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Opportunities for Sustainable Water Governance in Ranchi, Jharkhand, India

Identifying Localised Solutions to Water Crises Through a Capabilities- and Institutions-Centred Framework of Strategic Agency

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Abstract

Many citizens in Ranchi, Jharkhand, suffer from the consequences of contaminated drinking water. The city's water governance system therefore urgently needs to find ways to bring safe drinking water to its people. Prevalent models in water governance however do not provide effective guidance for the necessary transition process. They lack heuristics that facilitate an in-depth understanding of context-specific institutions and capabilities that interventions can build on. These contextual factors determine a person's strategic agency and thus individual actions such as the drinking of unsafe water. Based on an adequate theoretical framework and 28 interviews with local stakeholders, this thesis analyses how enabling and constraining institutions and capabilities determine the intake of contaminated water by citizens in Ranchi. It finds that the diverse and variable character of water contamination paired with citizens' reliance on several types of water sources make unilateral approaches unlikely to succeed. The analysis further identifies opportunities that can form part of a transition while examining knowledge levels among the population and the role of the local government, among others. More research is needed to test the strength and limitations of the developed framework of strategic agency.

Keywords: water governance, transitions, critical institutionalism, strategic agency, urban development, India

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Acronyms

B	Beneficiary
CL	Community leader
CM	Community member
IAD	Institutional analysis and development
ICSA	Institutions- and capability-centred strategic agency
IWRM	Integrated water resources management
LCG	Local community governance
LG	Local government
MLG	Multi-level governance
NB	Non-beneficiary
NGO	Non-governmental organisation
PHED	Public Health Engineering Department
RMC	Ranchi Municipal Corporation
RO	Reverse osmosis
TDS	Total dissolved solids
WSD	Water Supply Department

Author's Note

This thesis uses pseudonymisation to secure the anonymity of participants. The acronyms for beneficiary (B), community leader (CL), community member (CM) and local government (LG) are only used when referencing a respondent (in parentheses) or the respective group in Figure 2. Quotations of respondents were edited in cases where incorrect English could impede understanding. To my own understanding, no sentence has been altered in meaning and the original structure and style of statements has been maintained.

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1. INTRODUCTION

> By 2030, achieve universal and equitable access to safe and affordable drinking water for all. [Unite Nations, 2015: 18]

The first target of Sustainable Development Goal (SDG) 6 is becoming increasingly difficult to achieve in the remaining time as governments are not able to realise the assignment they have set themselves to. What is stopping them?

Current water governance systems that fail to deliver on SDG target 6.1 need to swiftly transition towards sustainable ways of providing safe drinking water. While there are many models and conceptions of the end point of such a transition, there is little guidance for the path leading there. Most importantly, it requires a context-sensitive approach as key factors vary between locations, be it water availability, contamination or water practices within the population. Therefore, practitioners on the governance level require theoretical tools that root a transition in the existing context ensuring that the process is effective and sustainable.

At the core of some transition processes is a change of behaviour towards a desired individual action. That is especially true for SDGs 2, 5 and 6 – respectively eating healthy food, attending a school that provides quality education or drinking safe water.[1] Humans have strategic agency, i.e. the ability to deliberately "navigate and respond to the opportunities and constraints of their context" (Werbeloff, Brown & Loorbach, 2016: 120). Exploring why people do not perform the above actions leads directly to the contextual factors that need to 'transition.' These factors encompass a person's institutional context (i.e. societal and external factors) and her capabilities (i.e., individual power as well as cognitive and intellectual capacities). In water governance, a theoretical tool that guides transitions towards a system that provides safe drinking water for all must therefore facilitate an understanding of the institutions and capabilities that enable or constrain the intake of clean water. This thesis asks: *How can a framework be designed that facilitates an understanding of the interactions between institutions, capabilities and strategic agency?*

In Ranchi – the capital of Jharkhand, India – the frequency of droughts has increased over the last two decades putting the city under immense water stress. Water availability is set to change again in the short- and medium-term future. It is most strongly influenced by precipitation rates and socio-economic factors such as population growth and lifestyle changes (Singh & Kumar, 2019: 8). As Ranchi's population grew rapidly and continuously by over 42

[1] These SDGs target more factors (e.g., SDG 6 includes sanitation) but these actions are essential to their achievement.

per cent between 2011 and 2019, water stress is likely to further aggravate (IndiaPopulation, 2020). The city will have to cope with the available resources now and in the future. However, much of its water was shown to be contaminated by varying degrees (see Chapter 4). Ranchi's water governance system thus needs to establish ways that bring safe drinking water to its citizens. Building on the framework created in this thesis, the second research question is: *How is the intake of contaminated water by Ranchi's citizens determined by enabling and constraining institutions and capabilities?*

Having stated the two research questions, I hereafter briefly present the relevant discourses in water governance, new institutionalism and transition theory (Chapter 2) that the new framework for strategic agency (Chapter 3) responds to or draws on. Chapter 4 introduces the case of Ranchi, providing detailed background information about drinking water sources, their contamination and health consequences. In Chapter 5, I explain the methodology used in this study to collect and interpret data. It is followed by Chapter 6 in which I apply the new model of strategic agency to the issue of contaminated water intake in Ranchi. Building on the experiences of that analysis, Chapter 7 discusses the usefulness and limitations of the new framework before I conclude with an overview of the outputs of this thesis.

2. LITERATURE REVIEW: TRANSITIONS IN WATER GOVERNANCE

Chapter 2 introduces the relevant discourses in the fields that this study emanates from: water governance, new institutionalism and transition theory.

2.1. An Overview of Theoretical Tools in Water Governance

In the late 20th and early 21st century research and practitioner communities have created and developed numerous approaches to analyse and address persistent situations of water crisis. Nowadays, a number of them dominate the water governance discourse and practice. These include Integrated Water Resource Management (IWRM), adaptive water governance, local community governance (LCG), transboundary water management, multi-level governance (MLG), water privatisation, market-based instruments, climate change adaptation, water security, and the Water-Energy Nexus (Bréthaut & Schweizer, 2018: 8). Collectively, they represent a paradigm shift away from the command-and-control mindset prevalent in 20th-century water management and towards an interdisciplinary mindset that focuses on social and ecological forces whilst accounting for the fact that conditions are impermanent (Akamani, 2016: 2).[2]

These theoretical approaches can be divided along their scopes of analysis. Some of them are suitable for larger structural investigations (e.g., IWRM, adaptive water governance or MLG) while others are designed to support a specific solution approach (e.g., LCG or transboundary water management). Others in turn explain distinct ecological processes (e.g., the water-energy nexus or climate change adaptation). When looking at approaches that facilitate transitions of water governance systems, the scope of analysis often remains on the systemic level (e.g., Brown, Keath & Wong, 2009; Whaley, 2018). That perspective, while important, does not encourage researchers to understand how contextual factors determine problematic actions on the niche-level (i.e., the individual level) such as the intake of contaminate water.

To give an example, Brown, Keath & Wong (2009) put cities on a theoretical trajectory from the first phase of a 'Water Supply City' over four other progressive states to a 'Water Sensitive City.' When applying it to a case, one could identify what characteristics of the next stage are not yet fulfilled and work towards achieving them but such an approach is both rigid and not centred on the water user. The authors themselves point out that "there is no evidence to suggest that cities could not move in both directions across the continuum as well as jumping and/or straddling phases based on changing circumstances" (ibid.: 851). Besides a historical reference, this raises the question of why a trajectory was created in the first place instead of compiling the identified aspects of urban water governance in a more productive theoretical structure. If transitions are not understood on the niche level, frameworks like the one just described provide little help in guiding progress (as further elaborated upon under section 2.3.).

LCG is an approach that inherently focuses on the niche level. However, the implied solution in this approach may not fit the case at hand. Sharma (2012) for example analyses the nature of poverty in Ranchi and argues that community-based approaches have a hard time addressing the poverty within urban communities. As a theory traditionally applied to rural areas, LCG is less fitted to incorporate the complex dynamics of urban settings (ibid.: 49).

Another dominant critique to many of the above models is the prevalence of western perspectives which have misguided efforts in the past and nullified possible improvements or even caused harm to local populations (Schweizer & Bréthaut, 2018: 283). The risk of western

[2] Although to varying degrees, the aforementioned frameworks still suffer from some of the same shortcomings, especially with regards to social factors, as will be shown below in the following paragraphs.

biases is relatively high considering the origin of the individuals who created the predominant water governance frameworks. Non-western scholars who see them being applied without due consideration of contextual factors have expressed their frustration speaking of "studies that make small tweaks to western models, or blindly apply a methodology developed elsewhere to an Indian river basin" (Srinivasan, 2017: 308).

The concern over misguided transitions in water governance weighs even heavier considering the path dependency of systemic change precluding alternative ways of development. Water-scarce regions around the world sometimes do not yet have a formally established water governance system in place. While existing informal mechanisms should never be neglected, that circumstance manifests an opportunity to implement sustainable governance schemes with less institutional resistance (Novalia, Brown, Rogers & Bos, 2018: 11-12).[3] New rules usually produce both losers and winners. Any technological or governance solution will garner significance in specific segments of local markets and politics influencing local populations (Smith & Stirling, 2010: 9).

This thesis does not reject any of the aforementioned water governance approaches *per se*, it rather encourages adjustments to their application based on a more in-depth exploration of contextual factors. Given the interpretative latitude of each of these frameworks, judgements should primarily be made in a given context rather than *a priori*. Still, theoretical tools entail distinct normative conceptions about the world (i.e., assumptions and ideals) which modulate the results of the analysis. When researchers apply them, they must be critical and see them as tools that either suit a situation or not. In general, they are more likely to obtain an accurate picture of a system or situation when combining different perspectives and complementing purely system-level approaches with analytical tools that are anchored in regional concerns and perceptions (Schweizer & Bréthaut, 2018: 284).

The intended scope of the framework developed in Chapter 3 is to provide a detailed snapshot of part of a system to instruct context-sensitive transition processes. It can thereby add significantly to landscape-level planning tools such as the trajectory by Brown, Keath and Wong.

2.2. Arguing for the Significance of Institutions in Water Governance

A crucial point of criticism raised against prevalent approaches in water governance is the neglect of existing institutions in a given context (Schweizer & Bréthaut, 2018: 283). This

[3] From here on referred to as "Novalia et al. (2018)" for simplicity.

thesis defines institutions as “prescriptions that humans use to organise all forms of repetitive, structured interactions” (Ostrom, 2005: 3), i.e. the rules, norms or guidelines that make humans repeat behaviour in similar action situations. From now on, when using the terms ‘institutions’ or ‘rules’ I explicitly refer to regulations, instructions, norms as well as biophysical conditions. If applicable, I will use either of these specific terms instead or use the term ‘social institutions’ to delineate the former three from biophysical conditions that have no social origin.[4]

In any given situation, there are numerous institutions at play that can enable or constrain the normative goals pursued by water governance frameworks such as ‘citizens drinking safe water.’[5] While an individual’s knowledge about such rules is extensive, they are not always fully aware of how they pervade their actions (Ostrom, 2005: 5). Pushing for a behavioural change is likely to require a change in the existing institutions either in the form of strengthening enabling institutions or by weakening constraining ones. While it is also possible to add new enabling institutions – as is often the case when solutions are taken from foreign contexts – it is more uncertain how strong their impact would be and what side effects might be caused.

Recent contributions pay tribute to this and problematise the often intuitive expectation that change should originate from factors introduced from the outside to the given institutional system. Novalia et al. (2018: 12) underline that undertaking transitions by trying to overcome existing institutions is counterproductive as any established system inherently functions to minimise alterations from the status quo. It is like rolling a stone from one riverbank to the other against the current rather than using the flow of the river itself to reach the other side. Practitioners are more likely to be successful when actively working with prevalent institutions as much as possible to achieve their desired outcomes and, in doing so, ensure sustainability. To the extent that the stone has to end up at a particular point on the other shore – i.e. to the extent that institutional shifts are necessary – they should be based on a thorough understanding of the surrounding context. In literature on transitions of socio-technical structures such as water governance systems, institutional change is a key mechanism.

2.3. Talking about Sustainability Transitions, Working in Niches

Development work including water governance is directed at changing human behaviour or environmental conditions (or both). Even if the objective is to protect or maintain something already existing, a change in some aspect will be required. Transition theory is one approach

[4] Physical laws effectively determine our behaviour in a predictive way similar to social institutions.
[5] Institutions can also be negligible of course.

that addresses the idea of institutional change often with a focus on tangible socio-technical practices like drinking water (e.g., Novalia et al., 2018). The target of said change are so-called 'regimes', i.e. autonomous and stable societal systems of heterogeneous actors that serve one or several societal functions (Nastar, 2014: 24). Apart from the involved actors themselves, these regimes are comprised of a set of complementary institutions. Collectively, they create and maintain the *modus operandi* of the socio-technical practice under consideration.

