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D6.1.5/6a: Analytical Framework – enabling factors for sustainable urban water management

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Deliverable Briefing Note

D6.1.5/6a: Analytical Framework – enabling factors for sustainable urban water management

Audience
The document is targeted at an audience both internal and external to the SWITCH consortium. It is firstly a guide for researchers compiling the linked case studies and secondly a resource to support the reflection and actions of researchers, planners, policy makers and other stakeholders involved in sustainable urban water management.

Purpose
The purpose of the document is to elaborate a theoretical framework for the comparative analysis of enabling and constraining factors of sustainable urban water management. This includes identifying framework conditions and mechanisms - in areas such as governance, institutional arrangements, economics and politics - that are drivers or barriers to the uptake and wider application of integrated processes for managing the urban water cycle in a sustainable manner. Also, the aim is to identify frameworks conditions and mechanisms that are either drivers or barriers to the uptake and wider application of innovative technologies and systems that can contribute to more sustainable urban water management. Findings might support plans and decisions for scaling up relevant innovation in cities both within and beyond the SWITCH context.

Background
The need for the analytical framework was identified during the review of progress with tasks under WP6.1. It was a response to the criticism of poor integration between work packages from an external review of the SWITCH project. It was also a response to the opportunity for influencing interested cities outside of the SWITCH project. The intention was that the analytical framework would feed into the "transitioning handbook" produced by the University of Abertay. Hence, Task 6.1.5: "Appraisal of influencing tools and mechanisms and recommendations on which is appropriate in different circumstances" and Task 6.1.6 "identification of barriers, opportunities and organizational arrangements for integrated urban water management", were brought together into Task 6.1.5/6.

Issues
The theoretical framework identifies strands of thought relevant to policy diffusion, shifts in governance, technological change and innovation diffusion. This helps identify broad questions relevant to different cities in different geopolitical contexts.

Recommendations
The identified questions refer to the enabling and constraining factors of sustainable urban water management. These recommend what factors to consider in the development of case studies as part of Task 6.1.5/6 (additional guidance for researchers is contained in the Annex produced by ICLEI). The identified questions are also offered for the consideration of policy practitioners.

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1. Introduction

This paper aims at elaborating a theoretical and analytical framework for Task 6.1.5/6 "Comparative analysis of enabling factors of sustainable urban water management", as part of the SWITCH Project. The objective of Task 6.1.5/6 is twofold:

a) to "identify framework conditions and mechanisms in areas such as governance, law, institutional set-ups, economics, politics, financing, communication, marketing, culture, geography, climate conditions and other that are drivers or barriers to the … *uptake and wider application of integrated processes for managing the urban water cycle in a sustainable manner* … and to draw conclusions from these conditions and mechanisms for scaling up IUWM in cities both within and beyond the SWITCH context"; and,

b) to "identify frameworks conditions and mechanisms - in the same areas as above - that are drivers or barriers to the … *uptake and wider application of innovative technologies and systems that can contribute to more sustainable urban water management and have been researched and demonstrated in SWITCH* ... and to draw conclusions from these conditions and mechanisms for scaling up innovation in cities both within and beyond the SWITCH context.

This paper aims first at identifying theoretical perspectives relevant to the objective of Task 6.1.5/6. More precisely, such theoretical traditions are instrumental to the definition of concepts of governance and technology, and to the investigation of change in policy, governance and technological systems. Their focus being on change, these theories do not specifically treat the content of policy, governance and technology. An analytical framework and methodology for the conduction of case studies are proposed in light of the identified theoretical traditions.

Part I addresses basic notions instrumental to understanding sustainable urban water management and technological innovation. These concepts include governance and IUWM (Integrated Urban Water Management) as a normative objective of water governance. Other sections illustrate policy networks as a metaphor to explore the interaction between stakeholders in a governance sub-system, as well as new institutionalism and path dependency which provide the structural environment in which agency takes place. Final sections investigate the dynamics of change in governance paradigms. This implies looking at institutional learning and policy diffusion and shifts in governance. Part II treats technological change, innovation theory and innovation diffusion theory, which provide a framework for the understanding of how different technological models emerge in a governance sub-system. Finally, it evaluates attempts to map the transitioning of cities through different technological phases. Such attempts are in fact relevant to defining the drivers for and barriers to the application and uptake of innovative technologies. SWITCH researchers are thus encouraged to test the validity of the hypotheses produced by the literature on transitioning in the water sector. Part III draws on the illustrated theories to identify the possible elements of the analytical framework and methodology. The analytical framework consists of a set of more general questions inspired by the reviewed theories and of a set of more detailed questions. These are not prescriptive but provide an example researchers can follow in the implementation of Task 6.1.5/6. As noted, the theories reviewed in Parts I and II investigate change in governance and technology rather than the dynamics and outcome of specific policies, governance paradigms and technological systems. SWITCH researchers might thus refer to

additional theoretical perspectives to guide their inquiry of governance and IUWM in their respective case studies. A final section discusses methodology and its implications for the implementation of Task 6.1.5/6.

Part I – Governance and integrated water management

Social theories may place different emphasise on agency and structure. Other differences may relate to the suitability to interpreting a given phenomenon throughout time, rather than as the result of actions in a static, timeless present. Capturing the complexity of the interface between technological change and governance, or other social dimensions, not only requires drawing on theoretical perspectives concerned with the interplay between agency and structure. Interaction between agency and structure should also be understood as a historical phenomenon, the product of past choices and external factors constraining choices in the long term.

Furthermore, the definition and operationalisation of the concepts of governance, sustainability and Integrated Water Resources Management (IWRM) constitutes a wicked problem due to the complex interdependencies between such notions. Lobina and Hall (2010b) and Lobina et al. (2009) show how a network approach can guide inquiry into, respectively, the interdependence between governance, sustainability and IWRM, and the interdependence between agency and structure.

2. Governance

Agarwal *et al.* (2000: 16) identify the water governance crisis as one of the major problems affecting IWRM (Integrated Water Resources Management). Drawing on a definition by the Global Water Partnership, Rogers and Hall (2003: 16) refer to water governance as the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society. Castro (2007: 761) elaborates further on the concept of governance as emerging from mainstream literature. This consists of the interaction between different management regimes: state authority (hierarchy), private management (market competition), and civil society (voluntary participation).

Among the preconditions to good or effective governance, in both water resources management and water service provision, Rogers and Hall (2003: 9, 27-29) identify inclusiveness, predictability, accountability, transparency, participation, equity and ethics, coherence, efficiency, responsiveness and sustainability. Good governance and its preconditions thus represent the normative dimension of governance.

