "multiple conjunctural causation" (ibid: 8).[38]

This is also in our view a major improvement on the positivist/regression-based analysis that it criticises, but it seems to lack a concept of structure and stratification. Do the configurations of conditions not form 'structures', in the sense of enduring combinations, constituting an object or system, or is there a large reservoir of conditions within which the appropriate selection and combination have to be found? The latter is the imagery of the CCM approach (see Ragin, 2008: chapter 6). The critical realist ontology of structures, mechanisms and events (see Figure 3) can, we suggest, enrich the combinatorial perspective.

A critical realist perspective on the small-N/medium-N comparative method would suggest that the in-depth analysis of situations or phenomena (intensive research, Figure 3) allows for insight in the complexity of the structural configuration of causalities in particular situations or phenomena. From a critical realist perspective, the stepwise comparison along different theoretically defined avenues that Levi-Faur proposes can be understood as helping to identify 'contingent' and 'necessary' causalities in a situation (or the 'internal' and 'external' relations of an object) that is investigated. In other words, stepwise comparison can help to identify which mechanisms are generated by which structural configurations, and how these contingently or necessarily combine in the generation of events.

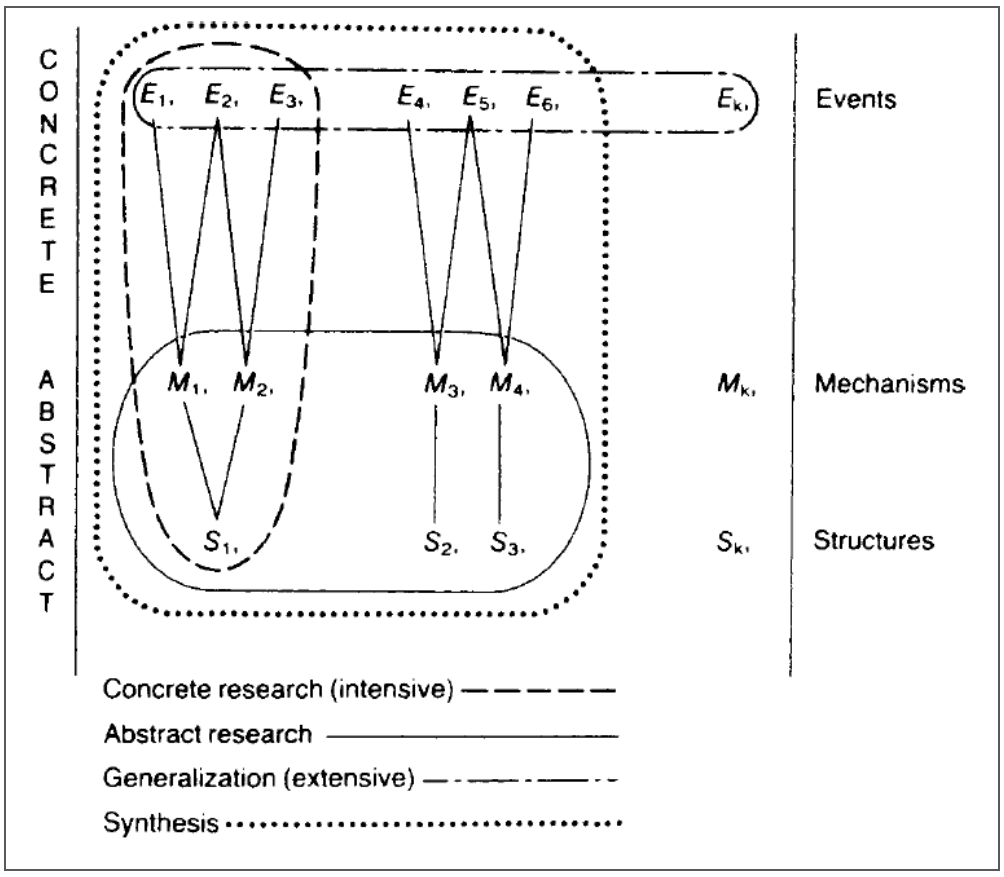
From this perspective, the limitation of the combinatorial perspective of the CCM approach can be understood as looking only at the mechanisms and events: it sees configurations of mechanisms ('conditions') that produce events ('outcomes'), acknowledging, like critical realism, that different configurations of mechanisms can produce the same outcome, while a particular configuration of mechanisms can produce differential outcomes when operative in different circumstances (see

[37] To what extent this 'smartness' can be formalised is an open question, to be addressed in subsequent work.