Transition theory conceptualises reality in a three-tiered nested hierarchy borrowing from MLG literature. On the top level, landscape developments stand for large-scale processes such as climate change. Regimes represent the mid-level. It depends on the analysis which regimes are included as many of them co-exist and interact. At the bottom (i.e., the niche-level) most individual action takes place. The theory of change in transition literature is that critical interactions between niche and regime level alter the composition of actors and institutions of a regime in the desired direction. Whilst the nature of said interactions is often straightforward (e.g., farmers being enabled to use different irrigation techniques, the private sector to engage in measures reducing water pollution), they have to be achieved on sufficient scale to establish a new *modus operandi* (i.e., to alter the prevalent regime). Eventually, it is interactions on the niche-level that lay the foundation of a transition (Nastar, 2014: 23) through incremental and/or radical variations of prevalent practices occurring in what authors label niche-experiments, pilot projects or social learning (ibid.: 12).

However, transition literature has not been particularly thorough in answering how such a change in niche-level practices can be realised (i.e., explaining the factors that influence actors to take actions that spur institutional change) nor does it give any theoretical tools to analyse niche-level interactions. For the most part, scholars emphasise the role of technological innovation implemented through a 'transition manager' that is separate from other governance actors. In that way, sustainability transitions are reduced to a highly technocratic and elitist process corroborating the aforementioned neglect of existing institutions. Participatory measures used by transition managers might not suffice to preclude negative biases that technocratic approaches are prone to entail (Smith & Stirling, 2010: 7).

Transition theory's reliance on transition managers is one example of how current water governance frameworks overly build on codified or expert knowledge.[6] Instead, embedded knowledge and the stakeholders holding it (e.g., community members, leaders, local

[6] Transition theory is of course not only an approach within water governance. It can be applied in other fields as well.

government representatives or locally operating NGOs) should have an equally high priority (Sara & Baud, 2014: 506). Local actors have their own ideas of what signifies a system in place and can express vastly diverging opinions and experiences (Scoones et al., 2007: 21). These views can then be brought to the negotiation table when designing solutions to ensure sustainability (Smith & Stirling, 2010: 8).

The key difference to experts or other outside actors – who can also have contradictory views – is that community-based stakeholders and their convictions and actions are directly relevant for understanding the relevant institutions in the specific context and thus also for the design of interventions. Community-based knowledge and contrasting views within that can teach outsiders about relevant social processes and power relations as is emphasised by political ecology scholars (Lawhon & Murphy, 2012: 366, 371). Accordingly, Montgomery et al. (2014: 21) point out that water governance "based on technocratic methods, market-based mechanisms only or command-and-control approaches [is] unlikely to be able to recognise and accommodate the diverse stakeholders involved" (Montgomery et al., 2016: 21). The question of who constructs knowledge when designing solutions is as central as the question of how water is governed and by whom.[7]

Mainstream transition frameworks often suggest a technocratic and technology-focused approach to transformation which leaves underlying institutions uncharted. In other words, transition theorists often fail to deliver heuristics through which niche-level interactions and their impact on institutions – and regimes for that matter – can be properly understood (Novalia et al., 2018: p. 12). Water governance systems must be able to respond to changing social and environmental conditions with the resources under its control. A transition therefore needs to establish institutions among stakeholders that are characterised by social learning, social capital and trust (Paul-Wostl et al., 2007: 11).

[7] This is not to denounce expert knowledge but to put its role in water governance in perspective.

3. A Framework of Institutions and Strategic Agency

Chapter 3 develops a new theoretical framework to analyse strategic agency and guide transitions through analyses of local contexts in water governance and other fields.

3.1 Typologies – Theorising in an Ever-changing World

Water governance systems are inherently complex as they include social (e.g., structural inequality, local/national/international politics), ecological (e.g., increasing ground water extraction, sealing of soils, changing landscapes in peri-urban areas) and technical factors (e.g., water-related technologies and infrastructure). Theoretical frameworks need to be able to accommodate real-life complexity while offering heuristic models to understand developments within such volatile environments. Considering the range of social and biophysical factors determining the drinking of contaminated water by citizens in Ranchi, many models would be oversimplifying. Overly complex theoretical frameworks on the other hand risk being of little use in giving practical advice. Bos and Brown (2013: 115) emphasise that what is needed to understand issues in water governance is "a hybrid of relevant social theories [that] provides an informed framework for guiding social-technical system change."[8] This thesis creates such a hybrid through typologies.

A typology is a "classification according to a general type" (Oxford, 2019). Instead of developing theories for distinct phenomena such as water contamination, typological frameworks interlink generic terms such as institutions or capabilities as placeholders for case-specific phenomena. In that way, they constitute analytical frames that can be applied to multiple situations and contexts. Typologies are "a step up the ladder of generality" (Frödin, 2009: 289-290) representing a more open-ended type of theorising. They can contribute to the generalisation of knowledge by elucidating the effects of dynamic social mechanisms (e.g., institutions). As their chosen contents differ depending on the case, they simultaneously maintain a high level of context-sensitivity while being able to incorporate diverse factors. However, researchers and practitioners using typological frameworks need to demarcate the conditions in which their claims apply very carefully given the generalist frame (ibid.). Instead of precise forecasts, an understanding of the complexity of structures and the prediction of a pattern of interactions may be the best result one can arrive at (Ostrom, 2005: 10-11).

[8] The term 'social-technical system change' arises from transition theory literature (see section 2.3.).

3.2. An Institutions- and Capability-centred Framework of Strategic Agency

In order to understand a key individual action (e.g., the intake of contaminated water), this study combines two existing typological frameworks into a new diagnostic framework of strategic agency. The first inspiration is Ostrom's (2005) Institutional Analysis and Development (IAD) framework which provides an abstract terminology to analyse the role of institutions in action situations (see Appendix 1). The second framework was devised by Novalia et al. (2018) as a tool for transition theory (see Appendix 1). It differs substantially from most contributions on the topic as it is a response to criticisms both from within the field and from other traditions such as political ecology. The framework illustrates how individual action – as determined by institutions and capabilities – influences institutions (and thereby regimes). In doing so, the authors address the "under-explored question of how agency might lead institutional transformation" (ibid.: 11).

The framework developed in this thesis borrows the basic structure from Novalia et al. but takes its terminology more from Ostrom's institutionalist typology. It separates contextual factors into 'institutions' and, following Novalia et al. (2018), 'capabilities' that jointly determine individual action. As opposed to transition theory approaches, I omit the term 'regime' and instead focus on institutions in general as the act of defining a regime would not be more than an analytical exercise that casts one picture of a system that is in reality more diverse.[9] Institutions can be ambiguous and have different effects depending on the action situation and the individual in question (ibi.: 13). This choice weakens assumptions about the rigidity of institutional structures and, instead, highlights opportunities for change. When applied, the framework creates a complex yet still simplified image of reality that only claims relevance with regards to the key action under observation. The tool will be referred to as Institutions- and Capability-centred Strategic Agency (ICSA) framework.

The ICSA framework – just like both Novalia et al. and Ostrom's frameworks – has the individual in an action situation at its centre.[10] That is in line with the insight that it is "the water user who links all the elements [in water governance] together" (Srinivasan, 2017: 309). Due to its generic nature, the framework is well-equipped to analyse actions by stakeholders in both lower (e.g. water user) and higher functions (e.g., community leaders, local politicians). The structure of the situation is assumed to be fixed in the short run with individuals having strategic agency, i.e. deciding to act in a way that conforms most strongly with their own

[9] See 2.3. for a definition and further explanations on 'regimes.'
[10] Even though Novalia et al. (2018) do not use the term 'action situation.'

assumptions about the opportunities and constraints of that situation (Ostrom, 2005: 33-34; Werbeloff, Brown & Loorbach, 2016: 120). With this orientation the ICSA framework is a good tool to understand key individual actions and related norms, knowledge and practices. When applied to a particular context such as Ranchi, the typologies lose their abstractness and become much more practical (as demonstrated in Chapter 6).

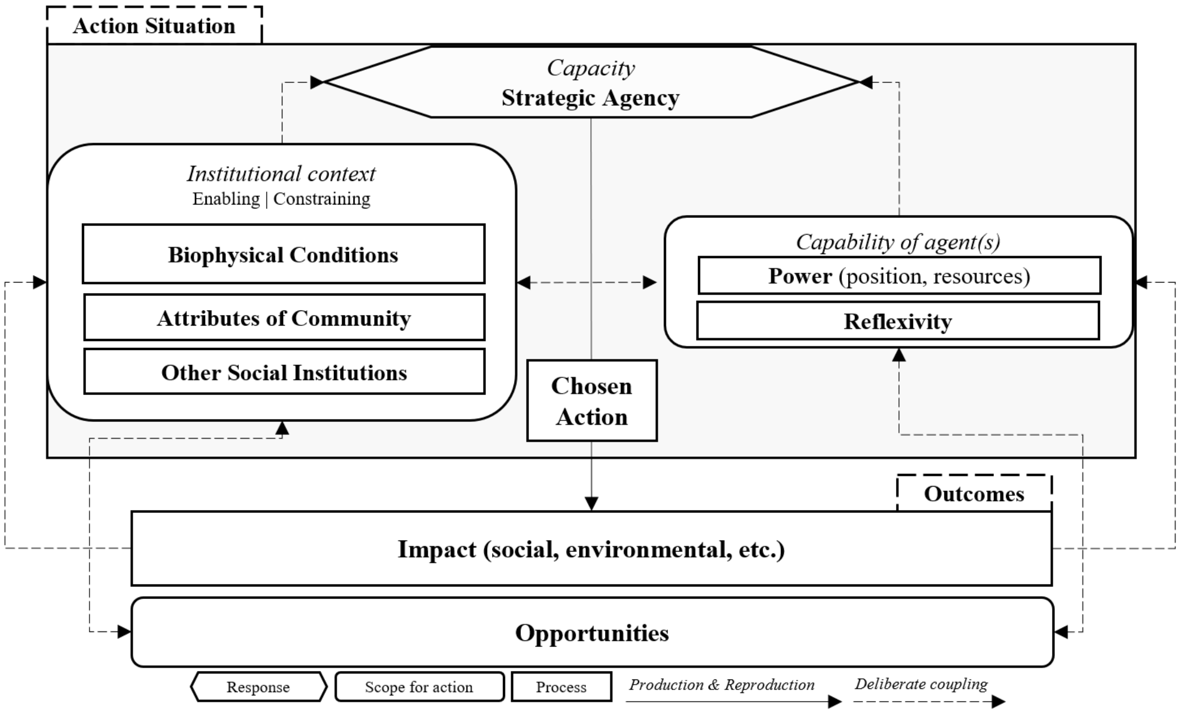

Figure 1: The ICSA framework based on Ostrom (2005) and Novalia et al. (2018)

In the ICSA framework (see Figure 1), *strategic agency* and consequently the *chosen action* is determined by the *institutional context* and an *agent's capability* that can also be interrelated. The institutional context and capabilities can have *enabling* and *constraining* effects (Ostrom, 2005: 30-31). Enabling settings are understood as those that support or reward the chosen action while constraining ones dissuade a person from it and possibly sanctioning the behaviour. The co-existence of both forces is natural, especially as institutional systems allow for ambiguity, multiplicity and unpredictability within themselves (Novalia et al., 2018: 13).

Following Ostrom (2005), the ICSA framework distinguishes between *biophysical conditions*, *other social institutions* and *attributes of community*.[11] 'Biophysical conditions' are only in few cases, if at all, shaped through social mechanisms but can influence behaviour in a

[11] See section 2.2. for a definition of institutions.

similarly predictive way (ibid.: 22).[12] Given the choice, most individuals would for instance choose visibly clearer water over turbid water for drinking. Personal health in itself can be incorporated in this category if it has a direct impact on the chosen action. 'Other social institutions' in turn are all regulations, instructions and norms that are not specific to the community in question. They can be formal or informal. Formal rules exist on paper and are legitimised through an authority complemented by a plethora of informal rules that emerge naturally where formal rules are absent, incomplete or ineffective. Society encompasses many informally regulated social spaces and individuals might also pursue goals that contradict formal rules such as any form of crime (Helmke & Levitsky, 2004: 730).[13] In some cases, hybrid social institutions exist that are to an extent both formal and informal. It can thus be useful to look beyond this dichotomy (Davis, 2017: 320).[14] Lastly, 'attributes of community' include only those social institutions shared by a larger group of actors guiding many interactions such as values regarding generally accepted behaviour in the community or other types of shared understandings and preferences. They usually exert high pressure on the individual to act accordingly (Ostrom, 2005: 26-27). Whether a person is considered a member of this 'community' depends on the analytical focus. In this thesis, it is the population of Ranchi.

As it is impossible to know about and to include all institutions that lead to a particular action, the analyst bears the responsibility to possess sufficient knowledge to select the appropriate assumptions about human behaviour and exclude rules that are self-evident or of marginal importance (Ostrom, 2005: 7).

Switching to the other side of the diagram, an agent's capability manifests itself in individual *power* and *reflexivity*. Novalia et al. (2018: 31) proposes that different conceptions of power may be used. This thesis considers power to be the result of two factors, the potential impact of an action and the extent of control over said action both of which are required to exert power (Ostrom, 2005: 50). An agent's *position* (e.g., community member or leader, NGO staff member, or local government official) and the *resources* at her disposal are key elements

[12] Ostrom (2005) groups biophysical conditions together with material conditions which determine the amount of resources at the disposal of an individual (ibid.: 22). In the framework of strategic agency developed in this thesis, material conditions are however seen as a form of *power* (see below).

[13] Here, not publicly acceptable should not be confused with illegality even though that is also included.