Green (2007: 2-9) identifies three positive dimensions of water governance: a) the process and outcome of institutional reform; b) the role of public, private and social actors; and, c) the economic, but also political and institutional, social and environmental implications of the first two dimensions. The preconditions to good governance refer to both the process and outcome of institutional reform. Among those, however, sustainability is the guiding principle informing governance.

Furthermore, Green (2007: 2) observes that mainstream definitions of governance, for example that provided by UNDP (1997), correspond to Aristotle's notion of politics. It is thus possible to redefine governance as decision making in a multi-polar, fragmented society, aimed at enhancing sustainability.

The most popular definition of sustainability, provided by the World Commission on Environment and Development in 1987, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The needs addressed by development according to the concept of sustainability are multiform and are captured by the acronym PESTE: Political and institutional; Economic; Social; Technical; and, Environmental (ERL-UCM and PSIRU, 2003). PESTE sustainability thus coincides with Green's (2007) third dimension of governance.

Lobina and Hall (2010b) define water sustainability as the ability to reproduce the political and institutional, economic, social, and technical cycles in water service provision and water resources management so that the needs of current and future generations can be met. As the five PESTE cycles are all interrelated, unsustainable change in one of them might undermine the sustainable reproduction of the other cycles and thus threaten water sustainability. Lobina and Hall (2010b) do not only view water sustainability as

multidimensional and interdependent, but also as a context-specific process requiring flexibility. In fact, the meaning of flexibility in developing countries is not necessarily the same as in developed countries.

For the purposes of our analysis, the distinction between internal and external water governance is particularly significant. The former refers to the "functions, balances and structures internal to the water sector", including legal agreements governing property rights. The latter extends the concept to embrace the influence of civil society and political actors on the management of water services (Rogers and Hall, 2003: 16-17). In that sense, Hall *et al.* (2007: 154, 156, 158) emphasise the importance of public participation and transparency in strengthening the democratisation, coherence and responsiveness of decision making on water sector reform.

3. Integrated Urban Water Management and Integrated Water Resources Management as normative dimensions of governance

According to the Australian Water Conservation and Reuse Research Program, "Integrated Urban Water Management takes a comprehensive approach to urban water services, viewing water supply, stormwater and wastewater as components of an integrated physical system and recognises that the physical system sits within an organisational framework and a broader natural landscape. There are a broad range of tools which are employed within Integrated Urban Water Management, including, but not limited to water conservation and efficiency; water sensitive planning and design, including urban layout and landscaping; utilisation of non-conventional water sources including roof runoff, stormwater, greywater and wastewater; the application of fit-for-purpose principles; stormwater and wastewater source control and pollution prevention; stormwater flow and quality management; the use of mixtures of soft (ecological) and hard (infrastructure) technologies; and non-structural tools such as education, pricing incentives, regulations and restriction regimes" (2004: 5).

Integrated Urban Water Management (IUWM) can also be defined as the urban dimension of Integrated Water Resources Management (IWRM). The Global Water Partnership (2000) defines IWRM as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." Biswas (2004: 248) criticizes the notion of IWRM for being "amorphous" and for the fact that "there is no agreement on fundamental issues like what aspects should be integrated, how, by whom, or even if such integration in a wider sense is possible".

Lobina and Hall (2010b) observe that IWRM is a normative dimension of water governance, instrumental to achieving sustainability as the ultimate goal of governance. Good water governance is directed towards achieving sustainability. In so doing, an integrated approach to water resources management and water service operation is necessary due to the complex interdependencies between and within the PESTE cycles.

4. Policy networks and the dynamics of governance

Much literature explores governance through the lens of social and policy networks (Klijn and Koppenjan, 2000). Governance is a multi-actor process based on interaction in a context of fragmented interests. Adopting a networks approach to the investigation of governance allows for reconciling and going beyond the apparent dichotomy between agency and structure. In fact, networks do not exist in a vacuum and both their origin and evolution are a result of the interdependence between agency and structure (Lobina *et al.*, 2009).

Klijn and Koppenjan (2006: 144) define networks as "patterns of social relationships between mutually dependent actors". These relationships are formed around policy problems or policy programmes (Klijn, 1997: 30). Actors strategically interact in pursuit of their own interests and objectives and such interaction is informed by the respectively available resources and the context which shapes the relationships (Klijn *et al.*, 1995: 439-441).

Relations can be characterised as transactional or conflicting. In the first case, actors exchange resources for the achievement of communal objectives. In the latter, resources are deployed for the attainment of divergent goals which generate antagonism (Hermans and Timmermans, 2001).

4.1. Policy networks and actors' resources: power

Resources include power, status, legitimacy, knowledge and money. Interestingly, Deutsch (1966: 111) defined power as "the ability to afford not to learn" and "the ability to talk instead of listen". Green and Anton (2010) refer to Lukes' (1979) definition of power as the capacity to induce change.

Power results from the effective or perceived resources held by a given actor. Klijn and Koppenjan (2000: 144) explain the ability of actors to acquire a privileged position in a policy network in light of resource distribution. If these resources are required to address a policy problem and can be substituted only costly, then actors acquire veto power on interaction processes. In addition, an actor's power can derive from the perception other actors have of his or her power (Klijn *et al.*, 1995: 439-441).

In light of the above, the definition of power as the capacity to induce change should be seen as encompassing the capacity to resist change.

4.2. Policy networks and actors' resources: knowledge

Green (2010) draws on Quinton (1967) and identifies the conventional philosophical definition of knowledge as "justified true belief". Another definition of knowledge, the "awareness and understanding of facts, truths or information, gained in the form of experience or learning (*a posteriori*), or through introspection (*a priori*)"[i], appears to be an elaboration of Quinton's (1967) definition. Knowledge as a belief informs attitudes and, through attitudes, guides behaviour (Axelrod and Lehman, 1993; Conner and Armitage, 1998).

Green (2010) observes that the Foucaultian view that knowledge is power is now widely adopted. This theoretical perspective emphasises the deployment of knowledge as a resource.

The two scholarly traditions appear complementary as they identify two coexisting and intertwined aspects of the interface between knowledge and agency. These consist in the role of knowledge as motivation behind action, and knowledge as a resource used and traded in the collaborative, conflictive and transactional relationships that inherently pertain to power.

Interestingly, Moriarty *et al.* (2005: 11) define knowledge as "the intrinsic ability of individuals or groups to carry out actions". This definition appears as a satisfactory synthesis of both behaviouralist and Foucaultian conceptions of knowledge as it strives to embrace the interface between knowledge and agency.