[38] This, thus, comes very close to the 'Humean constant conjunctions' conception of causality (see above).

particularly Ragin (2008: chapter 6 for this parallel). What the CCM approach does not do is to explicitly identify and analyse the structures from which the mechanisms, as emergent properties, derive.[39] The CCM approach argues that the configuration of mechanisms ('conditions') used in the explanation of outcomes needs to be 'theoretically informed' (Rihoux and Ragin, 2009). In addition to this it also needs, we suggest, to be ontologically grounded in the structures of society.

Figure 3. Critical realist ontology and types of research.



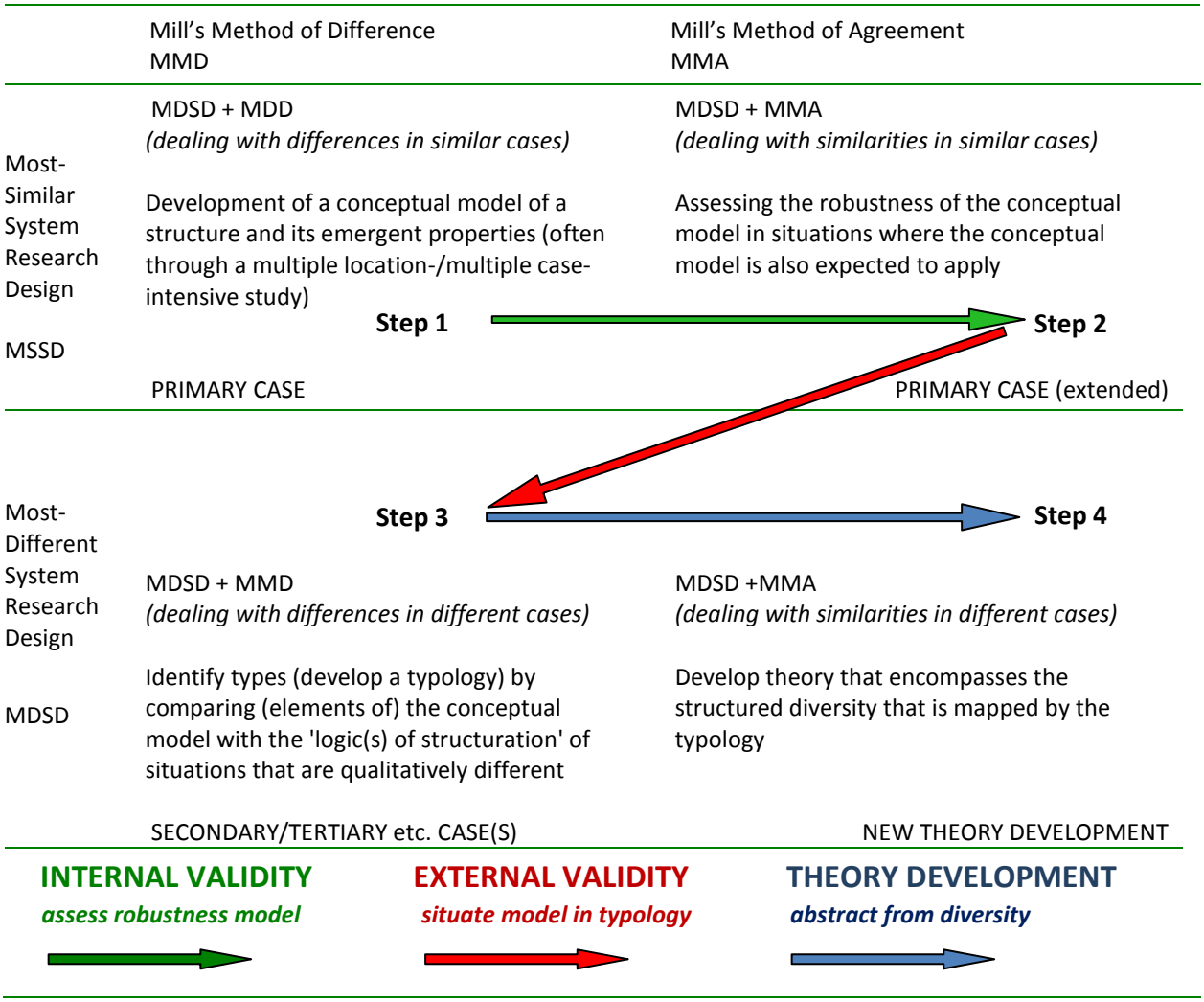
Source: Sayer (1992: 237).