[14] Björkman (2014) describes how engineers within Mumbai's water department go beyond that dichotomy when allowing poor urban populations from unauthorised areas to purchase access to the large water mains (ibid.: 50) or advising them on the use of illegal pumps, while also joking that they might have to confiscate the device in a future municipal raid (ibid.: 53). In that case study, access to water was regulated by both formal and informal rules that were functionally inseparable and subject to local networks of power and knowledge (ibid.: 52).

in determining both impact and control. *Reflexivity* in turn is the individual capability to understand and interpret a situation and possible actions in ways that enable her to find appropriate solutions. It encompasses both cognitive (e.g., intelligence) and intellectual capacities (i.e., knowledge). Reflexivity is expressed in speech. However, it can also be implied in actions or motivations that are more difficult to trace and often require in-depth research to be determinable (Novalia et al., 2018: 14).[15] An agent's reflexivity modulates her power in that it guides decision-making processes.

The ICSA framework also observes the *impact* of the chosen action. Among others, that can encompass environmental and health consequences. It can also be a change in the institutions and capabilities that determined the chosen action in the first place. It should be noted that even if actions and outcomes reproduce one another in the short-term, analysts must think of these processes as helical rather than circular in nature as institutions and capabilities evolve over time. Moreover, the institutional context and capabilities are the sources of *opportunities*. In this thesis, that is factors that can spur a transition in Ranchi's water governance systems. Using the terms of the ICSA framework, these opportunities can be realised by counteracting elements that constrain an individual in following the desired action or strengthening those that enable it.

Three more remarks: Firstly, in its application many findings can fall into different categories depending on how the researcher frames them (e.g., somebody's position of power will often be heavily influenced by attributes of community). Assuming conformity with the data collected, the guideline in such cases is to choose the framing that is most coherent with the conclusions drawn. Secondly, the ICSA framework is devised from the perspective of an individual. However, that is mostly a heuristic. Researchers applying it to groups must ensure that the individuals implied in the population are sufficiently similar and be specific about how conclusions may apply differently to specific subparts. Thirdly, while the chosen action is the logical centre of the framework it is not necessarily the best starting point in the analytical process. It is often conducive to start in categories that represent physical aspects such as outcomes (e.g., environmental consequences, adverse health effects) or biophysical conditions (e.g., types of water contamination) to then arrive at the actions causing them.

The ICSA framework aims to analyse dynamics of institutions, capabilities and strategic agency in a given context. Through an increased understanding of these contextual

[15] The first type of reflexivity expression can for instance be observed when actors interpret potential events or actions such as judging a diet by its environmental and health impacts rather than by its perceived normalcy.

processes, practitioners in water governance can fine-tune their work and – in collaboration with local stakeholders – identify opportunities for change. The ICSA framework is employed in Chapter 6 to analyse the findings obtained from 28 interviews in Ranchi mapping the dynamic contextual processes that determine the intake of contaminated water. The following chapter introduces the case at hand describing the existing system for drinking water in Ranchi.

4. Background: Drinking Water in Ranchi, Jharkhand – Dynamics of Water Stress in the Process of Rapid Urbanisation

Chapter 4 provides an introduction to the case analysed in this study describing the existing systems for drinking water in Ranchi. The capital of Jharkhand state – often considered India's second poorest state after its neighbour Bihar – is one of many Indian cities in a process of rapid growth. With a population of 1,073,440 in the 2011 census it is estimated to have grown to approximately 1,528,000 in 2019 (IndiaPoplation, 2020). Infrastructure, education and business expansion has accelerated Ranchi's growth to 2 ha/year between 2002 and 2015, largely occurring in the northern parts and too often unplanned.[16] Urban density has increased with unused and vegetated areas shrinking and rising traffic congestion as well as pollution of air and water (Ahmad & Goparaju, 2016: 7, 13). The anthropogenic pressure on the city's water resources grew together with its population often causing increased contamination (ibid.; Kumar & Pandey, 2016; Singh, Kumar & Kanga, 2017; Tirkey, Bhattacharya & Chakraborty, 2016).

4.1. Accessing Ranchi's Decreasing Water Reserves

There are five different water sources this study refers to: *groundwater*, *surface water*, *piped water*, *water from local tankers*, and *sealed bottled water*. When drafting and negotiating localised solutions, it is crucial to be aware of their role in Ranchi's water supply and their differences regarding possible contamination. The distinguishing factor is the point of access as the processes through which the water reaches individuals bear different risks of contamination.

[16] The timing of the increase in growth rate is not coincidental as Ranchi only became state capital in 2000 with the separation of Jharkhand from Bihar as a state of its own.

Groundwater is found underground in geologic formations of soil, sand, and rock called aquifers. People collect it through boreholes often aided by pumps.[17] In contrast, surface water is found above ground in rivers, lakes and ponds. The *Subarnarekha* river originates nearby the city and runs through its southern parts spreading smaller branches into various sub-districts. Besides that, several small rivers (e.g., *Harmu* river), numerous ponds (e.g., *Line Tank Pond*) and *Ranchi Lake* in the city centre. Most wells in Ranchi access water from low-flowing underground streams that are affected by the composition of ground layers but that, in terms of contamination, are considered surface water in this thesis.[18] Ground and surface water are connected through the hydrological cycle as water seeps away and resurfaces again in other locations. Ranchi is built on the Chotanagpur rock plateau, the porosity, cracks and fractures of which determine the rate of groundwater recharge in an area (Tirkey, Bhattacharya & Chakraborty, 2016). The city is also taking action to increase the recharge rate through rainwater harvesting (RMC, 2020b). The remaining three 'sources' are originally obtained from groundwater or surface water but undergo different processes of dissemination.

Ranchi also has a piped water system that is accessible in 29 of the 55 wards that constitute the city. It provides water during certain hours each day that households then store. The local government, Ranchi Municipal Corporation (RMC), states that 40 per cent of the population fall back on this service while the remaining 60 largely rely on ground water (Khwairakpam & Kumari, 2018: 1898, 1900). However, during the data collection many households reported to rely on multiple water sources and that they still prefer groundwater for drinking, despite being connected to the piped system. Piped water is fed by three dams around Ranchi, the water of which passes through a treatment plant before entering the main: *Kanke Dam* in the north, *Hatia/Dhurwa Dam* in the southeast and *Getalsud/Rukka Dam* in the northwest. Technically, these are surface water but are here seen as part of the piped water system. While the coverage is significant, many of the other households cannot pay for a connection. The local government, Ranchi Municipal Corporation (RMC), has tried to rapidly increase its piped water coverage over the last ten years as a way to curb groundwater depletion (LG/WSD, personal communication, 2019, January 31). The continuation of these efforts is highly probable considering the city's continued water stress.

When water levels of aquifers lower and wells run dry during droughts, RMC takes water from boreholes further away or from one of the three dams that also supply the piped

[17] Also referred to as "deep boring" by various stakeholders in Ranchi since that is the most common type.
[18] They are much less prone to contamination than open surface water though.

system and bring it to specific communities in tankers. This service is usually charged. Lastly, bottled water is sold by many companies but considered a luxury and not used on a regular basis by poorer communities. The two latter sources will be omitted in the following section as they are not affordable or available for many community members (see Chapter 6). Contamination of water from tankers largely depends on the original source and bottled water typically meets the standards set by the World Health Organization. However, there have been cases of contaminated bottled water throughout India linked to careless licensing and the reuse of containers (Hawkins, Potter & Race, 2015: 111).

Ranchi is experiencing increased water stress. Ground and surface water reserves in Ranchi district are highly dependent on the southwest monsoon from June to October when 90 per cent of annual precipitation falls (Shree & Kumar, 2018: 4). The climate in Jharkhand is erratic with floods and droughts occurring regularly. Over the past five years, the state has been hit by droughts three times (2016, 2018, 2019) and suffered from minor flooding events every year. Taking precipitation rates since 1901, rainfall has decreased by approximately 100 mm during the monsoon while precipitation during other periods of the year has remained relatively stable (ibid.: 7). A failing monsoon is highly problematic for Ranchi as it is likely to lead to drought conditions almost regardless of the weather during other periods (Pandey, Kumar, Chakraborty & Mahanti, 2011: 563). Even when taking this negative trendline, conditions have worsened recently. Between 1990 and 2014, thirteen years have had below average, four on average, and eight above average rates of precipitation (Shree & Kumar, 2018: 5). At least until 2019, this trend has continued as confirmed by the aforementioned droughts. In conjunction with Ranchi's growth and corresponding need for more water, scarcity is worsening.

RMC holds responsibility over the water reserves in the city including the three dams, the piped system and many of the borewells. In addition, private companies and civil society organisations provide borewells. As local government, RMC has a Water Supply Department (WSD) that issues new connections to the piped system. In early 2020, the water supply section of RMC has registered 105,907 consumers/households 65,900 of which are managed by the Public Health Engineering Department (PHED) (RMC, 2019). Both the WSD and the PHED install and maintain hand pumps and create new boreholes (PHED, personal communication, 2019, 31 January).

4.2. Causes and Repercussions of Water Contamination in Ranchi

Water quality in and around Ranchi has not been a topic for extensive research until recently. However, spurred by its status change to a state capital in 2000 and by the increased shortages, and growing concerns over contamination, the last decade has yielded several studies mostly on the quality of ground and surface water in the city. Testing results can vary depending on whether samples were collected during the monsoon or not. Higher precipitation dilutes water bodies usually reducing bacterial contamination. Increased rainfall simultaneously causes chemical weathering and, thus, raises pollution levels of elements present in rocks and soils.

4.2.1. Groundwater

Groundwater as primary source of drinking water in Ranchi is usually odourless and has agreeable taste (Kerketta et al., 2013: 370) but can contain various contaminants, especially traces of metal. Degree and type of contamination can differ significantly between areas depending on geological characteristics and intensity of land use. This variety explains contrasting statements about the quality of groundwater in Ranchi in addition to the fact that, apart from metal, which has not always been tested for, the groundwater is largely potable (Tirkey, Bhattacharya, Chakraborty & Baraik, 2017; Singh, Tiwari, & Singh, 2014). While Gorai and Kumar reported in 2013 that the deterioration of groundwater quality "is not [a] very serious problem except few areas" (ibid.: 10), other studies draw more alarming conclusions. After reports of symptoms related to arsenic contamination in 2014, a study testing 44 locations for ten metals confirmed the presence of arsenic which was, alongside manganese and selenium, well above acceptable limits but with variations between seasons (Tirkey, Bhattacharya & Chakraborty, 2016).

Building on that, a more comprehensive study tested physio-chemical characteristics and the presence of arsenic, manganese, nickel and selenium in the same locations during monsoon season classifying each location as either rural, peri-urban, urban, commercial or industrial. Harmful amounts of arsenic (37/44), manganese (not specified), nickel (12/44) and selenium (44/44) were detected. In addition, physio-chemical properties exceeding acceptable limits were (acidic) pH values (13/44), total dissolved solids (TDS) (9/44), total hardness (18/44) and fluoride (3/44).[19] Water from commercial and industrial zones yielded particularly bad degrees of contamination with the opposite being true for rural areas. While only four per cent of the samples were categorised as 'unfit for drinking', 80 per cent had 'poor', 7 per cent 'very poor', and merely 9 per cent 'good' water quality (Tirkey, Bhattacharya, Chakraborty & Baraik, 2017: 89-98).

[19] Other present physio-chemical characteristics of groundwater samples are not harmful in themselves but are conducive for the presence of some of the contaminants (ibid.).

The diversity of water contamination in Ranchi is underlined by the discovery of excessive iron in groundwater samples collected by an NGO working in various rural, peri-urban and urban communities. In the 2016 study mentioned above, it was either low or below detection level. In contrast, the contamination found by the NGO (1.57-1.79 mg/l) was strong enough to change colour and taste of the water obtained. Residents reported visible increases in iron contamination as well as turbidity during droughts (CM/NT, personal communication, . The tests also detected faecal coliforms which was not a parameter in the aforementioned studies (NGO, personal communication, 2019, 28 January).[20]

Water contaminated with metals can cause cerebral malfunction, lung and kidney problems, cancer and many other diseases (Tirkey, Bhattacharya, Chakraborty & Baraik, 2017). Like the other three metals, the arsenic found was non-carcinogenic but can still be strongly detrimental to the nerve system, skin and arteries. Further health effects linked to contamination detected in the study include gastrointestinal distress, pulmonary fibrosis and dermatitis (all nickel), reduced intellectual functions in children and mental diseases such as Alzheimer's (manganese), and respiratory diseases and fingernail loss (selenium). Arsenic contamination is by far the most worrisome type posing a high chronic risk. On their own manganese, nickel, and selenium had only negligible to medium risks but their composite risk was valued as very high (ibid.: 94, 98).