4.3. Knowledge and networks

Knowledge fulfils a variety of functions in governance and the policy process. As discussed in the above sub-section 5.2 *Policy networks and actors' resources: knowledge*, knowledge is a resource informing agency to such an extent that many see it coincide with power. Also, from a behaviouralist perspective, actors' knowledge directs the mobilisation of individually held resources (or collectively held resources, in the case of coalitions of actors) to achieve intended objectives and thus provides the motivation behind agency. Finally, as discussed in the below sub-section 6.1 *Cognitive institutions*, predominant knowledge and beliefs define what is collective wisdom in a given governance and policy sub-system. In other words, knowledge as a cognitive institution has a direct impact on what actions are thought to be possible, ethical and desirable in a given community. The generation, diffusion and revision of knowledge in all its different functions take place through social and policy networks.

Antonelli (2005) shows how technical knowledge is generated ad transferred through networks. Drawing on Antonelli (2005), Lobina and Hall (2008a) investigate the interrelationship between policy network structure and the transfer of knowledge among stakeholders. Knowledge is thus seen as a resource exchange among different actors participating in the governance and decision making on the reform of water systems.

According to Antonelli (2005: 52, 55, 70-71), it is possible to identify three different and rival concepts of technological knowledge that have been developed since the second half of the twentieth century. The first concept, of knowledge as a public good, relies on the assumption that markets and profit-seeking actors cannot produce knowledge "in the appropriate quantities and with the appropriate characteristics". Knowledge as a public good is characterised by non-appropriability, non-excludability, non-exhaustibility and non-tradability. The second notion of knowledge as a proprietary good relies on the market for the generation and distribution of knowledge, for example through the use of intellectual property rights and the direct access of new high-tech companies to the stock exchange. Knowledge as a proprietary good would be characterised by limited appropriability, modular divisibility, fundability by private equity and limited tradability. However, it would also be associated with limitations such as exclusion, concentration and the ensuing emergence of a trade-off between the incentives to knowledge generation deriving from commercial exploitation and disincentives to knowledge distribution. Antonelli's third concept is that of knowledge as a localised, collective, complex and path dependent process, which "is based upon a deeper analysis of the interaction of the generation and distribution of knowledge, the appreciation of the role of the variety of learning and creative agents, the understanding of their complementarity and systemic interdependence, in a context where prices do not and cannot convey all the relevant information". Furthermore, networks represent a vehicle for the distribution and generation of knowledge whose structure affects efficiency in the generation and distribution of knowledge within the networks themselves "and hence the actual availability of external knowledge" (Antonelli, 2005: 66).

Empirical evidence suggests that the above concepts of knowledge as, alternatively, a public good, a proprietary good or a localised, collective and complex, path dependent activity can be applied not only to technical knowledge. They are also relevant to the development of any type of knowledge informing decisions on water governance, including decisions on different approaches to water resources management. Moreover, while the definition of knowledge generation and transfer as a path dependent activity is more accurate, treating knowledge as a public good rather than a private commodity favours good water governance. In fact, removing barriers to accessing and using knowledge favours the inclusion and participation of stakeholders, together with accountability and transparency, which are posited as preconditions to effective water governance. Finally, policy networks created by local and international stakeholders around decision making in the water sector appear to be crucial to the distribution of knowledge (Lobina and Hall, 2008a: 98-99).

4.4. Networked governance and the socially constructed context: institutions and technology

Finally, the socially constructed context includes rules and other institutions such as dominant knowledge and beliefs, organisational and national cultures and values, which inform actors' engagement in the network. It also includes the technology which defines the limits of policy making and decision making (compare De Bruijn and Dicke, 2006: 721 on the interdependency between public values and technical infrastructure). In turn, all such contextual factors are the product of agency and interaction within and between social and policy networks.

Section 10. *Technological change* below addresses technology as a socially constructed phenomenon. Technology is part of the socially constructed context constraining the organisation of water services and water resources management and, thus, ultimately water governance. Lobina and Hall (2008b, 2010) illustrate how technology constrains the reform of water services by limiting the opportunities for liberalisation and the introduction of competition to competition for the market (so called Demstez competition). Technology also affects interaction between stakeholders and thus governance. For example, the strong natural monopoly character of water services implies the asymmetry of information between regulated and regulator.

Conversely, the generation, diffusion and revision of technology are strongly affected by governance. In that sense, see both section 10. *Technological change* and section 11. *Innovation and innovation diffusion theory* below. The nexus between water governance and technology requires addressing one to understand the other.

5. Institutions as socially constructed context: new institutionalism

Brown et al. (2008) offer a summary of the new institutionalism tradition. First, institutions are subdivided into hard and soft infrastructure. Hard infrastructure includes formal organisational structures and bodies, and formally institutionalised instruments and rules. Soft infrastructure includes "social relations, informal networks, administrative routines, professional cultures and social worlds". Second, hard and soft institutions are further categorised and distinguished as cognitive, normative and regulative institutions. Cognitive institutions comprise the dominant knowledge and thinking in society. Normative institutions include values and leadership. Regulative institutions consist of administration, rules and systems. Regulative institutions are designed to protect dominant values and thinking. Furthermore, "New Institutionalism reveals that the defining characteristic of institutions is their capacity for stability and to withstand attempts at being significantly changed over short periods (see Scott, 1995). For institutional change to successfully occur there must be a mutually reinforcing shift within each of the pillars of institutional practice" (Brown et al., 2008: 3).

5.1. Cognitive institutions

Cognitive institutions comprise the established notions pervading collective thinking and orienting collective action in a given society at a given time. Knowledge is not seen as a resource exchanged by actors to obtain their respective goals, but as part of the structure underlying agency. Dominant thinking can in fact be described as the dominant political discourse. This is a relatively stable dimension of political culture and can be crystallised somewhere in the spectrum between the social welfare and neoliberal ideal-types of the state. Until a shift in the political discourse materialises, this will define the range of sanctioned political actions in a given society (Dominguez, 2007; Lobina et al., 2009). Similarly, dominant thinking determines the actions approved in a governance sub-system.

Collective knowledge cannot be seen as the mere product of rational enquiry as it is also affected by norms, such as culture and values, as well as dominant interests. Collective knowledge is therefore the product of bounded rationality.

5.2. Normative institutions

Normative institutions such as culture and values are an important component of structure. They underlie and inform agency in different governance subsystems. Individual action is affected by organisational cultures and values within the firm or organisation. Such organisational cultures and values include public sector ethos, administrative zeal and faith in the market. At the same time, such norms contribute to the formation of dominant culture and values within a governance subsystem. In addition, national and local cultures pervade the functioning of organisations and institutions in different settings. Normative institutions in a given subsystem therefore result of the combination of national/local cultures with organisational culture along the public sector/private sector/voluntary sector divide.