Taking the irrigation example discussed above to illustrate this point, the 'primary case' research (step 1 in Figure 4) on unequal water distribution in canal irrigation found that credit and employment relations (between large- and small-scale farmers) were internal relations of the structural configuration of the political economy of water management, that is, they were a defining part of the causalities generating unequal distribution of water. It was also found that, for instance, caste relations were externally related to this structural configuration and only contingently shaped unequal outcomes. That this was not an individual attribute of the particular situation intensively studied, but a characteristic with robustness across situations, could be established by comparing the intensively researched situation with other situations in similar irrigation systems (Step 2 in Figure 4). The same

[39] The 'abstract research' on structures and mechanisms as depicted in Figures 3 can be understood as the basis of substantive theorisation of specific societies or parts thereof. The comparative method may be regarded as a, or perhaps the, methodological element of 'synthesis'.

structure exists and produces similar outcomes across a number of situations because the same mechanisms are at work, and when similarity in outcomes (events) does not exist despite the structure being in place, other structures and mechanisms can be traced to explain this lack of regularity.

Figure 4. Stepwise comparative analysis for theorising structured diversity.[40]



Further, stepwise comparison can help to distinguish the qualitative differences between the different instances of a particular kind of structural configuration (in the example, the set of components and relationships generating the mechanisms that explain unequal water distribution). In a critical realist perspective specific, robust configurations or sets are not unique or singular, but represent 'types' because reality is structured and layered, with configurations exhibiting endurance, against ontologies that are 'flat' (and aim at generalisation, based on regularity in 'events'). Hence, critical realism has a

[40] The notions of 'internal' and 'external' validity would for statistically minded comparativists refer to testing against 'control variables'. From that angle testing for internal validity could be called 'Comparison of Similar Cases on Control Variables' and testing for external validity 'Comparison of Variety of Cases Differing on Control Variables' (we thank Wendy Olsen for this feedback). However, internal validity and external validity have been put in quotation marks below the diagram given our discussion of set-theoretic combinatorial explanation. The vocabulary of 'robustness model', 'situate in typology' and 'abstract from diversity/theory development' fits the approach pursued here better than 'internal/external validity'.

strong interest in 'relational typologies'.[41] Small-N/medium-N comparative research allows the case to be understood as representing a type, and through systematic and stepwise comparison explores the characteristics of that type *against other types*, and thus develops an ontologically based typology of qualitatively different structural configurations (Step 3 in Figure 4).[42] In this way, the comparative analysis can be taken beyond the explanation of 'outcomes' to make a distinct contribution to theory development: the identification of types, as elements of typologies, with each type having a different 'logic of structuration' (Kontopoulos, 1993). Thus, this allows generalisation at the level of mechanisms generated by different structural configurations, which the 'abstract research' in Figure 3 represents (Step 4 in Figure 4).[43]

Rihoux and Ragin (2009: 16) state that "[a]s such (…) QCA does not yield new theories. What it may do, once performed, is to help the researcher generate some new insights, which may then be taken as a basis for further theoretical development or for re-examination of existing theories". We have suggested that within the framework of a critical realist ontology systematic, stepwise small-N/medium-N QCA can structure and support theory development more strongly than these authors state. In addition to explaining 'outcomes' we suggest that stepwise small-N/medium-N QCA can be fruitfully used to map and theorise 'structured diversity', as summarised in Figure 4.[44]

CONCLUSION

In conclusion, we suggest that the accumulation of knowledge and development of theory associated with small-N/medium-N QCA of water resources management (while adopting a critical realist ontology and epistemology) comprise the following three types of work:

1. Formal concept and framework formation[45] based on intensive research or suitable data sets. Capturing the 'concentration of many determinations' (Marx, 1973) requires formal concepts and frameworks that are non-reductionist and effectively articulate the multidimensionality of phenomena, situations and processes.
2. Development of concrete 'primary cases' through intensive research to generate substantive theory on specific phenomena, situations and processes.
3. Based on a series of primary case analyses, theorisation of structured diversity and its implications: this involves research that develops typologies of qualitatively different structural

[41] See Allen, 1983, and Whatmore et al., 1987, for examples. In water resources management studies, concepts like 'water policy regimes' can be considered as efforts to capture structured diversity while maintaining the time and space contextuality of the typology, or a 'domain of relevance' (for example, a typology of national water policy regimes within the liberal democratic states of the European Union).

[42] It is of course a theoretical possibility that there are as many structural configurations as there are situations, and there are senses in which, indeed, every situation is unique. The fact that many situations have structural features in common – say a parliamentary electoral system, a free market for consumer goods, a nuclear type of family, a Buddhist religious framework, a centralised form of piped water supply, etc. – makes for the existence of finite variation for specific phenomena, and allows for useful abstraction and the construction of typologies. Also Rihoux and Ragin (2009) emphasise that social phenomena have 'limited diversity' (also see Ragin, 2008: chapter 8); also see Rose's concept of 'bounded variability' referred to above.

[43] This framing has similarities with forms of complex systems theory that adopt an ontology of open, non-linear systems that are capable of adapting/learning, with emergence in a key role (see, e.g. Trosper, 2005). Water resources management systems are such complex systems.

[44] The development of this attempt to use Levi-Faur's stepwise small-N/medium-N comparative approach for research within an explicitly critical realist framework has been strongly shaped by inputs of, and discussion with, Nadine Reis and Amrita Lamba, which are gratefully acknowledged. The 'outcome'-focused analytical exercises of QCA would seem to be useful tools *within* each of the three steps, notably fsQCA (fuzzy set QCA; see Rihoux and Ragin, 2009). We thank Wendy Olsen for introducing the basics of fsQCA to us.

[45] Formal as in contra-distinction of substantive, as in critical realism (Sayer, 1992).

configurations, and shows how these differentially shape the phenomena, situations and processes under investigation; subsequently this structured diversity map is embedded into a more encompassing theory (abstract research on logics of structuration of society or parts thereof).

From the standpoint of comparative research, the third type of work is theorisation through comparative analysis proper, and the first two are necessary conditions for it. Without suitable formal concepts and frameworks able to capture complex configurations, the analytical work under items 2 and 3 will be severely handicapped; without rich primary cases to refer and go back to, the comparative analysis under item 3 is not feasible or risks losing touch with reality.

Wescoat (2002: 326) states that the most effective comparative studies are those driven by immediate water problems, and comparative analyses become more practical when they focus on water resources management 'successes' and 'failures' for their potential relevance beyond the places and times where they have been observed (Wescoat, 2005: 2). This reasoning resonates with the strong policy connection of water resources management studies that we have highlighted above (also see Rajagopal, 2009; Tobin, 2009). The challenge lies in connecting knowledge to action – action that is socially just, environmentally sustainable, and yet cost-effective over time.

While certainly not unjustified, 'utility' and 'urgency' forms of reasoning to underwrite enhanced effort at comparative water research are a specific, and not the only possible, definition of purpose (see section two). It begs questions like whose utility, urgency and problem are implied, and which decision makers. We are cautious about such forms of reasoning because it is perhaps exactly the strong policy connection of water research that inhibits certain types of theory and method development.

Nevertheless, with the huge advances in (largely policy-related) water research, the growth of internet resources on the topic and increase in access to scientific and policy information in the last decade alone, "there is no longer any excuse for ignoring the wealth of international water management experience", although the comparability of different international cases remains an ongoing challenge (Wescoat, 2005: 8). In addition to the availability of databases and repositories, we would emphasise the availability of a large number of in-depth case studies and other forms of intensive research that have been produced in the past decades in many water subject fields as well as in languages other than English. These provide a rich basis for the small-N/medium-N qualitative comparative research that we envisage can be usefully undertaken to enhance accumulation of knowledge and development of theory in critical water studies.

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