The four metals are unlikely to come from the same source as they showed poor correlation across sites. For all these metals, there are both geologic and anthropogenic causes and no singular source for either one of them could be identified (ibid.).[21] Other types of metal contamination (cobalt, chromium, copper, lead, zinc) found in soils and earthworms in Ranchi, have been confirmed to be directly related to unlined dumping sites for municipal waste. From there, it can spread to groundwater and enter the food chain through crops (Chokraborty & Kumar, 2016: 335; Singh, Verma & Kumar, 2018: 139). Bacterial contamination (e.g., faecal coliforms) is usually low in groundwater as seepage through rock layers is a natural filter. However, because Chotanagpur plateau lacks primary porosity, cracks and joints in the rock likely determine seepage rates from surface to groundwater (Tirkey, Bhattacharya, Chakraborty & Baraik, 2017: p. 87). A study from 2013 substantiates this suspicion, measuring

[20] It should further be noted that Tirkey, Bhattacharya, Chakraborty & Baraik (2017: 89) did consider sewage as possible origin of dissolved organic matter forming part of the excessive TDS levels in urban areas. The water test results by the NGO are not publicly available but can be requested from the researcher.

[21] Human causes for arsenic contamination include products like paints, fungicides, pesticides or rat poisoning, leachate from sewage sludge and waste dumps, coal burning and various industrial discharges. It can also enter the food chain through irrigation water (ibid.).

minimum rock-water interaction during groundwater recharge in areas with ‘fast-conducting’ fracture zones. It also confirmed contaminated surface water mixing with rain which is a possible cause for the NGO’s findings of bacterial contamination (Saha, Dwivedi, Roy & Reddy, 2013: p. 1113-1114). Bacteria can also enter groundwater through poorly constructed boreholes and septic tanks.

4.2.2. Surface water

Surface water quality varies depending on the type of water body with standing and smaller water bodies tending to be more contaminated. The condition of Harmu river in Ranchi for instance sparks public concern. RMC has taken measures but till this point these have failed to curb the pollution (The Telegraph, 2019b). When testing samples from the small river running through the heart of Ranchi, Rai, Paul and Kishor (2012) detected excessive results for pH value, electrical conductivity, total dissolved solids, total suspended solids, total hardness, calcium hardness, magnesium hardness, alkalinity, chloride and dissolved oxygen. Domestic sewage and urban waste were the main reasons for the results with repercussions for water users’ health further downstream, even beyond Ranchi (ibid.). Kerketta et al. (2013: 371) found rivers and ponds in the city to be ‘highly contaminated’ carrying excessive amounts of lead and cadmium, turbidity and foul smell. Additional contaminants come from open defecation frequently practiced in or close to open water bodies.

Surface water contamination is closely linked to anthropogenic factors including industrial and domestic waste as well as wastewater (Chakraborty et al., 2017: 56). Respondents in this study were keenly aware of the inferior quality of the water from lakes and ponds and named municipal waste and open defecation as primary causes for their pollution. Still, some of them reported about seeing people drinking from them as they lack awareness of the health effects or do not have access to any other source. That is confirmed by observations by Chakraborty et al. (2017: 55-56) who saw people fetching water from two central water bodies that they were testing, Ranchi Lake and Line Tank Pond. These had dangerous levels of chloride (up to 170.4 mg/l) which can cause colon and bladder cancer. The pond also had sulphate levels above 600 mg/l which are known to cause diarrhoea and other cathartic effects. Anthropogenically heightened amounts of phosphate pose a risk of bringing these water bodies to a tipping point in the future, especially Ranchi Lake. Three water bodies further outside the city were in a better condition (ibid.).

4.2.3. Piped water

Piped water only appears in one study but the circumstances in Ranchi allow for the following assumptions: As the water is passing through a treatment plant before entering the main, any pollution is unlikely to come from the dams where the water is originally taken from. Excessive amounts of lead (on average 0.11 mg/l) were found across 20 taps in Ranchi (Kerketta et al., 2013: 373).[22] Old pipes represent the first possible source of contamination and are a known origin of lead contamination. That assumption appears reasonable as the government official from the WSD stated that one of the mains was installed in the late 1970s and has not been replaced since (LG/WSD, personal communication, 2019, January 31).

Pipes are often running along the walls of the roadside drainage ditch which residents use for open defecation. Any damage is likely to cause bacterial and other types of contamination especially when water pressure in the pipes is low. The stealing of water from pipes by means of cutting and creating unregistered connections occurs regularly and causes more pollution (LG/PHED, personal communication, 2019, January 31). Therefore, contamination from, for instance, faecal bacteria is likely to vary in each household depending on the condition of the pipes leading to it. That reasoning is in line with the erratic results for TDS for the already 20 taps many of which exceeded the acceptable limit of 500 mg/l (Kerketta et al., 2013: 372). During the data collection respondents had mixed opinions about piped water which can possibly be explained by varying health effects from consumption depending on the condition of their household’s connection. While RMC probably has more comprehensive data on this subject, the existence of further undetected types of contamination in Ranchi’s piped water system is possible.

4.2.4. Methods to Reduce Water Contamination After Collection

There are six relevant methods to reduce water contamination that are hypothetically available to Ranchi’s citizens after the water has been fetched from any of the above sources. This section provides a brief and slightly simplified overview of them.

1) Clothes primarily filter dust and dirt but are only adequate for pre-filtering before using another method. It is useful sto reduce wearing off of filter parts or necessary amounts of bleaching powder in areas with high contamination.

[22] The WHO guideline value for lead in drinking water is 0.01 mg/l (WHO, 2017: p. 383).

2) Bleaching powder is a disinfectant that removes bacteria, but proper dosing is important and, if done incorrectly, it could also have adverse health impacts
3) Boiling of water removes bacteria and, if boil time is sufficient, most viruses. Viral contamination is usually less problematic though because populations build up an immunity against the viruses in their area.
4) The filter that was distributed to the beneficiaries of the NGO in the study area removes all bacteria and protozoa but only partially filters viruses, heavy metals and chemicals.
5) Alternatively, heavy metals can also be removed through filters with charcoal but those typically have a much longer dwell time (time that the water needs to pass through the filter).
6) All types of contamination can be eliminated through reverse osmosis (filtration), a process that also removes nutritional minerals that are recommended to be replenished afterwards. As long as the pH of drinking water remains within the recommended limits that is only a minor problem though.

4.2.5. Beyond Drinking Water

Drinking water pollution in Ranchi is typified by diversity and variability: it is diverse in its range of contaminants and it is variable in its degree and type which, among others, depend on water source, exact location, time of the year. These conditions, and the fact that some households rely on multiple water sources, make it difficult to assess how many of the 1,522,000 residents drink polluted water. Considering the contamination found across all major sources it is probable that

Guaranteeing good quality drinking water alone is insufficient to prevent the outbreak of waterborne diseases and other adverse effects of contaminated water as confirmed by a small household survey across five locations in Ranchi (Khwairapuram & Kumari, 2018: 1902). While there was a clear positive relationship between drinking water contamination and the occurrence of typhoid, cholera, diarrhoea, and jaundice, a significant part of the population with good water quality was still affected by said illnesses; depending on the disease between 8 and 18 per cent compared to 14 to 24 per cent in locations with average water quality (ibid.). Inadequate sanitation is a primary cause for waterborne diseases. In a 2016 study on the health of rickshaw pullers, 40 per cent did not have access to a toilet in their place of living, frequently defecating in the open instead (Kumar et al., 2016: 248). This was confirmed as a major impediment for healthy communities by NGO staff, interpreters and one of the community leaders. During flooding events, the roadside drainage ditch spreads pathogens and other bacteria in many parts of the city. In addition, waterborne diseases can be spread through unhygienic food (ibid.).

The case of Ranchi shows how complex and unique urban water systems are. In light of the diversity and variability of contamination in Ranchi, it can be hard for an individual to know whether a disease came from drinking water. It is thus all the more important to analyse locations in detail before drafting solutions.

5. METHODOLOGY

Chapter 5 elaborates on the epistemological approach underpinning this thesis, the study area, the design of the study, data collection and analysis processes, as well as limitations and ethical considerations.

5.1. Philosophical Underpinnings: Critical Constructivism

In accordance with my objective to understand strategic agency as determined by institutions and individual capabilities, I understand knowledge as a construct of human interaction. In social constructivism, all forms of perceptions are channelled through the human mind allowing for individuals to have varied experiences of identical external influences (Moses & Knutsen, 2012). In line with that, the interpretative ICSA framework developed above is a tool to explore how stakeholders choose to act and interact based on their subjective understanding of a given situation.[23] While it implies some theoretical assumptions, its main purpose is the construction rather than the ascription of meaning based on the inductive input of the participants in this study – an attempt to capture "the complexity of views rather than narrowing the meanings into few categories" (Cresswell, 2015: 24).[24]

A crucial addition to this perspective is the role of power relations. The ICSA framework emphasises the significance of power to pursue certain actions as a regulator of individual capabilities and, therefore, strategic agency. It thus acknowledges a key insight of critical thought recognising the niche a person occupies that comes with a distinct access to resources and positions within local authority structures (Momsen, 2006: 44). The creation and

[23] At its heart is the assumption that humans are intelligent, reflective and wilful (ibid.).
[24] The construction of knowledge through participants is eventually still subject to my own interpretation of what has been expressed by participants as will be addressed in sections 5.5. and 5.6. below.

proliferation of knowledge itself is subject to power imbalances, typically to the disadvantage of marginalist groups. Consequently, I advocate to observe knowledge production and consumption in their local and temporal contexts with particular attention towards known structural inequalities (Hickey & Austin, 2011: 87). Accordingly, I aim to be observant and critical of my own role in constructing knowledge.

5.2. Research Design: Data Collection & Interpreters

The explorative objective of uncovering existing social structures that may form a part of future changes in local water governance, necessitates a qualitative research design (Holliday, 2007: 5). I apply an abductive approach entering the field with previous knowledge but largely building my theoretical understanding of people and their context on the information I acquired in the field (Bryman, 2012: 401). The method of inquiry draws on the phenomenological tradition creating knowledge from individuals' lived experiences.[25] Simultaneously, the application of the ICSA framework to explain phenomena constitutes a form of grounded theory in which the scope and sometimes the exact nature of a problem arises from the data gathered (Cresswell, 2014: p. 42; Holliday, 2007: 16). Grounded theory would usually require multiple stages of data collection for theory refinement, but time and resource constraints did not allow for that. Accordingly, this study is explorative with an exemplary application of the developed ICSA framework. It provides insights into problems in Ranchi's water governance system with an aspiration to comprehensiveness but without claim to completeness.

Participants came from four communities in Ranchi (Banhora, Kokar, Harmu Nayatoli and Pokartholi) and were selected through convenience sampling rendering the sample non-representative of the total population (Scheyvens, 2014: 45). Either my interpreters (see below) or community development facilitators from the NGO functioned as gatekeepers establishing contact to the communities and helping to arrange interviews.[26] Still, within this limitation a diversity of stakeholder groups was included within the following definition: The total population are all citizens in Ranchi (beneficiaries, non-beneficiaries, community leaders) as well as actors that hold a responsibility in providing these populations with clean water (local government officials, NGO staff).

The main source of information are 28 semi-structured interviews (also see Appendix 2). The insights from those interviews are complemented through observations and informal

[25] In contrast to classic phenomenologists, I consider it impossible to derive the universal essence of any phenomenon as is underlined by my critical constructivist perspective (Cresswell, 2014: p. 42).

[26] Community development facilitators are typically born in the communities, live there themselves or have worked with them for many years, and are thus highly integrated into the local context.

conversations in the field (especially for background information of certain communities). In that process, three male research assistants from a local university (all graduate students in the development field) supported me as interpreters. Two of them were usually present for an interview. They were familiar with local cultures and provided significant background information and other help throughout the fieldwork period. The semi-structured interviews included three key informant interviews with local government officials (2) and NGO staff (1). The remaining 25 were done with community members, ten of which were beneficiaries of the NGO's household water filter project, 12 non-beneficiaries, and three community leaders who were also non-beneficiaries.

In water governance, it is "the water user who links all the other elements together" (Srinivasan, 2017: 309) and each participant in this study was both seen as water user and relevant actor capable of contributing to changes in the system. With minor variations all participant groups were asked the same questions (see Appendix B) to allow for comparison of statements. The first part of the interview guide focuses on individual household water use, even for key informants, to find out how individual behaviour might have shaped understandings of water quality. The second half then addresses perceptions of responsibility for guaranteeing clean water and capacity to influence the quality of water.

Except for two key informant interviews that could be held in English, all others were conducted in Hindi with the help of one of the interpreters. I used 'bracketing' (i.e. "setting aside judgments of the expected nature of things") to avoid false assumptions of shared knowledge making most questions *open* (Holliday, 2007: 20).[27] While the rating scale questions concerning water contamination are in themselves closed, those only served the purpose of laying a foundation for more open questions about the reasoning behind given ratings.[28] The questions were previously discussed and adjusted with a local field area expert from the NGO and another time with the three interpreters prior to the first interview. Throughout the data collection, I made sure to discuss any observation made by me or the interpreters during an interview either afterwards or instantaneously, if necessary.

[27] That was especially important for the key informants who were all highly educated but proved to have different opinions on a range of issues.
[28] For example: "How clean or contaminated are the following sources of water in Ranchi? – *Surface Water*" could lead to "Why do you think that surface water is highly contaminated?" which yields an answer that shows more about the respondent's understanding of surface water and its possible contamination.

5.3. Data Analysis

During the data collection period I took notes documenting various observations but also starting to identify possible themes for the analysis. These immediate reflections and questions were included in the transcriptions. I proceeded with the analysis using NVivo to code the interviews into themes and concepts. These were developed and adapted progressively while inspecting the data.