Social network scholars observe that the similarity of culture and values, defined as homophily, is a key determinant of social association and thus a determinant of social network structure (Lazega). Lobina and Hall (2010a) illustrate the combined effect of shared norms and shared interests in binding advocacy coalitions between the World Bank and water multinationals around the promotion of market-friendly policies. Pro-water privatisation advocacy coalitions overlook scholarly and expert research work showing there is no evidence of the private sector's superior efficiency and pointing to the limitations of private sector participation. In this case, the combination of shared interests, homophily and the resources of members of the coalition results in bounded rationality (Lobina and Hall, 2010a).

5.3. Regulative institutions

Rules and regulations, whether informal or formal, constrain actors' behaviour. They do so by penalising socially unacceptable deeds and providing incentives for desirable courses of action. Rules and regulations are defined and revised throughout time in light of dominant knowledge on the problem they are intended to address and dominant norms.

In a given governance sub-system, the effectiveness of regulative institutions depends on actors' interests and the distribution of resources among stakeholders. Lobina and Hall (2007) use policy networks as an analytical framework to test the cogency of public choice and property rights theory in water supply and sanitation. They explore the effectiveness of accountability networks in a governance sub-system at city level across 11 years, whereby accountability networks result of multiple principal-agent relationships between the state, civil society and the private sector. They find that the ownership of water operators defines the interests pursued in the given regulative context, and that the interplay between operators' resources and the rules of the game are a major determinant of policy effectiveness in enhancing sustainability. More precisely, in an industry characterised by natural monopoly market structure private operators enjoy greater resources than their regulators and take advantage of favourable rules. Conversely, public operators are more easily susceptible to accept greater transparency and stronger accountability through public participation in decision making. This results in public operators' superior potential to achieve public interest objectives (Lobina and Hall, 2007; Lobina and Hall, 2008).

6. Institutions as socially constructed context: path dependency

Path dependence contends that decisions made in the past are likely to have long-term impacts on water systems by binding, limiting or postponing alternative options (Katko et al., 2003b). Path dependency theory was originally used in the context of evolutionary economic theory (Nelson and Winter, 1982; Magnusson and Ottosson, 1997; Garud and Karnoe, 2000). More recently it has also been introduced to the research of history and the history of technology (e.g. Melosi, 2000).

The argument for path dependence is that a minor or fleeting advantage, or a seemingly inconsequential lead, for some technology, product or standard can have important and irreversible influences on the ultimate market allocation of resources. Path dependence literature is accompanied and motivated by mathematical literature of nonlinear dynamic models, known as chaos or complexity models, for which a key finding is "sensitive dependence on initial conditions." Analogously, a key finding of path dependence is the property of "lock-in by historical events", especially where those historical events are "insignificant" (Katko et al., 2003b).

Liebowitz and Margolis (2000) recognise three degrees of path dependence. The first implies no inefficiency; the second leads to outcomes that are sub-optimal and costly to change, as result of imperfect information; and the third and strongest degree leads to an inefficient outcome. Meier et al. (2001) define the strength of different degrees of path dependence according to the number of options that are left due to prior choices. Thus, the strongest degree of path dependence implies only one or very few options from which agents can choose, while weak path dependence modestly limits the number of alternative paths adoptable (Katko et al., 2003b).

North (1990) applies path dependence to interpreting the causes and significance of institutional change. The path of institutional change is shaped by: a) the symbiotic relationship between institutions and the organisations that have evolved as a consequence of the incentive structure provided by those institutions; and, b) agents' perceptions of and reactions to changes in the opportunity set. Incremental change comes from the perceptions of the entrepreneurs in political and economic organisations that they could benefit from altering the existing institutional framework (Katko et al., 2003b).

According to Gorringe (1995), path dependence not only occurs when there are constraints on the process of change, but also when the directions of change are self-reinforcing. This results in change being incremental, evolutionary rather than revolutionary, and in the inertia and stability of social systems. Policy makers may need to reinforce path dependence, e.g. in locking in good change. They may also need to guard against undesirable effects of path dependence (Katko et al., 2003b).

In summary, path dependence posits that the interaction between agency and structure, in light of agents' interests and available knowledge, constrains opportunities for future action. The influence of path dependence cuts across all the dimensions of PESTE sustainability, from the socio-political to the technical spheres.

7. Governance and the geopolitical context: the divide between developed and developing countries

Structure is not universally uniform but varies in function of the geopolitical context, thus affecting governance from country to country and even within countries. For example, structure varies considerably between developed countries and developing countries. Lobina and Hall (2010) point to a combination of factors to explain developing countries' failure to follow the path of developed countries and achieve universal coverage in the provision of urban water services. Such factors include fragile institutions, unequal societies, inadequate public finances and deteriorating economic conditions.

Furthermore, theoretical perspectives on global governance point to developing countries' dependence on external resources, particularly the financial resources of International Financial Institutions (IFIs), bilateral development agencies and multinational enterprises. In turn, economic dependence exposes developing countries' governance and policy processes to the influence of such external political and economic actors. A case in point is the conditionality of multilateral lending on the privatisation of water services.

Developed countries are not entirely immune from the influence of external actors (Lobina, 2005). Nonetheless, minor dependence on external resources can be expected to result in greater autonomy of a country's governance and policy processes.

8. Policy learning and policy diffusion

Hemerijck and Visser (2003: 21-29) identify two major theoretical traditions on policy learning. The proponents of social learning emphasise learning by policy makers in light of past failures to devise approaches to outstanding problems. The proponents of policy transfer emphasise that policy makers draw lessons from others' successful approaches to solving similar problems. Both social learning and policy mimicking might be affected by bounded rationality. This occurs when actors' limited knowledge and perceptions induce deviations from the pursuit of a rational course of action.

Meseguer (2005) distinguishes between different forms of policy diffusion from one country to another. These include coercion, for example in the case of conditionalities imposed by IFIs, emulation (or policy mimicking) and competition. Emulation often takes place when one country or other actors are perceived to be champions following whose example is expected to produce positive results. Policy diffusion takes place as a result of competition if one country feels obliged to follow the example of its competitor in order not to lose market shares. Arguably, policy diffusion via competition could be considered as being explained by a combination of emulation and coercion.

A further determinant of policy change is represented by external shocks or events that are external to a given policy sub-system but are able to induce change in it. According to Weible et al. (2009: 124), "External events or shocks include broad changes in socioeconomic conditions, public opinion, governing coalitions, and other subsystems. External shocks can foster change in a subsystem by shifting and augmenting resources, tipping the power of coalitions, and changing beliefs". Similarly, Green (2010) refers to the "punctuated equilibrium" model as a popular approach to explaining policy change. This posits that "there is stability until there is some event which forces a change".

Finally, policy learning and policy diffusion do not only happen as the result of attempts to solve existing problems in light of available solutions. Adopting a certain policy also requires creating a "window of opportunity", whose opening requires political support (Hemerijck and Visser , 2003: 19-20).

9. Shifts in governance

Shifts in governance occur when one governance paradigm is abandoned in favour of another and might result of policy learning or policy diffusion. However, governance cannot be confined to policy as it embraces the interrelationships between the state, civil society and the market. We can thus conclude that social and institutional learning and governance diffusion are major determinants of shifts in governance regimes.

Social and institutional learning is the interactive and path dependent learning that takes place through the exchange of knowledge between actors in the state, civil society and market sectors. Like policy learning, institutional learning might be affected by bounded rationality. Lobina and Hall (2010a) observe that bounded policy learning is not only the result of actors' knowledge and norms, but also of their interests and the collective distribution of resources. Institutional learning can also occur as a result of emulating the practices and governance paradigm adopted by other governance sub-systems, whether in another country and region or in another sector.

Patterns of governance diffusion do not only include institutional learning but also coercion. Coercion can be imposed by the state, international or foreign agencies, or result of the veto power used by stakeholders in a given governance sub-system.

Interestingly, Warner observes that widespread rhetoric of "water crisis" is functional to promoting the IWRM governance paradigm.

Part II – Determinants of technological innovation and innovation diffusion

10. Technological change

A number of theoretical perspectives on the history of technology followed the "internalist" tradition which focused on nuts and bolts. These included the so-called SCOT, or social construction of technology, and new institutionalism (Katko et al., 2003a). SCOT and new institutionalism appear complementary in their attempt to interpret the social shaping of technology, or the social influences on the design, development, and transformation of technology, by respectively emphasising agency and structure.

The SCOT approach is predominantly agency-centred and its conceptual framework is summarised as consisting of four related components: a) interpretive flexibility; b) relevant social group; c) closure and stabilization; d) wider context (Klein and Kleinman, 2002). Interpretive flexibility means that artifacts are the product of intergroup negotiations defining their final form. Any technology can in fact be developed in alternative ways and intergroup negotiation determines which one is finally adopted for the production of goods or services. Relevant social groups define the meaning associated to a specific artefact, with the final meaning representing the product of negotiation among multiple social groups. In case of multigroup design, controversies around conflicting interpretations might be resolved through negotiation until closure and stabilization is achieved with consensus on meaning. However, this process can be reopened in case the final artifact loses functionality in a changed context. Finally, SCOT recognises that the product of technological change is affected by the wider socio-cultural and political context in which artifact design and development occur. However, SCOT has been criticised for emphasising agency at the expense of social structure (Klein and Kleinman, 2002: 29-31).

With its emphasis on social structure, new institutionalism compensates SCOT. Brown et al. (2008) offer a summary of new institutionalism, for which see the above section on Institutions as context: new institutionalism. With its focus on institutional change, new institutionalism adequately addresses social structure. However, it does not provide a satisfactory explanation on how and why changes in cognitive, normative and regulative institutions take place. This requires combining attention to both agency and structure throughout time. A possible solution might be offered by combining SCOT with a new institutionalist approach. More precisely, SCOT revolves around the concept of negotiated normative values within and between social groups in relation to the design and development of a given artifact. This notion can be adapted and extended to encompass the intra- and inter-group negotiations leading to the implementation of combined technical solutions aimed at water resources management in each city. Other solutions are offered by drawing on other agency-centred theoretical perspectives, such as theories of governance and policy networks.

11. Innovation and innovation diffusion theory

Mytelka and Smith (2002) illustrate the development of innovation theory in the second half of the XX century, showing that this has been subject to a major reformulation. Innovation has come to be seen as a non-linear process of learning rather than a linear and progressive process of discovery of new scientific and technological principles. Neo-classical and Schumpeterian concepts of technological change were based on notions of linearity, summarised by the scheme invention-innovation-diffusion. Such view of technological progress heavily relies on the role of the market both as the source of stimuli for the generation of new knowledge and technology and as the vehicle for the transfer of the product of innovation.

The Schumpeterian view has been replaced by Lundvall's (1992) approach to the innovation process as a path dependent, locationally specific and institutionally shaped process. Lundvall (1992) offers an analytical framework for the understanding of the innovation process which sees dynamic learning through the lens of three concepts: the organised market, interactive learning, and the institutional framework. This leads Mytelka and Smith (2002: 1468) to argue that theory and policy are best seen as co-evolving, with learning occurring in specific institutional contexts, "that is, in systemic environments shaped inter alia by regulation, law, political cultures, and the "rules of the game" of economic institutions. These environments of course include policy institutions and actions".

It is now possible to revisit Lundvall's (1992) framework of the innovation process in light of the above illustrated notions of governance. We thus offer to go beyond an understanding of innovation as learning that is heavily reliant on the interaction between the organised market and policy and economic institutions. Interactive learning takes in fact place between the state (not only in its capacity as monopolist of policy making, but also as provider of services through the public sector), civil society and the organised market. Both policy and economic institutions are important components of interaction leading to social and institutional learning, but perspectives of governance point to considering the neglected role of civil society. Also, the vital contribution to learning and the innovation process provided by the public sector questions interpretations of innovation and innovation diffusion as revolving solely around the organised market.

12. Technology and the physical and human environment

Social interaction around the generation, diffusion/adoption and revision of technology takes place in function of the context-specific problems that technology is intended to solve. These emanate from the local physical and human environment, that is to say local geography.

Green (2010) identifies the following geographical factors as potentially affecting change:

- "*climatic*; differences in rainfall variability, intensity and total; P/PET ratio. Summer and winter temperatures.
- *water availability*; whether water source is local groundwater, rainfall, local surface water or long distance transfer.
- *topography*: whether city is on a plain or hillside, whether it sits on a coastal flood plain, alluvial fan or other feature.
- *population density*: in the ultra high density cities of Asia and Africa, there isn't much space to insert any form of infrastructure, including that for water management.
- *urbanisation*: in much of the world, urban population and hence city sizes are still growing, often through informal development. Informal development is itself a battle for legitimacy, for power. In other areas (e.g. the new land of Germany), populations are falling.
- *current water consumption and sanitation*: an adequate household water supply is in the order of 80-100 l/p/d; cities where this level of consumption is not yet provided seek to achieve it. Conversely, the problem in cities with consumption higher than this figure is how to move to water efficiency".