Following the objective to construct rather than ascribe meaning, the ICSA framework uses what Blumer (1954) refers to as 'sensitising concepts' (e.g., institutions, capabilities, outcomes) that offer general guidance in approaching empirical material rather than narrowing the scope to certain indicators (in Bryman, 2012: 388). Accordingly, institutions, individual capabilities, and other parts of the ICSA framework arose from within the material and were incorporated in relation to the selected problem (i.e., Ranchi's citizens drinking contaminated water).

5.4. Limitations

As Ranchi had been relatively neglected in academia before Jharkhand's independence of in 2000, it was hard to find sufficient information in English about some aspects of the local context. Therefore, parts of the background chapter were obtained in conversations during the time of data collection.[29] If possible, these were substantiated with existing research.

The gender ratio of the sample was skewed in that there were more women among the community participants due to their higher daytime availability. While I actively tried to include more men to diversify the sample, it is traditionally women who are responsible for household water management making their input arguably more relevant.[30] The NGO staff member and the two local government officials, on the other hand, were male confirming women's underrepresentation in higher-level positions. While this study is not primarily concerned with gender inequity, it is possible that female key informants would have raised additional points that better represent women's concerns. There are significant positive effects of female representation in lower- and higher-level political positions on women's living conditions including an increased visibility of related forms of oppression such as crime (Iyer, Mani, Mishra & Topalova, 2012). Still, two of the three community leaders were women as well as the majority of community members giving them a strong voice in this study.

[29] If that is the case, the origin of the information is made explicit in the text.

[30] This tendency was confirmed in conversations in the communities. It should go without saying that household water management as a female domain should be problematised in itself as for example done in Prabha Khosla's *Women's household water management in Mylai Balaji Nagar, Chennai, India* (2010).

In addition to having the gatekeepers acting as a guarantor for me, I was initially introduced in my function as researcher working ‘for the NGO’ rather than as an independent researcher which helped in establishing trust. When interviewing participants as a man – and with male research assistants – women can be reluctant to express their opinion for a variety of reasons (Scheyvens, 2014: 193). In advance to the data collection it was enquired with local staff from the NGO whether it was appropriate to have interviews in a room alone with a woman. The observation of participants’ body language and tone, and the collation of these with the interpreters after each interview, confirmed that there were no such barriers in communication. On the contrary, multiple female participants were enthusiastic and happy to share their views and experiences.

The communities knew the gatekeepers and the NGO from previous projects and are likely to have had positive associations with them, possibly connected to benefits received in the past. Besides that, the NGO is not a neutral political actor and my association with them could have influenced responses given (Mercer, 2006: 100-101). Prior to each interview it was clarified that the information provided is not related to planned interventions by the organisation. While the thesis would be shared with the NGO, it is with the intent to enhance its services to beneficiaries but there is no guarantee for that to happen. If profit-oriented thinking played a role among participants, it is unlikely to have affected the results significantly as the nature of most questions (see Appendix 2) does not provide evident opportunities to influence future benefits. No corresponding behaviour was observed during the data collection.

Working with an NGO proved invaluable as it provided an access point to local background information, connected me to gate keepers and helped me revise my questionnaire with a local field area expert. However, there is a risk that the NGO could have exerted a tendentious influence on my study, for example by steering attention away from aspects it falsely deems irrelevant or by making adjustments to the research process and outcome that they reflect better on them as an organisation (Mercer, 2006: 112-113). During the period of data collection, I conducted a second study in Ranchi for that NGO evaluating the adaptation rate of the provided household water filters. With each participant that took part in both projects (i.e., beneficiaries) I took the time to explain my position and the purpose of this thesis in comparison to the other study both verbally and in writing. Overall, I was able to work autonomously especially because the interpreters were also not affiliated with the NGO. The only point of conflict occurred when staff discouraged me from interviewing local government officials to avoid conveying an overly critical stance that could reflect back onto the organisation. Eventually, I was able to convince them that none of my questions was speculative of RMC's role or responsibility for contaminated water and related human suffering, and they helped me in realising the interviews.

Working with research assistants that are also interpreters bears the risk that they filter the results of the study through their translation. This was counteracted by building rapport with them prior to entering the field, ensuring a good understanding of the study on their side, continuous feedback and insisting on literal instead of concise translations of responses (Scheyvens, 2014: 157). As a final validation, I asked an independent person to transcribe the Hindi parts of ten interviews including all key informant interviews. After being assured that the interpreters' on-site translations were highly accurate, I chose to trust the given translations for the remaining interviews.

5.6. Ethical Considerations: Positionality, reflexivity, limitations

Throughout this study I sought to build "relations of mutual respect and recognition" (Peake & Trotz, 1999: 37) with all parties involved. Considering that I entered the context of urban and peri-urban communities in Ranchi as a foreign, white and male researcher, I sought to acknowledge possible implications of that identity. Each participant was asked for consent informing them, verbally and in writing, about purpose and institutional context of this study while guaranteeing confidentiality and anonymity. It was emphasised that the interview could be cancelled at any moment and that respondents can request the deletion of their data until the publication of this thesis.[31] In addition, time was taken before and after each interview to give respondents the space to ask any questions about the study or my own person.

The research design and data analysis complement this approach in that they recognise my own inferiority regarding contextual knowledge. From the beginning of the data collection I established a positive and open relation to the three research assistants. They had volunteered to help me as this experience would be valuable for their own studies and career and they confirmed this at the conclusion of our work. Nevertheless, I decided to pay a compensation of Rs. 80/hour which corresponds to a low research assistant's salary in India.[32]

[31] If respondents did not want to read the consent form, the interpreter made sure to explain all points verbally.

[32] In Jharkhand, as a comparatively poor state, this salary is still far above the minimum wage for skilled labour force (Rs. 65.30/day).

6. ANALYSIS – CONTEXTUALISING WATER CONTAMINATION IN RANCHI, JHARKHAND

Chapter 6 applies the ICSA framework developed in Chapter 3 to parse the available data into constitutions, capabilities and outcomes that surround the core problem: the intake of contaminated water by citizens in Ranchi. The *chosen action* in the centre of the framework is 'Behaviour that exposes a person to contaminated water,' incorporating other origins of polluted water besides drinking (as discussed in section 6.1.).[33] Figure 2 shows the interactions between institutional contexts, capabilities, strategic agency, the chosen action and its outcomes based on the analysis of the interviews and the information from the background chapter. While reasons for being exposed to contaminants are likely to vary between different individuals and water sources, I bundle all factors in one framework to give a comprehensive overview of the forces continuously at play.[34] In doing so, the ICSA framework expounds the relations between community members, local government officials and NGO staff and their parts in contributing to the current conditions. The analysis of aspects generating the status quo supports said stakeholders in implementing changes that reduce exposure to contaminants. Opportunities to break with the current pattern – using existing institutions and capabilities – also emerge from these findings and are discussed in the following chapter.

6.1. Institutional Context

As Chapter 4 established, the city's most common sources of potable water (groundwater from borewells, piped water and wells) contain various contaminants that cause adverse health effects. Having therein elaborated on *anthropogenic and geologic sources of water contamination* in Ranchi, this section starts with exploring another *biophysical condition* that contributes to citizens' exposure to contaminants: the *habituation to the taste of polluted water*. The taste and texture of water depends on traces of organic and inorganic substances in the liquid as well as its physio-chemical characteristics. While foul taste (and smell) trigger repulsion, water users do become habituated to more subtle nuances. That in turn makes water of a slightly different taste or texture appear to be substandard or worse than what they know. This is not a concern for stronger differences in taste. The NGO worker had experienced difficulties when introducing reverse osmosis (RO) filters for water purification to communities. The same can also happen with other sources or filtration methods. He explained:

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[33] If that seems odd, this decision can be justified with the main argument made in the following footnote.

[34] As written in section 3.2., the ICSA framework is a tool for guiding analytical processes and delivers 'an understanding of the complexity of structures and the prediction of a pattern of interactions', not precise forecasts. In addition, many water users rely on multiple water sources supporting this consolidation.

They are habitual of drinking from a contaminated water source (…) people taste other water and say that it's not good for their health. If we provide them with RO filters or bottled water, they think it has bad taste and they will not drink it. RO water tastes different from others but once you start drinking it, you will like it. [NGO, personal communication, 2019, 28 January]

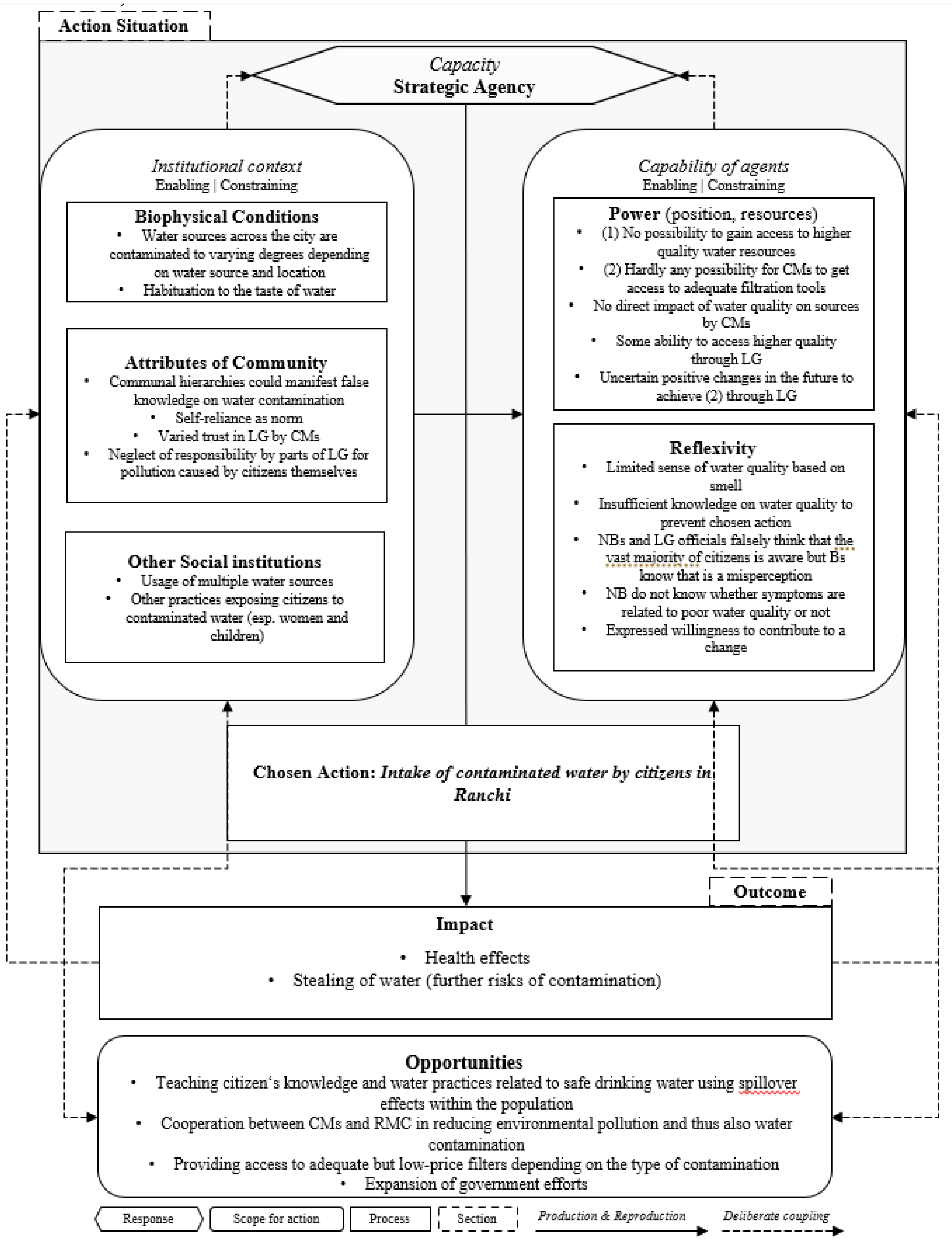

Figure 2: ICSA Framework with 'Intake of contaminated water by citizens in Ranchi' as chosen action

While almost all respondents at least trusted bottled water and the beneficiaries liked the filtered water, I still consider this a highly relevant point because the NGO worker had personally encountered this issue in Ranchi.[35]

Proceeding to *attributes of community*, *communal hierarchies* play a large *role in local knowledge production*. When asked about knowledge on water quality and its effects on health among the people in her personal environment, a younger community member replied: “The elders know. There are old people in our neighbourhood who know everything about it” (CM-NB/L, personal communication, 2019, 25 January). However, traditional forms of knowledge bear the risk of losing accuracy over time. Water quality in cities is often affected by urbanisation, overcrowding, land use intensification, poor sanitation, depletion of aquifers and ageing of pipes to name just a few. All of these are relevant factors in Ranchi exposing residents to health risks as the effects of contamination are not always felt immediately. Chapter 4 already described that the water quality of the main sources in the city has almost certainly changed in the past two decades, a time of rapid growth after becoming state capital.

Another attribute of community is the respondents’ perception of who holds the responsibility for ensuring clean water. Unanimously, participants expressed their own strong sense of responsibility (*self-reliance*) to curb the pollution and take care of the anthropogenic contamination in Ranchi’s drinking water.