13. The transitioning of cities through technological phases: an unresolved question

Brown et al. (2008) adopt a new institutionalist approach to explain the transitioning of cities from one technological phase to another. First, institutions are subdivided into hard and soft infrastructure. Hard infrastructure includes formal organisational structures and bodies, and formally institutionalised instruments and rules. Soft infrastructure includes "social relations, informal networks, administrative routines, professional cultures and social worlds". Second, hard and soft institutions are further categorised and distinguished as cognitive, normative and regulative institutions. Cognitive institutions comprise the dominant knowledge and thinking in society. Normative institutions include values and leadership. Regulative institutions consist of administration, rules and systems. Regulative institutions are designed to protect dominant values and thinking. Furthermore, "New Institutionalism reveals that the defining characteristic of institutions is their capacity for stability and to withstand attempts at being significantly changed over short periods (see Scott, 1995). For institutional change to successfully occur there must be a mutually reinforcing shift within each of the pillars of institutional practice" (Brown et al., 2008: 3).

Brown et al. (2008) point to changes in institutions as factors explaining the passage of cities from one phase to another in the relationship between the city and water. Six different phases are thus identified in light of the predominant technology in providing water services and approach to managing water resources. The Water Supply City is characterised by efforts to expand piped water supply to city dwellers. Once access to water supply is adequately secured, emphasis moves to addressing access to piped sewerage services, which characterises the Sewered City. The next phase, the Drained City, is dominated by efforts at ensuring flood protection. Aimed at achieving social amenity and environmental protection, the Waterways City is characterised by the prevalence of point and diffuse source pollution management. The fifth phase is the Water Cycle City, whereby limits on natural resources encourage resort to diverse, fit-for-purpose sources, conservation and the promotion of waterway protection. The sixth and final phase is the Water Sensitive City, inspired by the goals of intergenerational equity and resilience to climate change. In this phase, the prevalent approach to water resources management is constituted by a combination of adaptive, multifunctional infrastructure and urban design reinforcing water sensitive behaviours (Brown et al., 2008).

Transitioning from one phase to another is seen as a natural evolution of the city in history, whereby the passage from one developmental phase to another is associated to different objectives and technical solutions. In turn, technical solutions reflect a normative hierarchy of collective objectives. Initial priority is given to achieving the so-called "brown development", centred on notions of public health and social welfare (McGranahan et al., 2001). This is associated with the introduction and extension of water supply, sewerage and drainage services. Progress with "brown development" objectives leads to greater attention devoted to the so-called "green development", centred on the environment. The new emphasis and objectives imply the use of water services in the broader context of water resources management. Nonetheless, Brown et al. (2008: 9) acknowledge that "[t]oday, there is not an example of a Water Sensitive City anywhere in the world although the concept is attracting attention from scientists and practitioners interested in envisaging potential sustainable water futures".

Brown et al.'s (2008) linear model of transitioning from one technological stage to another seems to apply to a number of cities internationally, both in Europe and Latin America. For example, the progression from the Water Supply city to the Sewered City seems to have occurred in Sao Paulo, Brazil (Hall and Lobina, 2007: 773; Briscoe and Garn, 1995).

However, this linear model does not seem to apply universally. In fact, a number of European cities have historically seen the emergence of the Water Supply city phase at the same time as or after the Sewered City (Juuti and Katko, 2005: 98). Furthermore, Green (2010) looks at the emergence of the Water Supply city and the Sewered City in London's history to argue that the linearity of transitioning seems to exclusively apply to cities founded in the XIX century. This questions the validity of Brown et al.'s (2008) linear model of transitioning. More sophisticated theories of transitioning are required to predict the historical and future transitioning of cities in different geo-political contexts throughout different governance and technological paradigms.

Part III – Analytical Framework and Methodology

The case studies carried out as part of Task 6.1.5/6 are to address the interface between technological change and governance by looking at a number of dimensions. In order to develop our analytical framework, we first restate the research aims so that their formulation is consistent with the reviewed theoretical traditions and concepts. Drawing on the illustrated theoretical perspectives, we then set out a number of research questions so that these are relevant to any case study. These research questions are not prescriptive but provide an example researchers can follow in the implementation of Task 6.1.5/6. As noted, the theories reviewed in Parts I and II investigate change in governance and technology rather than the dynamics and outcome of specific policies, governance paradigms and technological systems. SWITCH researchers might thus refer to additional theoretical perspectives to guide their inquiry of governance and IUWM in their respective case studies. They are integrated by the enclosed Annex – "Structure for the case studies", by Barbara Anton – which provides a harmonised structure for the case studies together with more specific questions that all case studies should respectively follow and answer. Finally, we address methodology, from the selection of case studies to data gathering.

14. Analytical framework

14.1. Research aims

As noted in section 2. *Introduction* above, the objective of Task 6.1.5/6 is twofold:

- to "identify framework conditions and mechanisms in areas such as governance, law, institutional set-ups, economics, politics, financing, communication, marketing, culture, geography, climate conditions and other that are drivers or barriers to the … *uptake and wider application of integrated processes for managing the urban water cycle in a sustainable manner* … and to draw conclusions from these conditions and mechanisms for scaling up IUWM in cities both within and beyond the SWITCH context"; and,
- to "identify frameworks conditions and mechanisms - in the same areas as above - that are drivers or barriers to the … *uptake and wider application of innovative technologies and systems that can contribute to more sustainable urban water management and have been researched and demonstrated in SWITCH* ... and to draw conclusions from these conditions and mechanisms for scaling up innovation in cities both within and beyond the SWITCH context.

We are now in a position to reformulate the above objectives into research aims that are consistent with the theoretical perspectives reviewed in Part I and Part II above.

The first research aim is to define how governance has affected change in terms of IUWM in a given city. For the purposes of Task 6.1.5/6 we define governance as the process and outcome of decision making aimed at enhancing water sustainability. In turn, the process and outcome of decision making are informed by the interaction between agency and structure taking place around the solution of water sustainability problems. More precisely, agency consists of the actions adopted by public, private and social actors, in light of the respective interests, resources, attitudes and beliefs. The socially constructed structure includes the normative, regulative and cognitive institutions underlying agency, the path dependent and interdependent evolution of such institutions, and the geopolitical context. Change is herein considered as twofold: a) change in terms of the uptake of integrated processes for managing the urban water cycle; and, b) change in terms of the uptake of innovative technologies and systems. Change can either be positive or negative depending on whether the prevalent result of the interaction between agency and structure is the emergence of drivers or barriers to the uptake of, respectively, integrated processes for IUWM and innovative technologies.

Concepts and theories of technological innovation have been discussed in Part II. Green and Anton (2010: 8) refer to a number of technologies, systems and integrated processes aimed at sustainable water management through the reduction of water use, reuse and recycling. These are "demand management, rainwater harvesting, green or brown roofs, Sustainable Urban Drainage Systems (SUDs) in the reduction phase, coupled to greywater reuse and localised treatment for reuse and recycling". More precisely, "SUDS is a

chain of technologies whose performance as a means of managing both runoff and water quality depends upon the functioning of the system as a whole (Mott MacDonald 2008)" (Green and Anton, 2010: 5).