> We are responsible because we are the ones who pollute it. [CM-NT, personal communication, 2019, 27 January]
>
> We ourselves are responsible. If we would not be creating waste, we would be getting clean water. [CM-BT, personal communication, 2019, 27 January]
>
> If everyone will get together to clean the water, then it will be clean. So, we as citizens are responsible. [CM-KT, personal communication, 2019, 27 January]

In contrast, the respondents’ *trust in the local government* varied widely. Some participants expressed their disappointment. Others had positive experiences and could tell about incidences where RMC had helped them and their community. Most respondents relied more on themselves though.

[35] Both local government officials, however, mistrusted companies selling bottled water despite the good taste. The representative from the PHED was doubtful whether private companies were guaranteeing acceptable levels of pH-values and amounts of TDS assuming that the health of consumers was only a secondary concern among for-profit companies (personal communication, 2019, 31 January). His colleague at the WSD remembered reading about several companies that are not inspected strictly enough and do not follow the WHO’s tenor for potable water (personal communication, 2019, 31 January). Given what is said at the end of section 4.1. these concerns are somewhat justified.

> The ward leader comes regularly to check (…) for any problem, whether it is financial, if someone died or if it is water-related. He helps people. The government has also given us few borewells (…). [CM-BT, personal communication, 2019, 27 January]

> The government keeps telling that they provide clean drinking water, but they don't do it. [CM-AH, personal communication, 2019, 27 January]

> The government is responsible, but the government does their work very slowly. So, what can we do? They promised to establish a centre for jar water [i.e., water ATM] so everyone can get jar water for a really cheap price but that centre is just an idea. It has not been put into practice. [CM-BB, personal communication, 2019, 27 January]

On the side of the local government, the two interviewed officials displayed a certain *neglect of responsibility for contaminated water*, if the water initially provided was clean and if they believed that the pollution was the citizens' own fault. That could be observed for both piped water and groundwater. The area around some of the boreholes were apparently littered to such an extent that it contaminated the groundwater. The local government official emphasised that it is the citizens' responsibility to keep the area clean (LG-PHED, personal communication, 2019, January 31). A similar refusal to take responsibility was shown by his colleague from the WSD when speaking about piped water. Considering the lead found in taps across Ranchi, he is factually wrong when thinking that residents are responsible for all additional contamination present in the system (Kerketta et al., 2013: p. 373).

> After taking water from the dam we eliminate all contaminants but during the supply through the pipes, if contaminated water is added unknowingly, then there is contamination. Otherwise, at our water treatment plants, every contamination is eliminated or separated. Water is completely pure at that point. (…) we have the provision by law that every household connection has to be managed by people and whenever there is a leakage, when there is any sort of outbursts in their pipes, they have to repair it properly and timely. [LG-WSD, personal communication, 2019, January 31]

When looking at *other social institutions* apart from drinking water, it is most important to emphasise common behavioural institutions (i.e., 'instructions') that expose individuals to polluted water. Besides, the aforementioned *open defecation*, participants mentioned *washing of clothes, hands* (often "after excretion"), and *bathing* as common activities for which less pure water from rivers and ponds is being used (CM-BT, personal communication, 2019, 27 January). During those activities – for which they often cannot obtain sufficient amounts of water from other sources – they can come into contact with pathogenic bacteria. In particular women and children are exposed to these risks as they are typically responsible for fetching water and washing clothes. In addition, children are more vulnerable because their immune system is still developing. A beneficiary interviewee, who had mentioned cold, cough and dysentery that her family has been suffering from prior to receiving a filter, explained that her youngest child was still affected by sickness from contaminated water:

> Not the grown-ups but my daughter [who is two years old]. Any time when she goes to play in the neighbourhood and she is playing with the water, she is affected. Not at home because then I take care of her. [CM-B-NT, personal communication, 2019, 27 January]

It follows from the previous paragraph that Ranchi's citizens typically *rely on several water sources for different purposes* exposing them to different contaminants depending on the water source. The preferred source was typically groundwater even though most participants still said it needed some form of treatment before drinking (see 6.2. for common treatment methods). All five sources (piped, surface, borewell, tanker/storage unit, bottled) were used by the interviewed community members with piped and borewell being the most common (e.g., CM-B-AH, personal communication, 2019, 27 January).

6.2. Capabilities of Agents

There are several factors determining the capability of the respondents in this study. To avoid the intake of contaminated water in Ranchi, individuals need to know about the nature of water contamination in the city, its consequences and ways to access potable water. These elements constitute an individual's *reflexivity* influencing her 'chosen action' that will or will not expose her to polluted water.

The interviews confirmed that everyone shares a basic but *limited sense of water quality* based on smell, colour and taste (e.g., NGO, personal communication, 2019, 28 January). That was often explicitly confirmed in statements such as "It tastes like iron. Iron content is higher even though the water seems to be [visibly] clean" (CM-NT, personal communication, 2019, 27 January). However, by far not all harmful degrees of contamination are intuitively detectable, nor does this basic understanding imply any further knowledge about possible health consequences or measures to improve water quality.

Respondent's factual *knowledge* was very similar across both beneficiary and non-beneficiary groups. Interviewees were very much aware that water quality varies between sources and across different locations in Ranchi. Their personal assessments of specific sources were quite different at times. Besides differences in knowledge, the answers could also correspond to actual differences in water quality between different locations. Causes for contamination were assumed to be iron and dirt coming from the soil, few also mentioned bacteria.[36] Important knowledge on structural factors of contamination such as the construction of water pipes in the drainage beside the street, polluted run-off from rocks and the presence of other metals (besides iron) in the soil was widely lacking. Few respondents were aware of structural causes for water contamination such as overpopulation, overexploitation and deforestation.

> The groundwater level goes down. So then, people tend to dig more borewells. So that causes even more destruction from the ground water because then it gives out muddy water, so everywhere we get muddy water. [CM-B/NT, personal communication, 2019, January 27]
>
> (…) due to overpopulation everyone is dumping their drain into the rivers and the river has now become black. It is more like a big drainage system. [CM-B/BB, personal communication, 2019, January 27]

A trend was discernible when asking about the interviewees' perception of how well-informed people in their personal environment are about the effects of water quality on health. Most non-beneficiaries believed that everyone was well-informed. For them, people that drank contaminated water did so because they had no alternative.[37] Similar to non-beneficiaries, the local government official from the WSD was convinced that people are aware and that they would act decisively, if they believed their water might not be potable. Considering the widespread and diverse characteristics of water contamination in Ranchi laid out in Chapter 4, that would require additional filtering of water in almost every household and regular testing. The other interviews disconfirm the above impression. Almost all beneficiaries stated that knowledge levels differ and that there is a large number of citizens in Ranchi that are not aware. Given that beneficiaries are able to compare their own knowledge before and after being taught by the NGO, their opinion is likely to be more accurate.[38]

> Everyone knows … that drinking clean water is necessary but sometimes people are forced in rural areas to drink unsafe water. [CL-NB/BB, personal communication, 2019, 26 January]
>
> People are aware over here. Whenever they think the water is contaminated, they check their water here at RMC, with an organisation or we send the water

[36] Several questions targeted the depth of knowledge interviewees had about water contamination and its effects on health including questions about the type and origin of contamination and a rating of the degree of contamination for each water source prompting follow-up questions about the reasoning behind respective answers.
[37] From the total of 13, three of the younger non-beneficiaries (aged 19-25) diverged from that tendency.
[38] A few respondents estimated that one half of people is aware and the other is not. The data however does not allow for a verification of that.

> to a different lab for them. Only when it is confirmed that the water quality in that location is good enough for people, then they drink. Some that are not financially viable enough may drink contaminated water [LG/WSD, personal communication, 2019, 31 January]

> The people here were not aware of the importance of water quality before receiving the filter. We as women, tell those without a filter: "You have to filter the water. You have to boil the water for drinking." [CM-B/AH, personal communication, 2019, 27 January]

The contrast between respondents' shared but limited factual knowledge on water contamination in Ranchi and their *diverging assessments of public awareness* reveals that the existing awareness and common knowledge are insufficient in preventing people from drinking contaminated water. Instead it is the 'experience of following healthier water practices' itself that yielded the conclusion drawn by beneficiaries that public awareness is insufficient. That theory was substantiated in statements about waterborne health consequences in the household.

The vast majority of interviewees said that their family did not suffer from waterborne diseases even when asked for specific illnesses that are confirmed to occur in Ranchi. However, beneficiaries of the NGO who received a water filter for their household reported significant health improvements. The main symptoms that subsided were gastric problems, stomach-ache, cough, cold, diarrhoea, fever and general discomfort. As respondents in the interview were specifically asked about 'waterborne' diseases, it became clear that many respondents in the interview did not relate the symptoms they were experiencing with their drinking water.

Measures to reduce contamination in drinking water were commonly used among beneficiaries and non-beneficiaries but it is unclear in how far they know the functionality of each method.[39] Most households used clothes for pre-filtering and then boiled the water or used the filter provided by the NGO. In non-beneficiary households few also used bleaching powder and one woman mentioned separating dirt by letting it sink to the bottom of the container before taking water from the top to filter it with clothes or boil it. Recapitulating the effectiveness of different filter methods, it is clear that while bacteria are likely to be eliminated in most households, chemicals and heavy metals cannot be reliably removed with these methods. Depending on the location that can have serious health consequences (see Chapter 4).

When asked about what respondents themselves can do to improve the general water quality in Ranchi, most people said that they should take better care of their environment pointing to the litter floating in many waterbodies (linking this point to the interviewees' sense

[39] The respondents were not asked to explain the functionality of the method they used or any other method. Some also cleaned the water used for cooking as is recommended.

of personal responsibility under 6.1.). However, public waste hardly contributes to water contamination in groundwater as the most common source used for drinking. Since most causes of contamination are natural, it is of course difficult, if not impossible, to change them at the source.[40] Many respondents suggested that they could talk to more people and spread awareness about the importance of water quality and a clean environment. This *expressed willingness to contribute to a change* is significant and will be addressed again later in this section. In addition, one younger beneficiary suggested the following revealing a deeper understanding of the water cycle than most others had shown: I want to plant a tree. Everyone should plant a tree (…). It will bring up the ground water level (CM-B-NT, personal communication, 2019, 27 January).

Considering the factual knowledge among the majority of the sample, it is probable that there is a large segment of the population that is not aware and has only little information on water contamination beyond the indicators of smell, colour and taste. Generally, respondents were inclined to think that the measures taken in their own household were sufficient. Depending on location, water source and accustomed filter methods this limited reflexivity can have detrimental health consequences, especially for children.

The limited cognitive and intellectual capacity to prevent the consumption of contaminated water also restricts respondents' *power* to do so which can be defined as their control over the following two impactful actions: gaining access to higher quality water sources or reducing the contamination in the water available.[41] That includes the respondents' ability to achieve these actions indirectly through other parties such as RMC. The latter incorporates many communication mechanisms that could be named under 'attributes of community' (see 6.1). Nonetheless, they are covered in the following because they are essential in determining respondents' power.

Gaining access to higher quality water sources is mostly not realisable for the respondents. From Chapter 4 it is clear that, if any, bottled water is the only reliable direct source for potable water but many interviewees said they cannot afford it. Few households bought it temporarily when someone in the house had sufficient income.

> Pure or very clean but we can't afford that because we cannot spend money on drinking water. [CM-B-BB, personal communication, 2019, 27 January]

[40] Certain natural forms of contamination are exacerbated by human action such as overexploitation of aquifers and contamination in pipes can be controlled, but there is little that the individual water user can change by herself.
[41] As written in Chapter 3, an individual's position and resources are typically determining their control over certain actions.

> It is a source of water if we have a function at the house [i.e., job] but the main source of water is the borewell that was dug two years back. [CM-B-AH, personal communication, 2019, 27 January]

Alternatively, respondents seek to *reduce contamination in the water available*. Pursuing that at the source level is only possible for anthropogenic contaminants which in itself is insufficient and even those are difficult to tackle for the individual. While many showed a willingness to clean their environment and reduce littering, many felt overwhelmed by the amounts of waste in the city and did not believe that their actions could have a significant impact. “If no one does anything, I can’t do anything either” (CM-B-NT, personal communication, 2019, 27 January). The fact that a company with significant funding from RMC was not able to clean Harmu river shows that it needs large-scale efforts to curb water contamination from anthropogenic sources (The Telegraph, 2019b).[42]

Consequently, reducing water contamination on the household level is primarily possible through filtration, boiling or the use of bleaching powder. Considering the functionality and drawbacks of bleaching powder and the use of clothes, boiling or applying a filter are the preferred options (as follows from section 4.2.4.).[43] Boiling of drinking water is easy to do and could already be sufficient if bacterial contamination is the only concern.[44] In contrast, RO filters are the most effective option in light of the diversity and variability of water contamination across Ranchi. However, they are typically designed to be connected to the piped water system of and require a high initial investment.[45] Other filters including the one provided by the NGO or those with charcoal remove less contaminants but are relatively inexpensive. Their low volumetric flow rates represent a problem for larger households that need more drinking water. None of these options is ideal but they could be effective and achievable for some that either have sufficient disposable income for a low-priced RO filter, a small to medium household size and water not heavily affected by chemicals or heavy metals (other types of filters), or are only affected by bacterial contamination (boiling). The government official from the WSD confirmed that…

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[42] This is of course not to say that residents cleaning their surroundings is redundant. It simply is not sufficient.