The second research aim is to draw conclusions from the observations of drivers and barriers to the uptake of integrated processes for IUWM and innovative technologies. Such conclusions should identify implications for, respectively, scaling up IUWM and innovation in cities both within and beyond the SWITCH context.

As noted, the cycle of water governance and the cycle of technological change are interdependent. Therefore, understanding how governance affects technological change also requires looking at how the latter constrains the former.

14.2. Research questions

Task 6.1.5/6 looks at how governance (the independent variable), intended as the interactive and path dependent process and outcome of decision making, affects technological change in water (the dependent variable). Other EU-funded research programmes have looked at decision making in the water sector and can offer indications on how to structure our analytical framework. One of these research programmes is WaterTime - Decision making in water systems in European cities, European Commission, 5th Framework Programme, 2002-2005. Contract No. EVK4-2002-0095 (www.watertime.net). Hall and Lobina (2005) offer practical recommendations aimed at improving the process of making decisions on water and sanitation services. They do so by addressing the specificities of different phases of the decision making process. Such phases include diagnosis or the definition of the problem decisions are intended to solve, and the identification and evaluation of alternative solutions to the defined problem.

For the purposes of Task 6.1.5/6, SWITCH researchers are invited to look at different phases of decision making on water sustainability: 1) diagnosis, or the definition of the problem(s) decisions are intended to solve; 2) prognosis, or the identification and evaluation of alternative courses of action intended to address the defined problem(s); and, 3) the outcome of actions adopted as a result of diagnosis and prognosis. Observing the diagnosis requires identifying who defined the nature and the causes of the problem(s) at stake, why they reached their conclusions, and why such conclusions were either adopted or rejected within a governance subsystem. This implies describing the *status quo ante* the decision to introduce change, both in terms of governance, technology and the geographical context. Observing the prognosis requires identifying who evaluated the available options, who and why chose any of them as the preferred solution to the problem(s), and why the attempted change was either adopted or rejected within a governance subsystem. This implies describing the change it was decided to introduce either in terms of governance or technology. Observing the outcome of introduced change requires assessing the impact of change on water sustainability in a given governance subsystem and context. This facilitates the formulation of hypotheses on the desirability of introducing such change in different cities. Finally, the observation of the process and outcome of decision making allows for identifying drivers and barriers to the uptake and wider application of integrated processes for IUWM and innovative technologies. This underpins the formulation of hypotheses on the transferability of the observed change to different cities.

We now set out illustrative research questions that are inspired by the theoretical perspectives and concepts reviewed in Parts I and II above. Power, the negotiated design and adoption of technology, path dependency and institutions are all relevant to decision making throughout the three identified phases: diagnosis, prognosis and outcome. The below research questions should therefore be seen as tools for the elicitation of more specific research questions addressing the specificities of individual case studies. They should also be seen as flexible analytical tools to guide investigation in the different cases without rigidly confining their relevance to certain phases of the decision making process rather than others.

14.2.1. Research questions: diagnosis, prognosis and outcome

1) How did the local physical and human geographical context, and the governance and technological framework constrain the formulation of the problem in terms of sustainability and IUWM? Who contributed to the formulation of the problem? What were their interests and resources? Why did

they reach their conclusions on the nature and causes of the problem? Why was the formulation of the problem adopted or rejected within a governance subsystem?

2) What change was attempted or introduced to solve the identified problem? Did change relate to governance or technological systems and integrated processes for IUWM? Who did evaluate the available options to address the identified problem? Who did decide in favour of any of the considered options and why? Why was the proposed change adopted or rejected within a given governance subsystem?

3) What was the outcome of the introduced change in terms of sustainability and IUWM? What was the outcome of the introduced change in terms of governance and innovative technology? Was the introduced change desirable? What were the drivers and barriers to the introduced change and the achievement of its outcome? Is the introduction of the observed change in different cities and contexts desirable? Is the observed change transferable to different cities and contexts?

14.2.2. Research questions: networked governance

4) Who were the actors involved in the decision making process? Were they public, private or social actors? What were their interests? What were their attitudes and views of the world? Were coalitions established to advocate a certain solution or interpretation of the problem addressed? Have external events and shocks affected the configuration of advocacy coalitions?

5) What were the main resources held by the actors involved in the decision making process, either as individual stakeholders or as coalitions of actors? Were these resources official authority, financial resources or informal power (e.g. power given by knowledge, status and recognition)? Was power effective or perceived? Have external events and shocks affected the distribution of resources among actors and coalitions? How did these resources and their distribution among actors allow actors and coalitions to affect decision making? Were they able to impose a certain solution or interpretation of the problem on other actors? Or were they able to resist change by exerting veto power? Were relationships between different actors and coalitions based on collaboration, transaction of resources or conflict?

6) How was knowledge used by different actors and coalitions in function of diagnosis and prognosis? Was there asymmetry of information? Were there claims of superior knowledge by any actor? How did this affect the definition of the problem in relation to sustainability and IUWM, the evaluation of possible solutions and the decision making process overall?

14.2.3. Research questions: institutions and path dependency

7) What were the prevalent normative, regulative and cognitive institutions underlying agency? How did they constrain actors' behaviour? For example, what were the prevalent cultural values, formal and informal rules, and the collective wisdom relevant to the problem and proposed change?

8) How did the prevalent normative, regulative and cognitive institutions affect each other? For example, did a regulation result in the prevalence of a specific organisational culture? Conversely, did collective wisdom result in the adoption of a set of regulations rather than another?

9) How did path dependency lead to the current situation in terms of water governance and technological change? For example, how did the interaction between past choices and past events lead to the emergence of the prevalent normative, regulative and cognitive institutions? How did the interaction between past choices and past events affect the definition of the problem, and the adoption of technical solutions, systems and integrated processes for IUWM? What were the costs of introducing change in either water governance or technology as a result of path dependency?

14.2.4. Research questions: global governance

10) Who were the international actors, whether public, private or social, involved in the local decision making process? What were their interests, resources, cultural values and attitudes? What were the international regulations that affected local governance?

11) What was the local geopolitical context? Is the city in a developed or developing country? What were the implications of the local geopolitical context in terms of the strength of local institutions, the availability of public financial resources, the strength of the local economy, social equity and the openness of the local governance and policy process?

12) What was the degree of dependence on external resources? How did this inform the relationships between local and international actors and institutions? How did this inform the autonomy of the local governance and policy process? Did international actors and factors contribute to promote local sustainability and IUWM? How? And why?

14.2.5. Research questions: policy learning, policy diffusion and governance shifts

13) How did past experience affect the choices of policy and decision makers?

14) Were policies transplanted from one policy subsystem to another as a result of the emulation of champions, coercion or competition? Did the same factors lead to shifts in governance paradigms? How did interactive learning between public, private and social actors internal and external to the governance subsystem lead to or prevent the emergence of a shift in governance paradigm?

15) What external events and shocks and what "windows of opportunity" facilitated policy learning, policy diffusion or the shift in governance paradigm? Who causes the external shock? Who opened the "window of opportunity"? What was the role of public, private and social actors, either internal or external to the water governance of the considered city, in opening the "window of opportunity" or in inducing the external shock? For example, what was the role of the media, politicians, business, civil society and social movements or civic campaigns?

14.2.6. Research questions: technological change and innovation diffusion

16) To what extent did inter-group negotiation affect the design, adoption, adaptation, closure and reopening of technology, including systems and integrated processes for IUWM? What role did actors' interests and resources play in inter-group negotiations? What role did the social context play? What role did normative, regulative and cognitive institutions play?

17) How did path dependent and interactive learning between public, private and social actors inform innovation in technology, including systems and integrated processes for IUWM?

18) What was the historical sequencing of transitioning phases in the city? Was the sequence linear in the following order: Water Supply City, Sewered City, Drained City, Waterways City, Water Cycle City? Or was it non linear? Were certain phases occurring concurrently? What factors did affect the observed sequencing of the transitioning phases? How does the path dependency of historical transitioning affect the present and future development of water services and water resources in the city?

15. Methodology

This section outlines a proposed methodology aimed at supporting the development of case studies undertaken as part of Task 6.1.5/6. The proposed methodology aims at achieving two main objectives: contribution to knowledge and manageability. These inform both the selection of case studies and methods for data gathering.

Case studies are selected to ensure lessons are drawn from and are relevant to investigating:

- Successes and failures in relation to sustainability and IUWM;
- Different geopolitical and local geographical contexts; including relevant experience from developed and developing countries, and from SWTCH and non-SWITCH cities;
- A variety of institutional frameworks and different progressions through transitioning phases (Water Supply City, Sewered City, Drained City, Waterways City, Water Cycle City).

The selected case studies are:

- Seoul, Korea;
- London, UK;
- Berlin, Germany;
- Emscher region, Germany;
- Zaragoza, Spain;
- Delhi, India;
- Porto Alegre, Brazil;
- Lima, Peru;
- Beijing, China.

Finally, as regards data gathering, case studies will be mainly developed on the basis of secondary sources to ensure manageability. Findings from the reviewed literature will be complemented by responses to questionnaires and/or semi-structured interviews with stakeholders in the cities.

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ANNEX – Structure for case studies (by Barbara Anton, ICLEI)

Structure for case studies

Draft by Barbara Anton, ICLEI European Secretariat
27 May 2010

[Taking Berlin as an example]

Cover page Main title to give brief indication of distinct profile of city Sub-title something like "Case study on the factors enabling sustainable urban water management in Berlin" Authors Date SWITCH logo Picture of city
General summary page (??) Using SWITCH template developed for deliverables (?)
Executive summary Focus on findings regarding enabling factors/drivers of change (and potentially barriers)
1. Introduction Objective of case study (incl. reference to comparative analysis) (Retrace story of relevant decision-making and implementation/enforcement processes to get insights into enabling factors/drivers of change for more sustainable urban water management) *** Clarification on understanding of 'sustainable urban water management' as used in study *** Brief rationale for selection of Berlin Link to other case studies under same WP Short description on SWITCH project *** *** *should be the same for all case studies developed under this task*
2. Making urban water management more sustainable – achievements in Berlin Answering questions such as: What is 'sustainable' in urban water management in Berlin? → Is there an overall strategy/policy/framework for sustainable urban water management? And/or: → What has been the specific technology adoption (or invention) contributing to more sustainable urban water management? Incl. subchapter for providing some details (incl. facts and figures) on each of the achievements identified.
3. Berlin – a brief overview on its main features Relevance/status in country context Recent history Population/population density Urbanisation Location/topography Climatic conditions General political/institutional structure (centralised/decentralised) Main features of economy …

4. Water resources and services in Berlin
Where does water come from?
Quantitative aspects of resources: water availability, water abstraction
Qualitative aspects of resources: potential issues of pollution
Main water users
Facts and figures on water services: access to drinking water, current water consumption, sanitation coverage, …

5. Main players in urban water management in Berlin
Key institutions in charge of urban water management and their structure of relationships
Overview on their key competencies

6. Urban water management in Berlin today – an overview
Overview on different dimensions (water supply, stormwater, waste water management) and snapshot on key issues

7. Drivers of change for more sustainable urban water management in Berlin
Intro to following chapters

7.1 [Achievement #1]
Questions to be explored here are, as far as relevant:
At what time was the framework or specific technology introduced?
Who has introduced the framework/technology?
Why was it introduced?
→ Was it a requirement or rather an opportunity – and for what/in which context?
→ Was it to address a water issue – or an issue of another sector?
→ What have been the expectations of those that have made the decision?
→ Was it easy or difficult to realise it? What have been the difficulties? Or what was it that made it easy?
→ Have there been alternatives at the time? If yes, what have they been disregarded in the end?
What has been the role of, e.g.:
→ historic circumstances?
→ legislation?
→ political priorities?
→ technological innovations?
→ contemporary trends and fashions?
→ cultural aspects, social values, dominating perceptions?
→ a potential 'symbolic weight' (Green) of the framework/technology?
→ demands by society?
→ public health issues?
→ economic/financial issues
→ individuals?
→ a (social, economic or environmental etc.) crisis?
→ the media ...
– ….
In terms of governance more specifically (see also paper Lobina, 2 May 2010) – what has been the role of
→ institutions concerned with water management - and the rules of these institutions
→ the vested interests, own agendas and the interaction of different management regimes in the water sector: state authority (hierarchy), private management (market

competition), and civil society (voluntary participation) (*as quoted from Castro, 2007*) → power, status, legitimacy, knowledge, money → major reforms in any of the above that are NOT related to the water sector - ….. How has the framework/technology developed over time? (facts and figures of up-scaling/main streaming) What has enabled or even accelerated up-scaling/main streaming? What have been stumbling stones slowing down up-scaling/main streaming?
7.2 [Achievement #2] Questions to be explored here are, as far as relevant: At what time was the framework or specific technology introduced? Who has introduced the framework/technology? …….
7.3 [Achievement #3] Questions to be explored here are, as far as relevant: At what time was the framework or specific technology introduced? Who has introduced the framework/technology?? …….. Etc.
8. Conclusions and lessons learned Summary and analysis of key drivers of change for different frameworks/technologies
9. List of interviewees
10. References
Annexes (if applicable)

[i] Source: http://en.wikipedia.org/wiki/Knowledge.