[43] Bleaching powder can be a good option if larger amounts of water (e.g., in a tank) need to be cleaned or if obtaining fuel or energy for boiling is an issue.

[44] Looking back at chapter 4 that can only occur in households using a well or piped water, but contamination in these can vary at the same location even in the short run and would need to be checked regularly.

[45] A household connection to the piped system is already a cost factor and simply not available in certain areas of the city as discussed in 4.2.3. That leaves the potential hurdle of household members not accepting the different taste (as discussed in the beginning of section 6.1.).

> …obtaining clean water is not in the hand of every person in Ranchi. (…) Even when they know that the water is not potable, they use the water out of compulsion. They are not financially viable enough to have their own resources or to install the RO plants in their houses. [LG/WSD, personal communication, 2019, 31 January]

For the majority of respondents that cannot access any of the measures to reduce contamination in their drinking water, the remaining option is to do so *indirectly through the local government*. NGOs could have the same function as was the case for part of the sample in this study. NGOs' limited financial opportunities however preclude any potential to address Ranchi's entire population. Therefore, the following paragraphs focus on RMC with NGOs being considered complementary partners. The previous section already established that respondents were generally self-reliant and had varying degrees of trust in the local government, i.e. in RMC taking responsibility for its residents and delivering upon its promises. Provided that Ranchi's citizens are aware when their drinking water quality is poor, it must be asked what other factors keep them from utilising government channels to demand pure drinking water. And if they do raise their voice, how is the government responding to requests and to the water crisis in general?

Most interviewees mentioned their community leader as first point of contact for drinking-water-related problems, often together with neighbours that use the same water source. The community leaders in turn could provide examples of how they had helped members to send their complaints to RMC. Those that had expressed trust in the local government often mentioned RMC directly as first point of contact. Few did not know whom to address about drinking-water-related problems.

The official from the WSD further explained that citizens can contact them directly either at their office, through one of their toll-free complaint numbers or WhatsApp (LG/WSD, personal communication, 2019, 31 January). It is unclear how effective each of these channels is. Still, it is evident that there are practically functioning communication pathways between residents and the local government, both directly and indirectly through the community leader. This study could not assess RMC's response rate to the requests of its citizens as only few examples of successful complaints came up in the interviews. The varying trust in the local government could mean that responsiveness varies but other explanations are possible. It seems probable that RMC is more responsive to demands made by groups of people or community leaders.

> We asked the government for borewells and [after three months] at three or four places over here the government has provided them. So now, there is no shortage of water. (…) We showed unity and that is why the government had to provide us with the borewells. [CM-B/AT, personal communication, 2019, January 27]

> The government should not only creat deep borings and the borewells but should also put up a filtration centre with filtration machines so that the normal person can go and filter his water and drink. And use it for [other] purposes in his household. [CM-B-NT personal communication, 2019, January 27]

RMC is engaged in additional efforts to address the city's water crisis. An important aspect of its strategy is the installation of water ATMs throughout the city (i.e. larger RO plants which are directly connected to boreholes) as requested in the previous quotation. While that is a highly effective way of addressing drinking water contamination in groundwater, none of these water ATMs had been built in the area of study at the time of data collection. Besides that, citizens can always request to have their water tested. Furthermore, RMC is tackling the depleted aquifers through rainwater harvesting. The official from WSD reported such structures were already installed in 25,000 buildings (personal communication, 2019, 31 January). It remains to be seen whether these measures are sufficient in tackling shortages and contamination in the future. Recalling the neglect of responsibility for contamination in piped water shown in 6.1. the success of these projects appears uncertain. Nevertheless, any progress would alleviate the increasing water stress.

Ranchi's citizens are limited both in their reflectivity and power to avoid the consumption of contaminated water. Still, this section also proves that the respondents were willing to try to change their situation as some of them had already proven that when obtaining access to higher quality water through the government. Despite current projects by RMC to reduce water stress, the overall situation in Ranchi still allows for widespread consumption of contaminated water. Its consequences will be addressed in the last section of this chapter.

6.3. Outcomes & Opportunities

This section analyses *institutional work* and *other outcomes*, i.e. how the consumption of contaminated water affects the institutional context previously described as well as other relevant effects.

Starting with the latter the health effects of contaminated water have already been elaborated upon in Chapter 4 and are modulated by all measures that improve water quality. While all household members are affected significantly, there is a gender and age imbalance with women and children being likely to suffer more repercussions. Poor health influences all areas of life in the long run including mental health, education and income.

A consequence of the consumption of contaminated water is that some people 'steal' (higher quality) water especially from the piped system.[46] Every time a connection is damaged in that process, there is a high risk of contamination affecting every other connection further down the pipe, in particular if pipes are cut open in the drainage. In the long run this can reduce the availability of water in households that have paid for a connection as is the case in some neighbourhoods of Mumbai (Björkman, 2014: 47, 54).[47] In Ranchi, some respondents who had access to both sources already preferred groundwater over piped water. RMCs' efforts to keep expanding the piped system relies on the availability and quality of the delivered water. Both are negatively affected by the stealing of water. One of the two government officials said to be aware of the stealing but that they do not pursue the perpetrators because "water is a human right" (LG/PHED, personal communication, 2019 January 31). While that is proportionate and humanitarian stance, it needs to be ensured that in the medium term no one needs to take water without a registered connection to avoid the dilemma that water engineers in Mumbai face. One interviewee also reported that she found herself compelled to steal when the water from her borewell became too muddy for drinking during a drought but the government tankers were not delivering water to her area. During the night her family went to a tanker in a neighbouring community and took water for her and her family. Especially for women it is not safe to fetch water during the night.

> We used to go during the night to get the water [from the tanker] little by little just for drinking purposes. [CM-B/AH, personal communication, 2019, January 27]

It is clear that the institutional context and capabilities that induce the consumption of contaminated water in the first place remain unchanged, if not tackled. However, there are other medium- and long-term consequences of the status quo. Structural forces such as population growth, urbanisation and climate change are likely to worsen biophysical conditions in the future exacerbating shortages and water quality, if not counteracted by the aforementioned government efforts. To bring clean water to every household in a city of 1.5 million where, at the time of data collection, there were 105,909 registered connections to the (at least partly contaminated) piped system, a purely technological solution is not viable (LG-PHED, personal communication, 2019, 31 January). Increased awareness including knowledge about adequate

[46] As I am referring to taking water out of absolute necessity, I do not consider this a crime.

[47] The study describes how residents and authorities struggle to deal with water shortage and the emerging informal market fed by stolen water. The circumstances create a deadlock where many users remain underserved and many that steal out of necessity are repeatedly cut off or buy water from others.

water practices among the population is crucial. Such awareness includes knowledge but it must also encompass a sense of urgency and concern over the matter of clean drinking water.

Households experiencing health benefits from improved water practices might promote these in their personal environment. A widespread adoption of adequate water practices is however unlikely without strong efforts of the local government. Rigorous testing is a prerequisite for any successful intervention. RMC and NGOs would need to teach methods to reduce contamination in drinking water and provide poor citizens with the means to do so. The role of community hierarchies in knowledge production may decrease through further awareness raising and regular testing of water.

Opposed to the government official's disappointment about citizens sense of responsibility for their environment, the interviews revealed a strong potential in involving citizens more strongly in interventions. RMC and citizens were equally concerned over anthropogenic pollution. Especially beneficiaries that already reaped the benefits of improved water quality were enthusiastic about raising awareness. Incorporating citizens into the government efforts and propagate healthier water practices could strengthen the varying trust and cooperation between citizens and RMC in the long run. Sufficient communication pathways between community members, leaders and RMC exist to address individual problems but community leaders should ensure that every community member is aware of them. In addition, residents should learn to mobilise others in their neighbourhood to approach the local government as a group as that was the case in all of the successful examples that respondents mentioned in the interviews.

7. THE ICSA FRAMEWORK: A PRELIMINARY REVIEW

The previous chapter has applied the ICSA framework with the chosen action/problem being the consumption of contaminated water in Ranchi. Chapter 7 reviews the framework focusing on three questions: (a) With regards to the chosen action, did the framework successfully facilitate an understanding between institutions, capabilities and strategic agency, (b) how useful is this type of analysis for practitioners and (c) what are the limitations of this framework?

I believe the answer to question (a) is positive. Chapter 6 goes far beyond a basic understanding of the types of contamination in Ranchi and who may be affected by them. It elaborates on the constraining and enabling forces leading an individual to consume contaminated water. In doing so, it gradually explains numerous biophysical and social factors spanning geologic sources of contamination, communal hierarchies and residents' level of trust in the government. At several points, it is made clear that the systemic forces at play in this action situation apply differently to different individuals discouraging inflexible and one-sided solutions.

Obtaining such a comprehensive view is important for practitioners from government authorities and NGOs. Many of the elaborations and institutions in themselves are not necessarily new to them. Nevertheless, they may have not considered them simultaneously and in conjunction with the consumption of contaminated water. Depending on the data there are likely to be some novel findings. In this case, the difference in perception between the WSD official's perceived neglect by citizens to care for their environment and the respondents' evident willingness to contribute to better environmental conditions, is one such finding – a factor that could prevent future cooperation between these stakeholders.

The framework also yields opportunities that practitioners can use to design interventions or adapt existing ones. These opportunities can be realised in two ways. Here, that is in the form of counteracting elements that constrain the consumption of higher quality water (e.g., poor knowledge about water contamination, no access to better water/filters) or strengthening those that enable it (e.g., willingness to raise awareness by community members, government efforts such as water ATMs). What these ideas have in common is that they are rooted in a solid understanding of existing capabilities and institutions and are therefore more likely to elicit participatory and context-sensitive interventions. At the same time, they are concrete opportunities to address the problem at hand at the systemic level.

One could argue that the ICSA framework discourages innovations from the outside or foreign approaches through its emphasis on what already exists in a certain context but I do not think that is true. On the contrary, new innovations that are not irreconcilable with present institutions and capabilities can be tailored to the local context using the in-depth understanding the ICSA framework is able to facilitate.

The ICSA framework faces few important limitations. It is typological and thus does not prescribe any of its contents precluding strong biases at the early stage of the research process. That strength entails that its usefulness solely depends on the accuracy and availability of the data and the researcher's ability to prioritise the most significant factors. While this limitation is relevant for any framework or model, it is particularly important to consider for the ICSA framework as it gives its user less guidance.

Its generalist character makes this framework applicable to a range of other issues in development contexts that have an individual action at their centre. However, social movements or environmental conservation efforts will hardly benefit from its analytical capacity. The terminology borrowed from new institutionalism and in part political ecology (power) might further restricts its applicability to other cases.

In addition, the focus on one 'chosen action' limits the factors that can be analysed in relation to each other. In Chapter 6, I decided to broaden the scope from contaminants in drinking water to the consumption of contaminated water in general. That is a small change but I could not think of a framing that would allow me to incorporate more aspects from my interviews. That shows that the ICSA framework does not allow to incorporate multiple action situations into the analysis even if more than one is important. This limitation is somewhat mitigated by the possibility of framing other relevant actions (e.g., the stealing of water) within institutional context, capabilities or outcomes.[48] Taken as a whole the ICSA framework allows to include more aspects than most other models. Nonetheless, analyses that aim at displaying more aspects of a water governance system than one key action could relate to, might revert to models with a systemic perspective such as IWRM.

That bandwidth of factors that can be incorporated into the ICSA framework is evident in the diversity of aspects included in the analysis conducted in Chapter 6. This complexity comes at the cost of clearness. Other frameworks or models usually have a more directed focus. In contrast, the structure of the ICSA framework encourages its users to explore all aspects of an action situation without necessarily emphasising any particular one. The division of institutional context and capabilities can visibly – although not necessarily analytically – separate factors that interact in reality (e.g., the role of communal hierarchies in knowledge production and poor knowledge on the nature of contamination in Ranchi). Carefully arranged and less 'packed' framings can therefore be more straightforward for researchers and practitioners.

As a response to that argument, it should be noted that not all types of institutions or capabilities necessarily play a significant role in an action situation. It is up to the researcher to decide what factors to include with the guiding questions being: how relevant is this factor in determining the chosen action and/or does it represent an impactful opportunity for achieving the desired transition?

[48] It is also an option to fill the ICSA framework multiple times with several action situations at its centre. Many of the contextual factors and capabilities are likely to stay the same.

At the core of this theory is the acceptance that theoretical tools can only display a small section of reality. The ICSA framework can be thought of as a puzzle that should be completed as far as possible to gain a clear picture of the phenomenon under observation. However, it is crucial to be aware that the world extends beyond the edges of the puzzle and any conclusions are likely simplifications. It is therefore advisable to stay aware of new impressions or contradictions when using the results in practice. Accordingly, the ICSA framework is a tool functioning *complimentary* to others. Just as the analysis in Chapter 6 benefited indirectly from other theoretical tools (e.g., models on groundwater recharge mechanisms), other analyses can gain an understanding of niche-level actions and how these interact with systemic factors from the ICSA framework.[49]

8. CONCLUSION

This thesis began by pointing to the urgent task of providing clean drinking water to the citizens of Ranchi, Jharkhand. To achieve that, it requires changes to the city's water governance system. However, there is a lack of context-sensitive models or frameworks to guide such a transition process. Chapter 2 takes up discourses in water governance and transition theory concluding that it is an understanding of induvial action on the niche-level and its interactions with institutions that is necessary to guide sustainable transition processes. The following chapter consequently tackles the question of *how to construct a framework that facilitates an understanding of interactions between institutions, capabilities and strategic agency*. The developed ICSA framework needs to include two main factors. Firstly, it must be able to incorporate institutions that shape a person's scope of action. These were divided into biophysical conditions, attributes of community and other social institutions. The second key element are individual capabilities – namely power and reflectivity (i.e. cognitive and intellectual capacities) – as these strongly modulate a person's strategic agency. The outcomes of the chosen action at the centre of the ICSA framework can then be understood in light of relevant institutions and capabilities.

Returning to the case, Chapter 4 starts exploring the *enabling and constraining institutions and capabilities that determine the intake of contaminated water by citizens in Ranchi*. It describes the biophysical conditions in Ranchi's water supply system elucidating

[49] That is processes on the regime and landscape level (see section 2.3.).

how each water source carries different contaminants (e.g., bacteria or arsenic) and why the severity of contamination for the same source can vary between locations in the city. The chapter further touches on health consequences of water contamination and relevant household measures to reduce it before emphasising that clean drinking water alone is not sufficient to prevent such health effects. Chapter 6 incorporates these biophysical conditions into the ICSA framework and analyses further institutions and capabilities that constrain or enable the consumption of contaminated water based on the data collected from 28 interviews in Ranchi.

While respondents shared a basic sense of water quality, their knowledge of the characteristics of water contamination in Ranchi was poor. Since communal hierarchies play an important role in local knowledge production there is a high risk of false, outdated or incomplete information to be spread. In addition, respondents' limited resources prevent them from accessing better sources or filters. Even if higher quality water is accessible, the habituation to the taste of contaminated water can make the transition difficult. These circumstances are further complicated by respondents' use of different water sources for drinking but also for other activities such as washing or playing. Respondents that had established healthier water practices were automatically more aware of the deficient awareness among the rest of the population. Often, they showed enthusiasm about circulating their knowledge and experiences in their personal environment.

The local government as the central actor providing Ranchi's citizens with drinking water (e.g., providing new boreholes) is itself affected by constraining and enabling forces. The respondents' trust in them varied widely and most of them did not rely on the local government to provide clean drinking water. Nonetheless, RMC pursues additional efforts to alleviate the situation such as rainwater harvesting and the provision of public water ATMs. The impact of these interventions remains uncertain. At least in parts of RMC, the interviews also revealed an unwillingness to take responsibility for contaminated drinking water in cases where citizens themselves caused it. The contrast to citizens interest in taking better care of their environment illustrates the misunderstanding between these parties. Pathways for communication between communities and RMC exist and are already in regular use but citizens should be encouraged more strongly to use them.

The analysis of factors that enable or constrain the consumption of contaminated water in Ranchi yielded many starting points for interventions that promote healthier water practices. Existing and new approaches to address the situation can be adjusted using the insights from this framework. As research on the conditions in the city remains sparse, this study presents relevant findings on Ranchi's water governance system for the first time in such a comprehensive manner especially with the focus on both biophysical and social factors. Further studies on both are urgently needed possibly focusing concrete factors that have come up in this thesis (e.g., the prospects of water ATMs in solving Ranchi's drinking water crisis, the potential of stronger cooperation between RMC and its citizens to promote healthier water practices).

With the diversity of contexts and challenges in water governance, tools are necessary that can guide academics and practitioners in their work. The ICSA framework proved practical in facilitating an in-depth understanding of the interactions between institutions and strategic agency producing individual action. Its generic nature makes it appliable in many development contexts where an (un)desirable individual action is at the core of the analysis. However, to further optimise it, research is required reviewing how the ICSA framework performs in other contexts or with different types of data.

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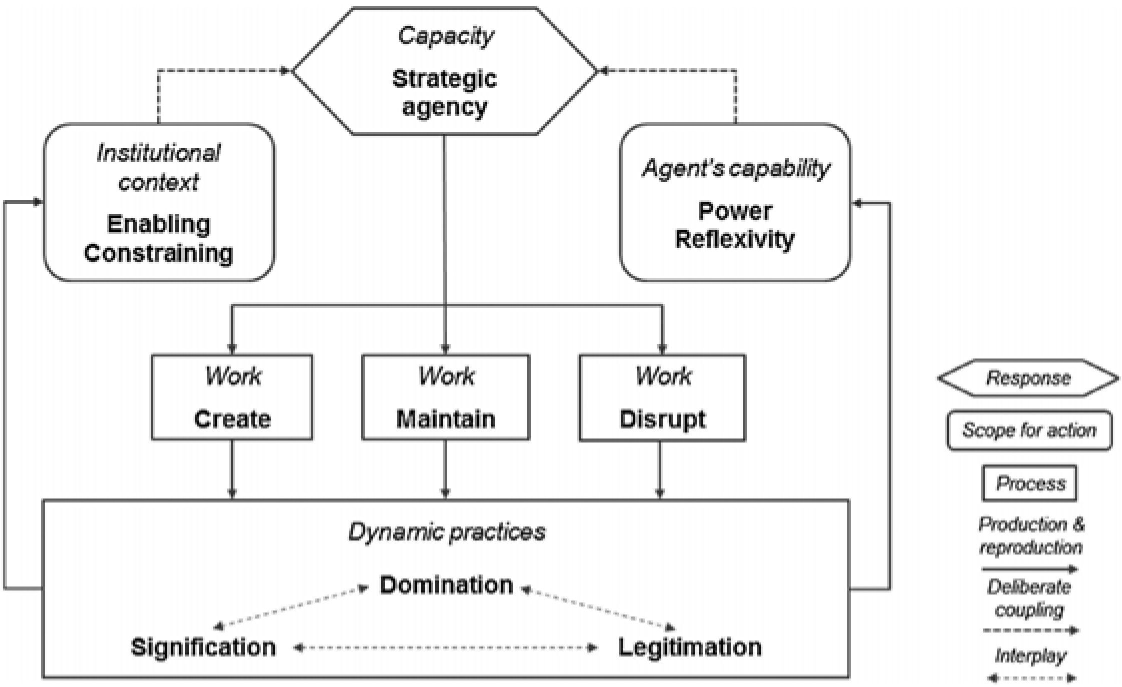
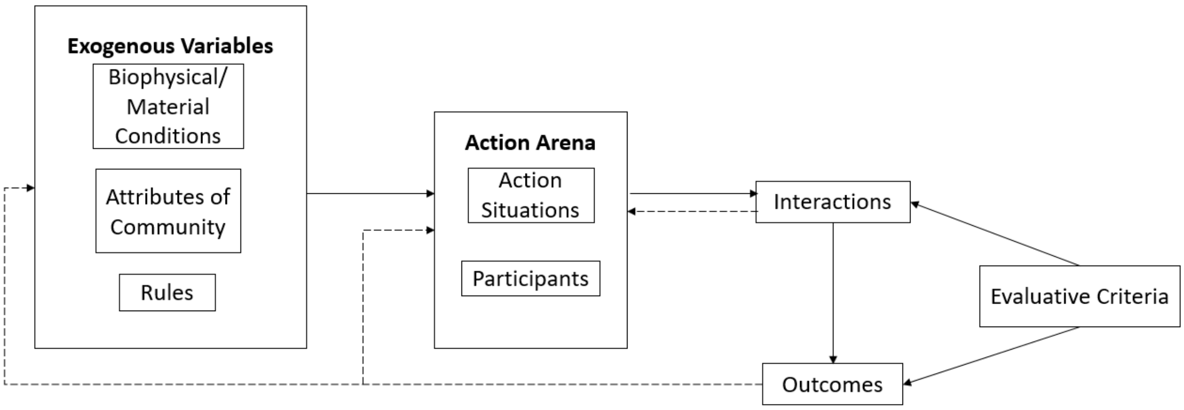
APPENDICES

Appendix A – Theoretical Origins of the ICSA Framework

- Diagnostic framework of strategic agency as developed by Novalia et al. (2018)



- Ostrom (2005)



Appendix B – Interview Materials

Consent Form: Research on Perceptions of Water Quality in Ranchi
(participants received form in Hindi)
Date: Community:
Full name of participant:
Gender of participant: Age of participant:
Statement of Consent
This project is done by Jonathan Wirths who is a student within the M. Sc. Programme in International Development and Management at Lund University, Sweden. In Ranchi he is supported by World Vision India in planning and conducting the research. This project is co-financed by a research grant from the Swedish International Centre for Local Democracy.
In this research, data is collected to explore what perceptions of water quality exist in Ranchi and how different stakeholders understand their own and other actors' responsibility with regards to water quality. The purpose is to reveal different perspectives on water quality and, in comparing those, fostering improved future interventions by stakeholders for the sake of water quality. Besides questions on individual water practices, this interview includes, among others, questions on the role of citizens, local government and civil society in ensuring water quality.
Upon the agreement by the respondent, this interview will be recorded. The data collected will be treated confidentially. That means, the raw data provided (including the recording) will not be revealed to anyone besides Jonathan Wirths and the interpreters collecting it. In the final thesis, information given by respondents is never presented in ways that individuals are identifiable! At any point until the completion of the thesis, respondents can inform Jonathan Wirths that they would not like their provided information to be part of the data and request that it is deleted. The thesis will be publicly available to students and staff at Lund University and a copy will be sent to World Vision India and the Swedish International Centre for Local Democracy. If requested, it will be sent to respondents via email.
The purpose of this research has been explained to the participant. The decision to partake is free and there is no direct incentive for the respondent except the contribution to this project and future improvements in the work by citizens, local governments and civil society for water quality. The decision of a beneficiary to participate in this research and the information provided will not directly influence any benefits that she/he received at any point from World Vision India, nor will it do so in the future. The respondent is free to deny the request for participation or terminate the data collection at any time without having to fear any negative consequences.
I, the participant, have been made aware of the points above. I have understood them fully and any questions I had were answered. I agree to partake in this research.
Signature of Participant

The points above have been explained to the participant and full understanding was ensured. All questions related to this section have been answered. The participant has agreed verbally and in writing (signature above) to take part in this research.
Signature of Researcher

Community Member Interview Guide

Name of respondent: Age of respondent:

Community name:

Date: Start time: End time:

1. What elements can be present in water that are harmful to humans?

2. Are there harmful elements in the water you obtain in Ranchi? If yes, what are these?

3. Is the quality of the water the same everywhere in Ranchi?

4. How clean or harmful are the following sources of water in Ranchi?

Piped water:

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Surface water:

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Groundwater from borewell/pump

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Local storage unit (filled by tanker)

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Sealed bottled water

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting required health standards	Lightly contaminated	Contaminated	Strongly contaminated

6. Do you follow any practices to clean the water you use for drinking, cooking or brushing teeth?

7. How informed are people in your personal environment about water quality and its effects on health?

8. Where does the contamination of water in Ranchi come from?

9. Who is responsible for ensuring water quality?

10. Have you or members of your family suffered from diseases that were related to poor water quality?

11. Do you think you can influence water quality in Ranchi? If so, how?

12. Where you approached by and/or did you ever approach the local government or civil society regarding water quality? If not, who would you contact if you had an issue with water quality in your household?

Notes and impression of the interviewer + impressions of the interpreter:

Key Informant Interview Guide

Name of respondent: Age of respondent:

Date: Start time: End time:

1. From what types of sources do you obtain your water? [multiple answers possible]

○ 1	○ 2	○ 3	○ 4	○ 5
Piped water	Surface water (river, lake, etc.)	Groundwater from borewell or pump	Local storage unit (filled by tanker)	Sealed bottled water

2. What elements can be present in water that are harmful to humans?

3. Are there harmful elements in the water in Ranchi? If yes, what are these?

4. Is the quality of the water the same everywhere in Ranchi? (thinking of each water source respectively)

5. How clean or harmful are the following sources of water in Ranchi?

Piped water:

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Surface water:

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Groundwater from borewell/pump

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Local storage unit (filled by tanker)

○ 1	○ 2	○ 3	○ 4	○ 5
Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

Sealed bottled water

○ 1	○ 2	○ 3	○ 4	○ 5

Pure/very clean	Potable/meeting necessary standards	Lightly contaminated	Contaminated	Strongly contaminated

6. Do you follow any practices to clean the water you use for drinking, cooking or brushing teeth?

7. How informed are people in your personal environment about water quality and its effects on health?

8. Where does the contamination of water in Ranchi come from?

9. Who is responsible for ensuring water quality?

10. Do you think you can influence water quality in Ranchi? If so, how?

11. What does the local government/NGO do in Ranchi to ensure water quality for its beneficiaries?

12. What factors prevent people from obtaining and receiving clean water?

13. What is the role of Ranchi's citizens in achieving and maintaining good water quality?

14. What is the role of the local government/NGO in achieving and maintaining good water quality? (depending on question 11.)

15. What is the role of civil society in achieving and maintaining good water quality?

16. How do individuals living in Ranchi, the local government and civil society communicate and/or collaborate on the subject of water quality?

Notes and impression of the interviewer + impressions of the interpreter: