SWITCH Deliverable Summary Sheet

SWITCH Document (SWITCH Transitioning Report)
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Audience This document is targeted at researchers who are seeking background rationale to the SWITCH Transitioning process.
Purpose This paper addresses the rationale for the development of the transitioning framework developed for SWITCH. The SWITCH Transition Framework is an explanatory guide for influencing a city towards the paradigm of sustainable and integrated urban water systems. The paper details the three levels of the framework which are strategic, tactical and operational. The framework can be used to identify and analyse transition strengths and weaknesses in a city that is attempting to manage its urban water systems in a better way.
Background Many transitioning ideas were available in the literature but none could adequately deal both with niche management and the concept of the Learning Alliance. Some twenty frameworks in the literature were reviewed and unsuitable frameworks were rejected leaving five to be examined in detail for development of the new framework. The main transitioning frameworks referenced were; the Sustainable Transition Management Cycle developed by the KSI network; Niche Management and Experimentation, and; the conceptual Sustainable Urban Water Management Framework, developed in Australia.
Potential Impact The impact of the transition manual will be to assist in engaging the SWITCH principles with a wider audience. It does this by putting across the transitioning principles in an easily accessible way with many examples of applications in cities and 'how to' guides for the SWITCH tools.
Recommendations Use the SWITCH approach to change your city. Transitioning works.

018530 - SWITCH

Sustainable Water Management in the City of the Future

Integrated Project

Global Change and Ecosystems

Research Report: Developing a Framework to guide Urban Water Systems Transitions.

Objective of the Report

This report documents the rationale and development of the SWITCH Transition Framework which considers the transitioning of Urban Water Systems to sustainable services and practices.

Final Version

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1. Executive Summary

This report provides the rationale behind the Transitioning Framework which has been developed for the EU 6th Framework Project, SWITCH. The Transitioning Framework followed an analysis of a wide range of frameworks. The report presents the results of the analysis of the frameworks. The Framework draws on three existing approaches to transition research: The Sustainable Transition Management Cycle which incorporates Strategic Niche Management principles developed by the DUTCH KSI network and the conceptual Urban Water Management Transition Framework, developed at Monash University, Australia.

The overall framework is driven by three management levels that form the basis of the transition management cycle: Strategic, Tactical and Operational, where processes and activities within and between the levels align and reinforce each other. The strategic level involves the development of visioning processes in a transition arena, developing a transition agenda for implementing short-term strategic goals for improvement of sub-systems (the different elements of the entire urban water system) is the focus at the tactical level and short-term actions such as experimenting with innovative techniques and methodologies takes place at the operational level. The whole process is cyclical to allow reflection (which takes place at both the operational and tactical levels) in order to ensure that the transition continues to move towards sustainable outcomes for water systems.

The SWITCH project introduced the Learning Alliance (LA) Approach for the management of water systems in cities and the transition framework consolidates the LA Approach with activities that are at the core of the transition management cycle. At project inception, SWITCH incorporated much of transition management concepts which became crucial ingredients of the LA approach. The SWITCH Transition Framework has been developed to facilitate an understanding of transitioning strengths using insights from SWITCH cities as they implemented the LA Approach. The extent of engagement with the transition management cycle such as building strong transition arenas with committed stakeholders keen to take forward the integrated and sustainable urban water management and transition experimentation agendas was analysed. Analysis showed that the sustainable transition management cycle (Dirven et al, 2002) should lie at the core of the framework. In essence, the transition management cycle mirrors the SWITCH approach in that the transition arena is the SWITCH LA, the development of a transition agenda is the strategic planning process and transition experiments constitute the science that has been underway in SWITCH over the last five years (the LA demand led demonstrations or action research). Evaluation and learning activities are synonymous with both approaches. This activity involves documenting the change process as it occurs which allows for reflection to take place to ensure that the transitioning process continues along a sustainable trajectory.

The report presents the different elements of the framework, showing how each element has been developed from international best practice and concludes by indicating how the framework may be used to focus any city, despite its location or cultural norms, on sustainable transition end goals.

2. Introduction

The future is uncertain and presents serious and persistent (wicked) problems. It is known that changes are required as a priority but uncertainty is hard to plan for especially in the context of 'resilience and adaptability'. Uncertainties and complexities have always characterized the management of water and '***we need to be able to absorb the local and global shocks that are banging at our door and search for diverse solutions that draw in partners from other disciplines and sectors of society and move forwards together by imagining new futures that are richer and better and more equal than today***' (Adams

& Jeanrenaud 2008). Transitioning stems from a growing urgency that changes in water management are needed. The main appeal for transitioning is that it is a fresh approach to dealing with the complexities of the conventional urban water dilemma. Conventional urban water management practices the world over are even less sustainable in the face of persistent global pressures such as climate change and increasing urbanisation, and there is a fundamental need to respond to the changes required.

The transition to a different future should be guided by clear goals for each forward action that may be a step or in some cases a leap based on accountability, reflexivity and adaptability. The co-evolution of emerging technologies, spatial planning objectives, market requirements, policy reform and societal needs must be taken into account in order to deliver urban water systems that have an increased adaptive capacity with stronger sustainable performances (see also Loorbach, 2002; Geels, 2005).

Water managers acknowledge on a global scale that current unsustainable practices are no longer acceptable from the different perspectives of ecology (disruptions to the water cycle and habitats), public health (water qualities, sanitation services) and the economy (flooding and drought consequences, resource overuse). From a transitioning perspective, integrated and sustainable urban water management is considered to be the 'next revolution'.

3. The purpose of the SWITCH Transitioning Framework

3.1. Switch and Transitioning

SWITCH is an EU funded interdisciplinary, integrated, action research project with the aim of facilitating the uptake of innovative solutions that will deliver sustainable urban water services in the cities that are able to cope with increasing local and global challenges through the LA approach. The SWITCH LA are multi-stakeholder platforms which drive the quest for, and implementation of, sustainable solutions for a city through knowledge transfer and a willingness to experiment with emerging technologies and solutions to reach pre-defined goals for their city of the future. An important part of this process is communication between city practitioners and scientists in order for research to be truly demand driven and subsequently improve scaling up potential.

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Uncertainties and complexities have always characterized the management of water. Urban water practitioners, stakeholders and policy makers around the world struggle continuously with the challenges of transitioning the practices of sustainable urban water management in the light of future global pressures (see also Shove & Walker, 2007; Verhagen et al., 2008; Pahl-Wostl et. al., 2009; Lienert, Monstadt & Tuffer 2009; Ellis and Revitt, 2010).

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It is acknowledged on a global scale that current unsustainable practices are no longer acceptable from the different perspectives of ecology (disruptions to the water cycle and habitats), public health (water qualities, sanitation services) and the economy (flooding and drought consequences, resource overuse) (Duffy and Jefferies 2009). From a transitioning and socio-political perspective, integrated and sustainable urban water management is considered to be the 'next revolution' in the world of water managers.

3.2. Developing the Transitioning Framework

Transitioning is not a new idea but the terminology is not well established and there is relatively limited research into successful transitions (Geels & Kemp, 2000; Dirven et al., 2002; Kemp and Rotmans, 2005; Van der Brugge & Van Raak, 2007; Duffy and Jefferies, 2009). Transitioning stems from a growing urgency that changes in water management are required. A fresh approach is needed to engage with the complexities and limitations experienced with conventional systems and practices (Shove and Walker, 2007). Conventional urban water management practices the world over are proving to be even more unsustainable in the face of persistent global pressures including climate change and increasing urbanisation, with a fundamental need to respond to the changes required (Brown, Keath & Wong, 2008; Butterworth et al, 2008; Haxeltine & Seyfang, 2009; Van der Steen & Howe; 2009 Duffy et al, 2010).

At project inception, SWITCH incorporated much of the transition management philosophy such as transformation strategies which are crucial ingredients of the SWITCH LA Approach. These included;

- addressing cultural and geographical diversities and differing water crisis situations at the landscape level;
- implementation of strategic plans at the regime level, and;
- experimentation and innovation nurturing at the niche level.

From a transitioning perspective, the progress of SWITCH through the LA approach in the case study cities can be viewed as a short-term global socio-technical transition experiment.

The SWITCH Transition Framework has been developed to facilitate an understanding of transitioning strengths using four case study cities. The process involved studying outputs from the cities to test, adapt and potentially advance existing theories and frameworks from a transitioning perspective. The extent of engagement with transition management activities such as building strong transition arenas with committed stakeholders who engaged with transition experiments was assessed for each case study city. Two issues were critical;

- the extent of their engagement with the integrated and sustainable urban water management agenda, and;
- the extent that experimentation was facilitated in the cities using innovative processes.

3.3. The SWITCH Framework as a Guide to Transitioning

The SWITCH transition framework has been developed as an explanatory guide for influencing a city towards the paradigm of sustainable and integrated urban water systems. The Framework applies transition and strategic niche management processes through visioning, strategic management activities, experimentation with and nurturing of, innovative technologies and methodologies.

The framework is based on a systemic approach taking into account the entire water system with sustainable and integrated design and operation of all water networks (natural systems,

water supply, sanitation and stormwater) being the ultimate goal or vision (Howe & Van der Steen; 2008; Duffy, Jefferies & Fisher 2010). According to Geels (2005) & Grin, Rotmans & Schot (2010), key to transforming urban water systems that will meet expectations of a future sustainable city is the ability to influence system innovation over a long timescale which takes into account social scientific practices. The transition journey will consist of integrating, replacing and transforming complex and dominant socio-technical regimes with socio-technical systems that require a more adaptive and flexible management approach to resources and urban water systems.

The Framework draws on three existing approaches to transition research;

- The Sustainable Transition Management Cycle developed by the DUTCH KSI network (Knowledge Network for Systems Innovation and Transitions) which in turn builds on the EU funded NeWater and MATISSE projects, (Geels, 2005; Olsthoorn & Wieczorek, 2006; Van der Brugge & Van Raak, 2007; Grin, Rotmans & Schot, 2010);
- Strategic Niche Management and Experimentation (Geels, 2005; Raven, Van den Bosch & Weterings, 2007; Van der Brugge, 2009), and;
- The conceptual Urban Water Management Transition Framework, developed by Monash University, Melbourne (Brown, Keath & Wong, 2009).

The framework also incorporates the SWITCH Leaning Alliance and Strategic Planning Processes (Butterworth et al, 2008; Howe and Van der Steen, 2008;) and innovative methodologies, many that have also been developed during the project, which have been branded 'tools to facilitate transitioning'.

The Framework indicates a continuous cycle of stages or events that should be taken into consideration when attempting to resolve the complex or 'wicked' problems of implementing integrated and sustainable urban water management systems.

For the purpose of SWITCH, a transition is a structural transformation that is defined as *'a radical switch from conventional socio-technical systems to next generation sustainable urban water system'*. Transition management is a strategy where evaluation of past and current (urban water) systems is undertaken to influence and shape the long term sustainable vision through integrated and participatory urban water management practices in a city (Loorbach and Rotmans., 2006; Brown, Keath and Wong, 2008; Duffy and Jefferies, 2009). Strategic niche management and experimentation (nurturing technological innovations) are important if not vital for the delivery of sustainable systems as they provide the scope and pathways for a transition to occur (Van der Brugge, Rotmans and Lorbach, 2005). The urban water management transition framework is a heuristic benchmarking tool that can be used to assist urban water practitioners to better envisage future paradigms and transition trajectories. A radical transition does not necessarily imply the immediate uptake of new innovations but is more commonly a process whereby a society selects, adopts and implements new systems and methodologies that are radically different from existing systems (Van der Brugge, 2009). Radical in this context implies a switch in systems and/or processes as opposed to dynamics or timescale (Duffy et al., 2010).

However, Shove & Walker (2007) caution that during a time when the idea of transition management is capturing the attention of governments and academics around the world it may not be possible to '*steer change, shape future development and manage movement onto a more sustainable track in a complex world dominated by hegemonic ideologies of neoliberal capitalism, global finance, and commodity flows*'. Cautions include:

- Once movement along a trajectory is in the 'right' direction, how are turning points defined at an early stage of a process that traditionally take decades to unfold
- Who are the transition 'managers' and on whose authority will they act?
- When, how and by whom will transition goals be subject to scrutiny and who wins?

- Who loses when a trajectory is taken in one direction and not another?

Another important caution by Shove & Walker (2007) is transitions which are undesirable but appear from 'leftfield': transitions that head in the opposite direction of sustainable outcomes. The widespread use of mechanical compression air conditioning is just one example. How will sustainable transition managers engineer the collapse of undesirable systems?

These cautions are reinforced by Smith & Stirling (2008 b) who view the issues as especially problematic but not unique since other participatory approaches share the same dilemmas. The solution according to Smith and Stirling is down to well thought-out engagement strategies with other political processes and institutions.

Shove & Walker, (2010) continue and widen their 'caution' debate following research into Practice Theory and observations of the uptake (or not) of sustainable practices in daily life. A socio-systemic approach to change is also required (alongside socio-technical transition theory) which recognises that there is no simplistic uptake of approaches that are deep rooted in the complexities of systems thinking and the fundamental changes required in the ordinary routines of everyday life. Socio-technical co-evolution is required but the real question remains - how easy is it to control the fate of innovations and consumer practices and expectations?

4. Framework Review Criteria.

The purpose of any framework is to solve or address complex issues. A framework can deliver several objectives and as such there are a wide range of frameworks that deal with urban water management issues at all levels that are available to inform decision makers, strategists and operatives alike in achieving a pre-preconceived goal for a particular process or processes (Hockings et al., 2006; Ashley et al, 2010).

The SWITCH transition framework underpins the sustainable transitioning concept and is the key educational or learning tool to help focus and clarify transition management trajectories for influencing and potentially accelerating the delivery of a sustainable urban water systems future (Waheed et al, 2009). The main purpose of the framework is to provide technical and non-technical decision makers in the water sector with a non-complex overview of key sustainable transition management processes or actions that should be considered when attempting to move towards an inherently unpredictable future.

Twenty frameworks were reviewed and a score assigned to each based on their relevance to informing the development of a SWITCH transitioning framework. The aim was to examine the frameworks with a view to building on the relevant concepts and theories presented and apply them to SWITCH transition research outputs. Some frameworks were clearly unsuitable for delivering SWITCH objectives. For example, a framework such as the Water Framework Directive, is a basic list of actions that are timeline driven to reach a desired outcome (Directive2000/60/EC).

Transitioning and transition management in particular is an attempt to influence a socio-technical change towards sustainability goals. Transition management is described by transitions researchers as a form of intelligent, long-term planning through small steps based on learning and experimenting. Transitioning should be an interactive, reflective and iterative process where the flow of knowledge is multi-directional allowing interaction between technology users, creators and managers. This should be represented by a cyclic, continuous process that is influenced by various management (or governance) levels;

- Strategic or landscape (visioning, strategic discussions, goal setting etc);
- Tactical or regime (agenda building, negotiating, networking etc), and;
- Operational or niche (experimenting, project building, implementation etc) to reach desired goals.

Kemp & Loorbach (2006); Loorbach & Rotmans (2006); Grin et al, (2010).

5. Criteria for reviewing frameworks.

In order to judge the different frameworks, twelve criteria were established; several which are based on transition management concepts, others on the core concepts of the SWITCH approach and others on sustainable urban water management principles. In addition the SWITCH transition framework needs to be a roadmap designed to provide a low barrier of entry for the user which is visually appealing and interesting so that the user would want to learn more about the key messages.

5.1. Visually appealing

The most effective frameworks have visual appeal which improves their user friendliness and communication potential with non-technical audiences. Being able to communicate effectively while steering clear of cluttered designs helps to convey key information and break communication barriers so that the user is less reluctant to use it; i.e. this will increase its usability (Kreitzberg and Little, 2009). The framework should be interesting so that the user wants to learn more about the key messages.

5.2. Simple

The focus again is on the non-technical user of the framework. The framework should be readily understandable and easily encapsulated in straightforward diagrams. It should be simple and easy to use in order to facilitate a knowledge leap by clearly communicating the pathways and tools available for transitioning. The primary function of the framework is to facilitate a 'mental shift' so that the user can begin to consider the possibilities of implementing next generation urban water systems.

5.3. Systematic and Systemic Process

Promote systemic and systematic strategies whilst delivering flexible applications to deliver the vision and orientate governance activities.

Adoption of systemic and systematic strategies throughout the transition management process will help to avoid problems and deliver more adaptive and flexible applications that are not too prescriptive (Grin et al, 2010). This includes setting short term objectives that are based on exploring the persistent problems and identifying unsustainable system drivers through normative back-casting and exploratory scenario forecasting approaches to deliver a long-term shared vision (Loorbach and Rotmans, 2006; Morioka et al, 2006). This will encourage positive steps, or leaps in some cases, at the technical, governance and financial levels i.e. institutional transitions for the uptake of sustainable solutions towards a more sustainable future (Weaver & Rotmans, 2006; Tabara and Ilham, 2007).

5.4. Sustainability

Encourage a systems engineering approach that embraces the complexity of sustainability concepts.

Howe & van der Steen (2008) surmise that a systems analysis approach is a fundamental component of SWITCH and comparison with the SWITCH approach identifies key areas where a systemic approach could be expanded to cope with sustainability. SWITCH LA and their drive for demand driven science combined with strategic planning mechanisms that have short and long-term objectives show how multi-disciplinary approaches to problem solving may influence and potentially accelerate sustainable trajectories that implement new generation urban water systems that can cope with future global risks.

5.5. Interdisciplinary

Manage the complex dynamics that result from bringing together a range of disciplines.

Organising and facilitating interaction between multiple actors with different interests from diverging perspectives is of vital importance when establishing a transition arena or stakeholder platform. Education and knowledge transfer amongst the different actors is also another important factor as this enables a deeper understanding of the complex issues that need to be addressed when developing goals and visions (Grin et al, 2010; Loorbach & Rotmans, 2006; Kemp &Loorbach, 2006). A combination of different stakeholder roles, for example, advisor, user and actor, will ensure positive and productive interaction at the stakeholder level to ensure dynamic interaction between individual goals, beliefs and social norms to satisfy conflicting values, ambitions and targets (Weaver & Rotmans 2006).

5.6. Innovations and Implementation of Science

Encourage strategic niche management and transition experiments

Many types of socio-technical transitions result from niche development (Geels, 2005; Nykvist & Whitmarsh, 2007). Strategic niche management and transition experimentation (nurturing technological innovations) are important if not vital for the delivery of sustainable systems as they provide the scope and pathways for a transition to occur. Technological niches are generally nurtured in relatively protected environments by networks of dedicated actors who are willing to invest resources in the new technologies. The niche experiment(s) will be aligned with the pre-defined vision or sustainable path (Grin et al.; 2010; Loorbach & Rotmans, 2010). Transition experiments may eventually see the resultant innovation replacing dominant regime practices and contribute to a sustainable transition (Van der Brugge et al 2005; De Graaf, 2005; Raven et al., 2007).

5.7. Institutions, Geography & Cultural Norms

Apply to location specific circumstances.

Location specific circumstances exist in any city or country, whether developed or developing. Socio-cultures and ecological issues, for example resource scarcity, acting as transition triggers at the landscape level were studied in the Spanish context during the MATISSE project to assist in explaining *why* a transition process occurred that began with the 'New Water Culture' which facilitated developments in Spanish water policy (Tabara, & Ilhan, 2006). Constraining and enabling capacities of the culture were observed as being part of the wider process of 'sustainability learning' which helped drive the transition. The attitudes of citizens can also play a significant role in slowing down or accelerating a transition such as the uptake at the cultural level of new philosophies (Van der Brugge et al., 2005; Duffy & Jefferies, 2009). Transitioning the urban water system in a city will involve the development and implementation of sustainable solutions to existing infrastructure that can also adapt to increasing local and global pressures such as urbanisation, resource scarcity and climate change (Nelson, 2008; Duffy & Jefferies, 2009).

Da Silva, Sutherland & Green (2008) state that an improvement in governance is required at two levels for the promotion of sustainable solutions that deliver integrated urban water management practices - mechanisms and processes, and structures and institutions.

5.8. Financial Issues

The OECD report 'Managing Water for All' (OECD 2009) states that poor governance and inadequate investment are resulting in billions of people not having access to water and sanitation services due to the deterioration and eventual collapse of infrastructure. The report focuses on the ultimate financial sources of investment for the water sector – the '3Ts': taxes, tariffs and transfers and stresses the importance of strategic financial planning to find the right 3Ts mix for achieving water and sanitation targets and for leveraging other sources of finance. The report also adds that tariffs play a vital role in achieving sustainable cost recovery while ensuring affordability.

In the guidebook 'Costing for Sustainable Outcomes Urban Water Systems' Mitchell et al (2007) provide an overview of the need for new costing approaches if we are to deal with the

challenges of transitioning to sustainable urban water systems. This is because the new systems encompass new technologies, new outputs and services, new management approaches, new risks, new business models, new regulatory arrangements, and new operating and institutional arrangements. Costing of the new systems is a key issue for decision makers involved with urban water infrastructures. Least cost studies will inform investment decisions for promoting sustainable outcomes. Core concepts of sustainability include economic and resource efficiencies in order to ensure solutions that meet environmental objectives without incurring high financial costs that are resource intensive.

5.9. Adaptive

Address complex methodologies and technologies associated with sustainable solutions.

Innovations are not born but require adaptations before they can be defined as a good solution (Loorbach, 2007). Implementing sustainable solutions will also involve the uptake of adaptive and resilient management practices that will deliver more sustainable pathways for urban water systems to address future global risks (Loorbach & Rotmans, 2006; Van der Steen & Howe, 2009; Grin et al, 2010). There are many emerging environmentally sound urban water technologies and methodologies that can perform the same job as existing conventional systems (in many cases they do the same job more efficiently) and that better integrate all areas of the urban water cycle. They are also more economical and sustainable. The new solutions will better fit the purpose that they were designed as they will include adaptability and flexibility (resilience) so that they can cope with rapidly growing urban areas or the effects of drought or prolonged storms. Next generation urban water systems are termed complex adaptive systems as they are able to adjust or adapt to the changing conditions in the particular environment that they must operate in (MLIT, 2001).

5.10. Reflective

Endorse reflective and iterative processes.

Change processes should not be fixed but reflective and iterative, and should be carried out partially and completely in sequence, in parallel or randomly in order to reflect changing circumstances and the appraisal of new interventions (Dirven, Rotmans and Verkaik 2002; Grin et al, 2010). Periodic review ensures that the desired direction continues to reflect changing circumstances and appraisal of new interventions i.e. re-opening the debate as to what the future sustainable path for a city is - why, for whom and how? (Smith & Stirling, 2008b). This allows adaptations or upgrades to plans or proposed activities and potential adjustments to an already developed transition vision (Loorbach & Rotmans, 2006; Butterworth & Dasilva, 2007).

5.11. Visionary

Enable forward thinking by facilitating a forum that is not rooted in present day issues.

When planning for a sustainable future, stakeholders need to know where they want to arrive at in order to plan the pathway to get there (Brown, Keath & Wong 2009). Sustainable and integrated design and operation of all water networks (natural systems, water supply, sanitation and stormwater) is the primary consideration when envisaging goals for the urban water system of the future. (Howe & Van der Steen; 2008; Duffy et al., 2010). Visioning processes are developed at the strategic level of transitioning prior to developing plans for delivering strategies to take the transition agenda forward. This should involve strategic discussions where collective goal and norm setting is debated and subsequently long-term goals can be formulated. Visioning should consider all issues that relate to the culture of the society and the existing state of play of the socio-technical systems in the city that wishes to transition. These issues should include anticipation of what the functional requirements of sustainable urban water systems are in the local context and the relevant importance to the city from a global perspective (Loorbach, 2007).

5.12. Learning

Supports capacity development and a legitimate educational role for the media.

Educational programmes are important for all water users, decision makers and the media in order to embed sustainability and transitioning concepts (Pagelar, 2009; Duffy et al., 2010) These should help mitigate resistance (barriers) to switching to more innovative urban water practices (Heslop & Dixon, 2008). This should ensure that users, operators and managers involved with the new technologies are aware of the shift in mindset that is required to encourage sustainable practices which may involve changes to patterns and expectations of daily life (Shove & Walker, 2007). It will also help to overcome issues relating to institutional and technological lock-in (Heslop & Dixon, 2008; Brown & Farrelly, 2009; Pagelar, 2009). The media could and should be used as a tool for raising awareness to the issues and the potential solutions that can be delivered through the uptake of sustainable urban water practices as they are a primary channel for effectively interpreting and communicating technical, institutional and economical issues to the public at a level that they can relate to (Pagelar, 2009; Duffy et al, 2010).

Embraces stakeholder and community engagement and social inclusion.

The SWITCH LA approach aims to work with stakeholders by facilitating a transition arena that allows unsustainable urban water management practices to be identified. Stakeholders are then encouraged to move forward and 'do better' than in the past by choosing and implementing better solutions through exchange of knowledge between the appropriate academics who research, guide and educate for the processes involved, and the partner institutions. LA that have a broad membership including marginalised stakeholders will have more scope to engage with governance issues for promotion of the uptake of an integrated and sustainable vision. Haxeltine & Seyfang (2009) studied the growing 'Transitions Movement' in the UK – a new civil society movement with a focus on bringing communities together to produce change and innovation at the whole systems level, which has spread rapidly in a very short timescale. The movement relies on community-level action to align the threats of climate change and fuel scarcity with community defined and implemented plans over a 15-20 year time span. This research explored the differences and parallels between transition and resilience concepts being used by stakeholders and academics and uses the results to inform transition and resilience frameworks regarding the governance of social and technical change in the context of sustainability.

6. Review of Existing Frameworks

6.1. Introduction to the review

Twenty frameworks covering three key SWITCH knowledge areas (technology, governance and finance) were reviewed based on the twelve review criteria outlined in section 5. The criteria were applied by subjectively assigning a score of 1 or zero to each criterion. This resulted in five frameworks having the highest score of 12 and these are detailed in Table 1. The remaining fifteen frameworks lacked basic attributes assigned to the review criteria and these frameworks are listed in Table 2. The approach used is recognised as being highly subjective since it relied on the authors' interpretation of the strength of each framework with respect to the review criteria but was nonetheless used to decide which frameworks had added value for informing the development of the SWITCH transition framework. The top five frameworks (a score of twelve out of twelve) were then evaluated in more detail to gain an insight into how themes were linked to develop each framework. The basic conceptual, theoretical or operational rules of the frameworks were then adapted or in some cases directly adopted for the purpose of developing the SWITCH Transition Framework.

Table 1. Five highest scored frameworks (12/12)

	Title, Reference, Country	Benefits
1	**Land Use Framework. Government of Alberta, Canada (2008)**	Iterative systems approach
2	**Transitions to Sustainable Development: New Directions in Long Term Transformative Change. Grin et al, The Netherlands (2010)**	Cyclical interpretation of events
3	**Samenleving in Transitie: een vernieuwend gezichtspunt (Society in transition: an innovative perspective). Dirven et al, The Netherlands (2002)**	Cyclic representation of interaction between management levels
4	**Evaluating Effectiveness: A framework for assessing management effectiveness of protected areas. Hockings et al, Global (2006)**	Cyclic representation of interaction of management actions
5	**Transitioning to Water Sensitive Cities: Historical, Current and Future Transition States. Brown et al, Australia (2009)**	Central theme which 'grows' in importance

Table 2. Fifteen frameworks analysed but not used

	Title, Reference, Country	Benefits	Drawbacks	Visually Appealing	Simple	Sustainability	Inter- disciplinary	Systems Analysis	Science/ Innovation	Governance/ Cultural	Finance	Adaptive	Reflexive	Visionary	Learning	SCORE
1	**Water Framework Directive 2000/60/EC/ Europe**	Systematic and reflexive	Basic list of actions with a fixed timeline	N	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	9
2	**A framework for system analysis for SUWM. Hellstrom et al (2000). Sweden**	Multi-dimemsion criteria linked sequentially	Complex and difficult to flollow up sequential relationships to see the bigger picture	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	11
3	**Sustainable Urban Stormwater Management in Australia: Professional Perceptions on Institutional Drivers and Barriers. Brown and Farrelly (2009)**	Analytical and progressive	Basic list of variables. No consideration of systemic approach to ensure reflexivity /adaptability	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11
4	**Challenging the norm: The capacity of local government to implement 'low impact' design practices. Heslop and Dixon, New Zealand (2008)**	Guidance based on 'growing' or building on a central theme	Focuses on a central theme with no consideration of systemic approaches	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	10
5	**Developing sustainability criteria for urban infrastructure systems. Sahely et al, Canada (2005)**	Systemic & Reflexive illustrating feedback mechanisms	Does not tackle system innovation directly	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	11
6	**Guide to Demand Management. Water Services Association of Australia (2008)**	Systematic and iterative		N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10
7	**Integrated Management and Transition Framework. Pahl-Wostl, Europe (2008)**	Links several frameworks based on the integration of conceptual approaches	Architecturally complex and difficult to understand - designed for experts in transition community	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10
8	**Frameworks for Adapting to Floodrisks: Experiences from the EU's Flood Resilient Cities Project. Ashley et al, Europe (2009)**	Draws on common actions to develop the framework	Supports a multitude of complex issues in one framework resulting in fragmentation of ideas	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	9
9	**Water Stress Mitigation : The AquaStress Case Studies. Assimacopoulos (Ed), Mediterranean Basin (2009)**	Integrated framework	No direct reference to collaboration or financial considerations	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	10
10	**Learning Alliance Briefing Note 13: Rapid Urban Water Assessment. Batchelor and Butterworth, Global (2008)**	Links key knowledge areas with knowledge flowing in both directions	Linear and mildly complex	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	11
11	**Sustainable Water Services A procedural Guide. Butler et al, UK (2004)**	Reflexive and iterative	Basic hierarchy showing linked stages	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	11
12	**Stormwater as a valuable resource in the urban water cycle: SWITCH Deliverable 2.2.4a. Ellis and Revitt, Global (2010)**	Matrix illustrating intra-organisational non-sequential relationships	No references to a reflexive approach to ensure uptake of new interventions	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	11
13	**INECO. Guidelines towards the application of institutional and economic instruments for water management in countries of the Mediterranean Basin. European FP6 project (2007)**	Relational, systematic and reflexive	No relationships to innovation uptake	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	11
14	**Surface Water Management Plan Framework. DEFRA, UK (2010)**	Integrated phased approach	Linear approach	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	11
15	**WSUD Implementation Framework for Darwin: Discussion Paper. McAuley et al, Australia (2009)**	Integrated 'tree' approach	Is complex, non-reflexive and appears fragmented to non-expert	N	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	8

6.2. Using the five best frameworks to develop a new framework

The SWITCH Transition Framework needed to be designed as an assessment 'road map' in order to provide a low barrier of entry for the user i.e. to be simple, easy to use and understandable in order to facilitate a knowledge leap by communicating the pathways and tools available for encouraging the uptake of innovative practices and techniques that may guide or influence a transition towards the goal of sustainability for urban water systems. It also needed to be visually appealing and interesting so that the user would want to learn more about the key messages. The framework should encourage and focus the user to readjust their thinking away from conventional socio-technical pathways of urban water

management and towards pathways that offer more sustainable options or solutions. The primary function of the framework was to facilitate a mental shift which encourages the user to consider the possibilities of implementing the next generation of urban water systems alongside conventional systems by applying an historically reflective and back-casting approach before enabling a move forward to achieve long-term objectives through re-evaluation and re-adjustment processes based on the uptake of new knowledge areas as they become available.

The five frameworks reviewed that satisfied all of the criteria are described in more detail below. Overall, the essential benefits they provide include the encouragement of continued improvement through reflective, systems analysis and adaptive approaches with the emphasis on problem solving by implementing scientific interventions. They also support knowledge flows between key stakeholders and between the activities or stages of a process. These are all key factors in facilitating the uptake of sustainable practices and transition management concepts.

6.3. Land Use Framework

(Government of Alberta 2008)

After many years with periods of high and low growth, the Government of Alberta realised that the province had reached a 'tipping' point regarding the finite capacity of their land, water, air and habitat as they attempted to come to terms with record prosperity and unprecedented population growth (two million twenty five years ago to an expected five million in 2026). Combined, these factors placed unprecedented pressures on the landscape with oil, gas, forestry, mining, agriculture, recreation, housing and infrastructure all competing for the same land. A land use framework was developed in order to manage population growth, sustain the growing economy and to balance this with Alberta's social and environmental goals: in short, 'smart growth'.

The Alberta Government realised that what had previously been satisfactory, no longer benefitted the community. The old rules were no longer able to guarantee the quality of life that they had come to expect. They consulted with the Albertans to develop the framework and together they opted for a top down approach which placed greater provincial leadership on land-use issues without creating a heavy-handed, central bureaucracy. The Government provide policy direction, guidelines and opportunities that local government cannot provide but left decision for newly developed regional planning requirements with the local authorities. However, the Framework does take forward several previous guidelines where precedents had been set by 'far-sighted' leaders. These leaders had managed the growing population and economy during several previous periods of growth; the first one hundred years of the province, the growth spurt stimulated by oil discovery in the 1940's, and another rapid growth period in the 1970's.

The Land-use Framework provides a blueprint for land-use management and decision-making that addresses Alberta's growth pressures. Components of the framework include: ***Provincial leadership*** to provide clear direction and parameters for regional, local and landowner decisions. ***Integration and co-ordination*** of provincial policies governing air, water and land. ***Clearer definitions of roles and responsibilities*** for land-use decisions at the provincial, regional and local levels. ***Improved processes to deal with conflicts*** between land users. ***Enhanced conservation and stewardship on both private and public lands*** to promote ecological sustainability. ***Improved information sharing*** about the condition of the land and the effects of activities on the land. ***Increased consultation*** to ensure a fair opportunity to influence new policies and decisions.

Figure 1 illustrates components of the systems approach which the Alberta Government adopted to implement the land use framework and help achieve long-term economic, environmental and social goals. The strengths of the framework include a reflective and

iterative approach to outcome-setting, planning, monitoring and improvement of land-use management and decision-making. Visioning, planning, implementation and re-evaluation are promoted for continuous improvement to attain goals by developing information systems, sharing knowledge and applying innovative technologies and tools.

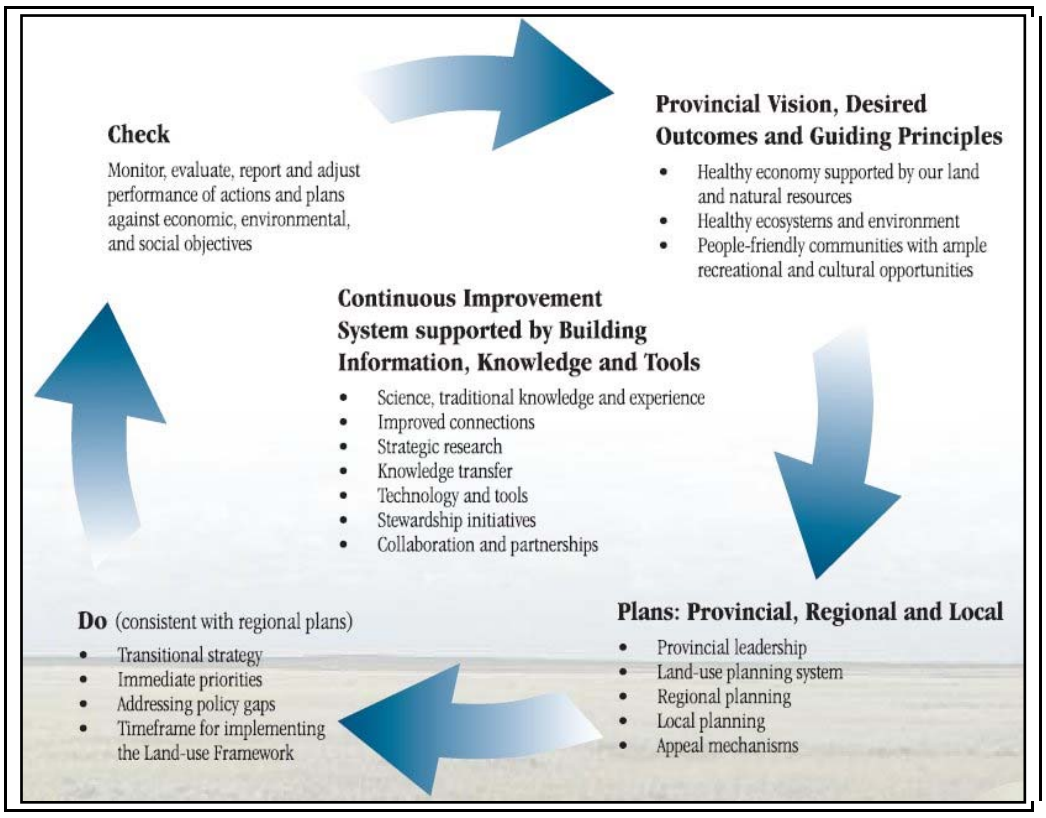


Figure 1. Alberta Land Use Framework (from Government of Alberta 2008)

6.4. Ten Steps of Transition Management Framework - basis for the Transition Management Cycle.

Dirven, Rotmans and Verkaik (2002).

The first ten steps of the transition management cycle (see Figure 2) were developed following extensive experimentation in the Netherlands during the Parkstad Limburg Project: Regional Transition Management (Dirven et al., 2002; Grin et al 2010). The area of Parkstad in Limburg is located on the boundaries of Holland, Germany and Belgium and consists of eight municipalities. In this former mining region, historical problems included: socio-cultural - low income, ageing populations, loss of young people to more prosperous areas, high crime rates, unattractive and old housing stock; economic – high unemployment levels, lack of high skilled labour due to misfit of core research areas, lack of business incentives; ecological – fragmented spatial areas with a mix of high quality natural and cultural areas and highly polluted former mining areas and watercourses, some of which were attributed to neighbouring countries (Grin et al., 2010; Loorbach and Rotmans, 2010).

The project sought to experimentally apply the transition management approach as developed by Rotmans (2000) during the European VISIONS-project which was based around long-term scenario development (or future projections) and participatory approaches for mutual learning. Transition management concepts were applied on a regional scale through a combined regional spatial vision.

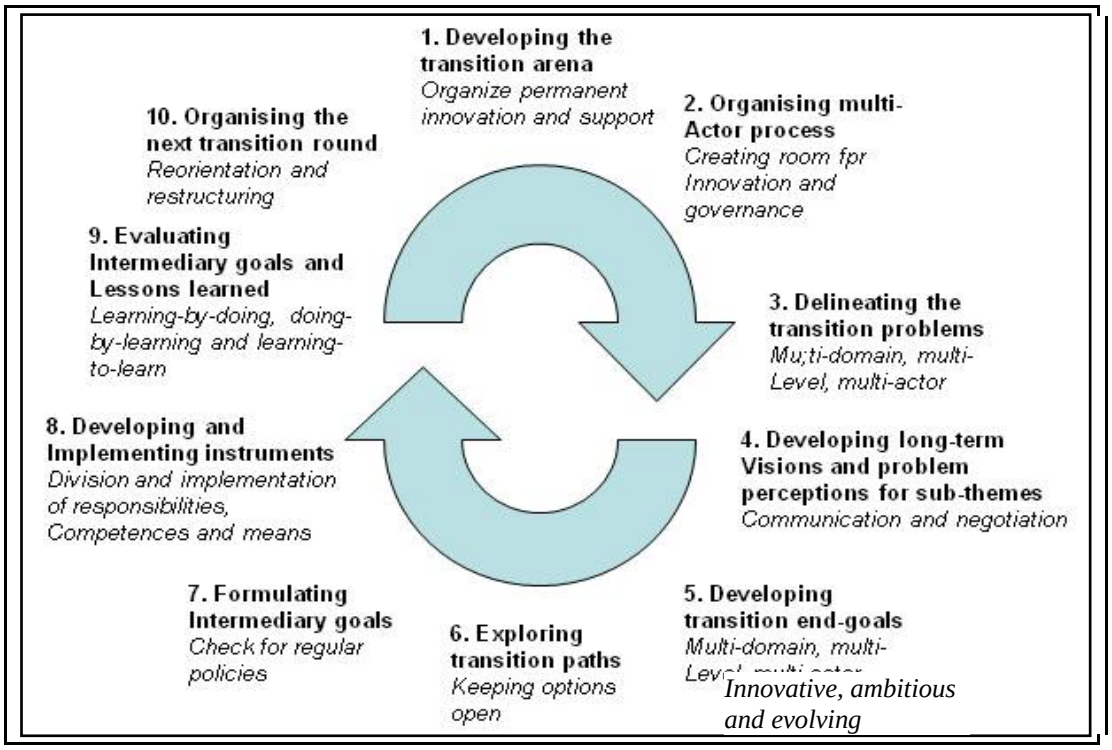


Figure 2. Ten steps of transition management (from Dirven, Rotmans and Verkaik (2002)

The main outcome of the project was the formulation of an empirical basis for the transition management framework which solidified the theoretical aspect of the transition management approach (Grin et al., 2010). Understanding and building on the systems analysis approach, developing the transition arena and agendas and a focus on the social process of visioning for the long-term were crucial outputs from this research. Actors that participated in the transition arena stimulated the political debate and the general perception of the region. They became empowered to act on the opportunities available to regenerate the region in a way that reflected the changing times such as integrating sustainable energy business opportunities that created a link between regional history and the future i.e. generating heated water from former mines (Grin et al., 2010; Loorbach and Rotmans, 2010).

The resultant final transition management stages were translated into transition paths and strategies which have several intermediate steps focused on innovation and experimentation. Through a process of learning by-doing, doing-by-learning and learning-to-learn, systematic knowledge was developed that resulted in ten transition management steps which created a process of continuous learning, experimentation, foresight and feedback. The result is a gradual alignment of perspectives and views on sustainable development (Dirven et al., 2002). Non-linear knowledge generation is termed 'social learning' and is based on learning how to interact with different stakeholder viewpoints which result in a 'reframing' or change in perspective (Fischer-Kowalski and Rotmans, 2008).

The ten steps transition of management framework is not a blueprint, nor should it necessarily be completed in the order provided, but it should be a cyclical and iterative process. The steps involve a multidimensional scope of activities in varying combinations that depend on continuous development and the extent to which the transition is developing. Steps 1-3, and 10 focus on the design, structure and organization of the transition arena. The remaining steps relate to the different process activities that take place in the arena, and between the actors of the individual organisations involved in the arena (Dirven et al., 2002).

The key lesson learned at the end of the project was that transition management had an important influence on mobilising actors and stimulating a more positive, collaborative and future orientated way of thinking as they internalized problems and issues and gained an understanding for the potential to transition towards sustainable goals (Grin et. al., 2010).

Note: The steps in this framework have been slightly adapted and adopted as a core concept of the SWITCH Transitioning Framework.

6.5. Framework for the Transition Management Cycle and Activity Clusters.

Loorbach and Rotmans (2006). Grin, Rotmans and Schott, (2010).

In Chapter 10 of 'Understanding Industrial Transformation', Loorbach and Rotmans (2006) discuss whether managing transitions is possible: the answer being no – not in a traditional sense. This is primarily due to the interdisciplinary nature of transitions and autonomous landscape processes which are highly unpredictable. The authors conclude that the direction of a transition can be influenced through various mechanisms: markets, plans and institutions.

Loorbach and Rotmans (2006) outline an operational method for transition management that is based on the conceptual multi-level (niche, regimes and landscapes) and multi-phase (pre-development, take-off, acceleration and stabilisation) frameworks. The transition management cycle has been tested and developed in the Netherlands by researchers from the Dutch Transitioning (KSI) network and several ministries who have been actively engaged in advancing transition research through the participatory approach, experimentation and case studies over the last decade (Grin et al, 2010).

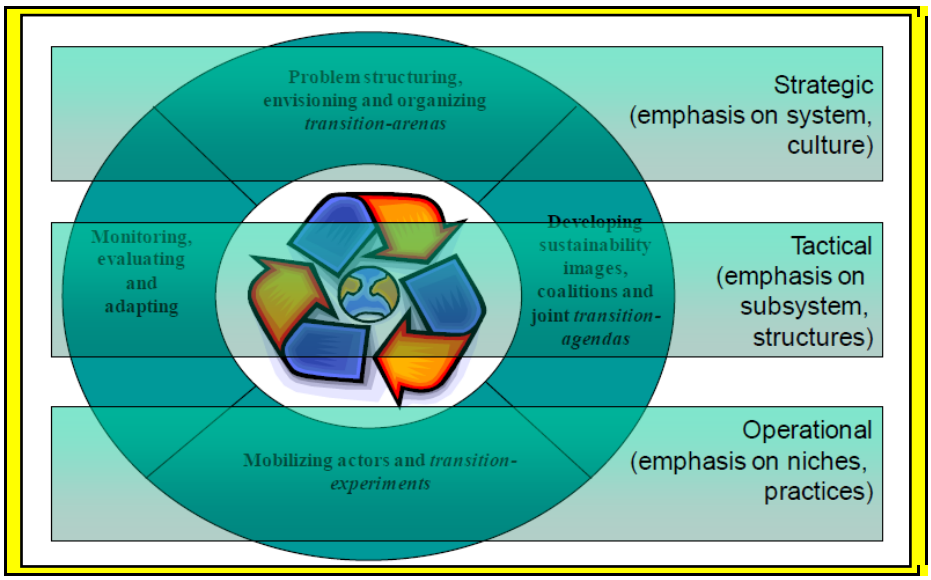


Figure 3. Transition management cycle and activity clusters (after Smith and Stirling 2008).

Transition management is a cyclical, coordinated, multi actor process (Figure 3) which distinguishes between three levels that are organised around four co-evolving activity clusters: strategic (vision development, strategic discussion, long-term goal formulation); tactical (agenda building, negotiating, networking, coalition building, evaluating, monitoring, learning); and operational (experimenting, project building, implementation) (Kemp and Loorbach, 2006; Van der Brugge and Van Raak, 2007; Grin et el., 2010). In reality there is no fixed sequence to the phases and activities can be carried out partially and completely in sequence, in parallel or randomly.

Transition management activities are aimed at influencing, organising, and coordinating processes at the different levels so that the processes are aligned and reinforce each other. The transition arena is a powerful systemic tool that provides room for long term reflection and prolonged experimentation (Grin et al., 2010) as this is the basis of transition management – creating space for stakeholders or fore-runners (niche and regime players) to stimulate the transition management process (Van der Brugge and Van Raak, 2007).

Note: The transition management cycle and clusters have been fully adopted as a core concept of the SWITCH Transitioning Framework.

6.6. Framework for assessing management effectiveness of protected areas.

Hockings et. al. (2006)

The World Conservation Union (IUCN) brings together States, government agencies and a diverse range of non-governmental organizations in a world partnership that is spread across 150 countries. The Management Effectiveness Evaluation Framework was developed as one of several best practice guidelines that provides a system for designing protected area management effectiveness evaluations based around six elements: context, planning, inputs, processes, outputs and outcomes. It is not a methodology, but is a guide to developing assessment systems based on the adaptive management process

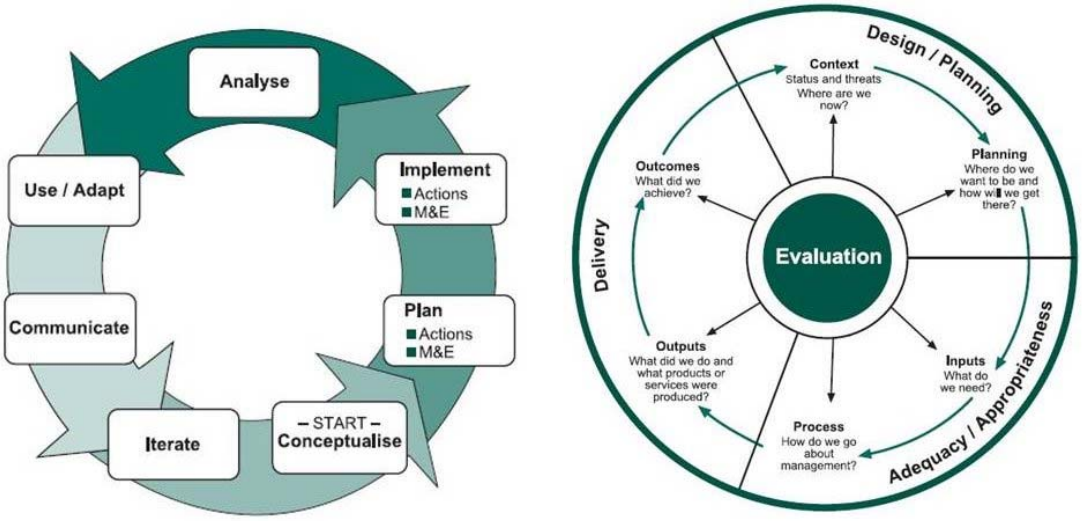
Protected areas now cover over 10 per cent of the world's land surface. This represents a major commitment to the protection of biodiversity, along with associated environmental services and cultural values, by local and national governments, local communities and private landowners. The people investing in protected areas, whether through voluntary donations to NGOs or through government taxes, have a right to know that these areas are being well managed. Achieving effective management requires adopting appropriate management objectives and governance systems, adequate and appropriate resourcing and the timely implementation of appropriate management strategies and processes. It is unlikely to be achieved fully without an approach that is inquiring and reflective and which seeks to understand how effective the current management regime is and how it could be improved.

The first and most important message in the guidelines is that evaluation should be seen as a normal part of the process of management. Adaptive management is based on a circular management process which allows information concerning the past to feed back into and improve the way management is conducted. Evaluation helps management to adapt and improve through a learning process. Adaptive management has roots in complex systems theory which initiated a shift away from traditional 'predict and control' management processes towards the complex, adaptive and unpredictable behaviour of ecosystems thinking and socio-ecological resilience by learning to manage and managing to learn (Van der Brugge and Van Raak, 2007). As a policy hypothesis, adaptive management requires experimentation. Learning by doing accelerates progress towards improved policies and management practices. Learning is facilitated by feedback obtained from monitoring and evaluation and without feedback, learning about the consequences of policies or management actions is slow; change is cumbersome and may come too late. If re-evaluation is not undertaken then situations are created where actors simply 'muddle through'.

As there were a growing number of frameworks for assessing effectiveness of management systems being developed it was feared that too much diversity would limit the capacity to compare and learn across assessment systems, making it difficult to draw general conclusions about the effectiveness of protected area management at national, regional and global levels. The Framework provides a consistent basis for designing assessment systems without attempting to impose one standardized methodology.

The Framework is based on the principle that good protected area management should follow a cyclical process with six stages or elements, as shown in Evaluation that assesses each of the elements (and the links between them) should provide a relatively comprehensive picture of management effectiveness.

All six elements shown in Error! Not **a valid bookmark self-reference..** are important in developing an understanding of how effectively protected areas are being managed. They reflect three management 'themes'; design (context and planning), appropriateness/adequacy (inputs and processes) and delivery (outputs and outcomes).



Error! Not a valid bookmark self-reference.**. Adaptive management framework** (Source Conservation Measures Partnership 2004) **and Framework for assessing management effectiveness of protected areas.** (Hockings et,2006)

6.7. Urban Water Management Transition Framework.

Monash University, Australia.

When planning for a sustainable future, stakeholders need to know where they want to arrive at in order to know how to get there. The conceptual urban water management transition framework developed at Monash University, Australia (Brown et al, 2008; Wong and Brown, 2008) provides a benchmark that shows stakeholders where they are and where (potentially) they can go by proposing attributes that would ensure more sustainable city phases. The framework (Figure 4) enables water practitioners to better visualize sustainable transition pathways including the capacity development and cultural reform initiatives required to deliver the future sustainable urban water paradigm of a 'water sensitive city' (Brown et al., 2008; Ison et al., 2009).

The framework is based on historical, contemporary and futures research which resulted in the typology of six city phases that cities transition through when moving towards more sustainable urban water systems. The research was undertaken in order to give an insight into the extent of conventional 'hydro-social contracts' and to identify the actions and activities that were required and will be required to move towards a 'water sensitive city'.

The framework identifies attributes for the first three phases (water supply, sewered and drained cities) that are considered typical of the evolutionary changes within urban water management practices over the last 200 years in Australia from a socio-technological context. The attributes assigned to stage four, the Waterways City, are considered to be the current urban water management phase for most cities (Brown et al, 2009; Wong and Brown, 2008). The attributes assigned to a water cycle and water sensitive city are based on future scenarios where progressive sustainable urban water management practices (transition strategies) will be integrated into existing urban infrastructures to deliver a paradigm shift.

To a certain extent, the waterways city scenario can be considered to be emerging in many cities as they shift towards urban water management practices that offer more sustainable solutions, indicating that a transition take-off phase may be underway (Duffy and Jefferies, 2010). There are no true examples of an existing water sensitive city but there are cities around the world that are leading with approaches that align with the sustainable urban water city or water sensitive approach proposed by Wong and Brown (2008).

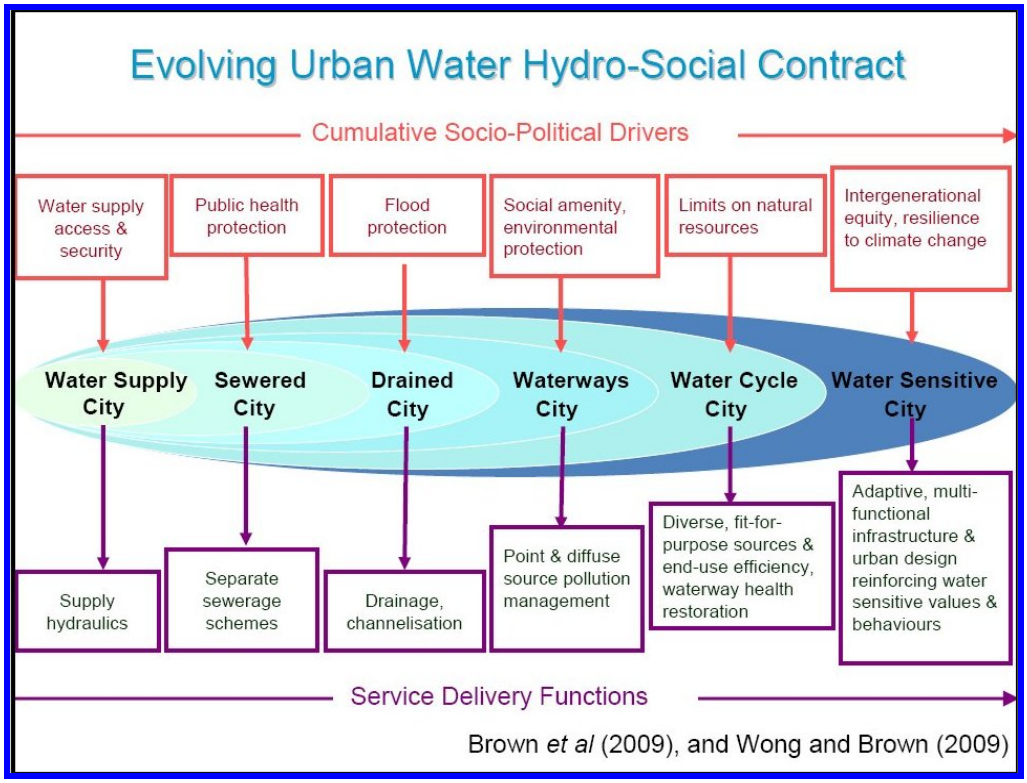


Figure 4. Urban water management transition framework

Note: The progression of city phases towards a water sensitive city have been adapted to provide a simpler and more holistic visioning tool where the concept of a water sensitive city is the central goal and this has been incorporated into the SWITCH Transition Framework.

6.8. Conclusions from the review

The SWITCH Transition Framework should facilitate an understanding of the processes involved in transitioning urban water management systems. Development of the framework utilised a key component - the SWITCH LA Approach (Smits, Moriarty, and Sijbesma, 2007; Verhagen, Butterworth and Morris 2008), which very closely 'mirrors' transition and strategic niche management processes. Transition management activities should influence, organise and coordinating processes at three different levels (strategic, tactical and operational) whereby the processes should become aligned and reinforce each other. Transition management 'instruments' (transition arena, transition agenda, transition experiments) should be used at the different levels which involves different actors depending on what their roles are, and which competencies and knowledge areas they bring to the transition process (Grin et al., 2010).

It was clear that the most effective frameworks with the objective of guiding future actions had an overall cyclical process. The strengths of the Alberta framework (Government of Alberta 2008) include the reflective and iterative approach to outcome-setting, planning, monitoring and decision-making. Visioning, planning, implementation and re-evaluation are promoted for continuous improvement to attain goals. The ten steps for transition management framework (Dirven et. al. 2002) translated the transition management stages into several intermediate steps that focus on continuous learning, experimentation, foresight and feedback resulting in a gradual alignment of perspectives and views on sustainable development. Loorbach and Rotmans (2006) identified three governance levels of transitioning (strategic, tactical and operational) that are organised around transition activity clusters: transition arena; transition agenda; transition experiments and evaluating and

learning. Hockings et al. (2006) adopted the adaptive, cyclical process and stressed that evaluation should be seen as a normal part of the management process. Brown et al. (2008) add important visioning and back / forecasting elements to sustainable transition trajectories including capacity development and cultural reform initiatives which are required to deliver the future paradigm of a 'water sensitive city' at the strategic level.

The separate approaches have been combined to give a clearer picture of overall processes required to effect a more sustainable transition for urban water systems. The transition journey will consist of integrating, replacing and transforming complex and dominant socio-technical regimes with next generation urban water systems that will need more adaptive and flexible management approaches. The SWITCH transition framework is designed to guide or influence a city towards these goals through an iterative approach to the process.

7. Outline of the SWITCH Transitioning Framework

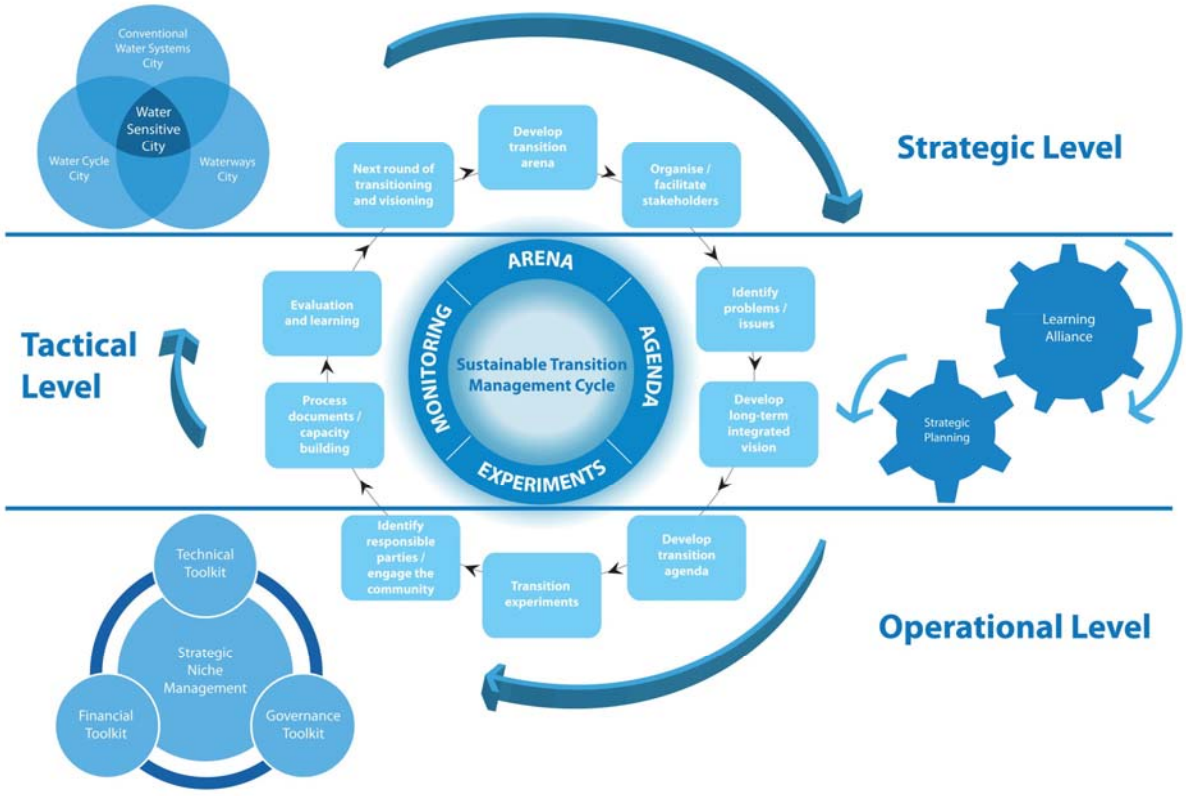


Figure 5. The SWITCH Transitioning Framework

SWITCH Transition Framework Inner Layer

The inner layer of the framework consists of the transition management framework steps and clusters as these closely resemble activities that have taken place within the LA during the SWITCH project. Labelling of the transition management steps have been slightly adapted to better reflect activities and experiences documented from the SWITCH cities but the core concepts remain the same.

- **Develop the transition arena.** This will involve organising permanent support in a multi-stakeholder platform for implementing innovative techniques that apply to the water sector. The arena is the place where ideas for the transition are developed. High level support should be gained as this not only increases credibility but provides motivation for

the process and allocation of budgets. Funding is important for groups to work effectively together and to increase the chances of success. This is not just for the studies, experimentation and scaling up of new ideas, but also for the more mundane tasks of record keeping to ensure that lessons are learned for the next round of transitioning.

- **Organisation and facilitation of stakeholders.** Problems must be defined for the stakeholders through the process of working together and understanding each others' long-term ambitions and aspirations. Key to building an effective LA is the identification of stakeholders, their respective roles, interests and relationships. This was undertaken in SWITCH by an appointed, trained facilitator who immediately carried out a 'stakeholder analysis' which identified those with a stake in urban water management, and although this was primarily focused on the city level, vertical linkages were considered to the national, catchment or local level (SWITCH Briefing Note 2). An understanding of the stakeholders and their concerns in urban water management in required Social Learning techniques are an important aspect at this stage as this enhances the legitimacy of decision making and helps to reduce the risk of disagreement between stakeholders. Involvement of all stakeholders ensures that the particular needs of organisations are defended and negotiations on different goals become possible.
- **Identify water problems and issues.** Before entering into a process of change, a city needs to know its starting point. Without investigations into the problems and issues which have resulted in poorly performing and unsustainable water systems, solutions will not be found. Influences on decision making processes should be identified, together with governance and regulatory issues that act as barriers to resolving issues. This will involve developing a baseline assessment which provides an overview of the current water management situation and identifies key issues which will guide the collection of information that is relevant implementing a strategic planning process. Both quantitative and qualitative data should be collected to generate societal, environmental and technical knowledge. For example: RIDA Analysis which defines: the status of water resources, infrastructure and trends in local water supply and demand; relevant legislation and existing policies; water management activities and institutions; Water stakeholders.
- **Develop a long-term integrated vision.** Transition management does not aim to control the future; it attempts to influence ongoing processes of changes in society by systematically reflecting on the future and developing shared ideas for desired sustainable futures. Transition management anticipates long-term effects and influences through the use of visioning, scenario and trend analysis, and selection of appropriate innovations. The joint vision is not set in stone but should act as a framework for action which can be modified as time progresses. The future will always be uncertain but systematic reflection of what is likely to occur will ensure that flexible and robust strategies can be developed (Loorbach D. 2007, Butterworth, J., Dasilva, C., 2007).
- **Develop the transition agenda.** Flexible and adaptive approaches to transitions are developed through shared agendas and having a range of experiments that stimulate innovations, which might be technological, institutional or socio-economic. These approaches must be constantly questioned and re-evaluated to encourage a combination of 'push and control' strategies with those of 'pull and adapt' depending on where power lies. (Loorbach 2007).
- **Transition experimentation.** Experiments come in all shapes and sizes and by their very nature they open doors on new options. However, there is no guarantee of success so three mechanisms are used to manage transition experiments: deepening learning from transition experiments; broadening experiences by repeating experiments in adjusted formats, and scaling-up and embedding experiments into the existing structures of the current water systems..
- **Identify responsible parties, engage the community and brief the media.** Historical analysis of successful transitions gives insights to the type of champions who have a

significant impact on the dynamics of transition pathways. Often it is innovative individuals and not institutions that have a positive impact on transitioning activities both at the detailed and at a strategic level. These champions are generally powerful actors with strategic capabilities in the business sector, the policy domain, academia or society. The activities of the transition arena should be publicised in order to engage with influential stakeholders and communities outside the alliance to improve scaling up potential.

- **Capacity building / social learning activities and document the process of change.** Process documentation systematically captures what happens in a process of change and how it happened. Good process documentation enables the stakeholders to reflect and analyse why changes happened and to organise and disseminate the findings. This is particularly important after different project phases.
- **Evaluate progress to benefit from 'learning by doing and doing by learning'.** The stage should occur after there a systematic analysis of the previous transition management cycle has taken place. It should be thought of as an approach where investigation and learning take place at the same time. The process is made up of; learning to learn, doing-by-learning (developing empirical knowledge and testing it against the theory), and; learning-by-doing (developing theoretical knowledge and testing it through practical experience). Social learning is central to the transition processes because it focuses on re-framing and changing the perspective of the players in the transitioning process. It also creates variation in terms of multiple pathways and experiments
- **Next round of transitioning and visioning.** Sustainability should be thought of as a journey of discovery rather than a fixed goal that can be worked towards. The quest for sustainable outcomes will generate new knowledge areas as well as identifying gaps where knowledge does not exist. Ways of filling these gaps can be built in to the next round of transitioning and the vision readjusted.

7.2 SWITCH Transition Framework Outer Layer

The framework outer layer is designed to highlight the key activity clusters that the SWITCH cities concentrated on in their attempt to guide the cities towards more sustainable solutions for water systems (Figure 6). The core activities represented in the outer circle deliver all of the activities detailed in the transition management clusters and steps. The combination of the inner and outer layers consolidate, strengthen and validate both the SWITCH Approach which builds on previous research developed in the WASH sector by further developing the LA concept and putting it into in practice for five years with that of the Transition Management approach which is also a developing field of science.

The framework illustrates the continuous sequence of stages or clusters in a circular flow which is intended to represent the reflexive and iterative aspect of the change process. Continuous review ensures that the desired direction continues to reflect changing circumstances and the appraisal of new interventions i.e. re-opening the debate as to what the future sustainable path for a city is - why, for whom and how? (Smith and Stirling, 2008b). This allows adaptations or upgrades to plans or proposed activities and potential adjustments to an already developed transition vision (Loorbach and Rotmans, 2006; Butterworth and Dasilva, 2007).

Visioning strategies at the Strategic Level were a crucial tool for not only bringing the stakeholders together in the arena but encouraged a participatory approach by the Learning Alliance members to debate and plan for a future together. This strategy is represented in the framework as a simplistic version of the Monash visioning tool provided by the Urban Water Management Transition Framework. To use the Monash Framework in its entirety would have complicated the outer layer so it was adapted to better reflect the SWITCH approach

towards IUWM. The concept of the water sensitive city fits well with future water aspirations for a city of the future so it was not thought useful to change a concept that is already understood by many researchers and practitioners in the field. The linear aspect, although a powerful methodology that enables water practitioners to visualise a stepped approach to the end goal was thought too restrictive to use for a global framework that needed to consider transitioning trajectories for all cultural and geographic norms including developing nations that were unlikely to follow a linear path.

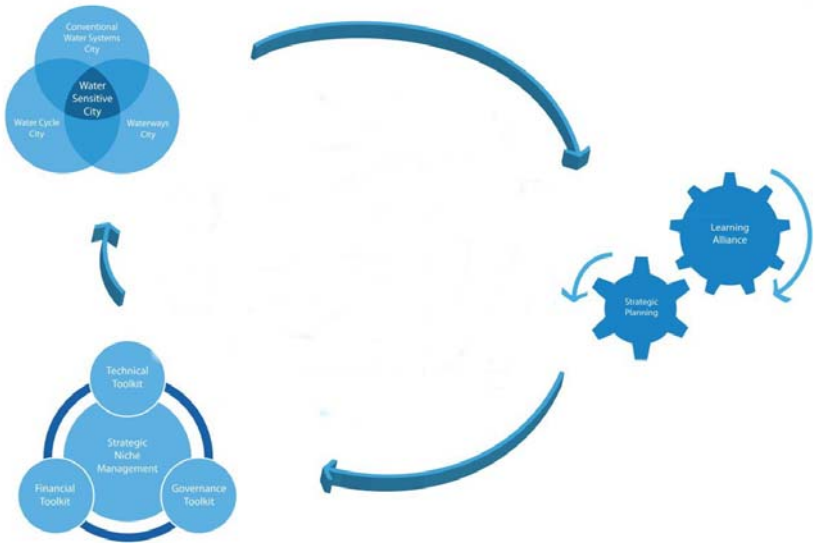


Figure 6 SWITCH Transition Framework Outer Layer

The Learning Alliance and Strategic Planning approaches are intrinsically linked as they are the core driving mechanisms for implementing strategies to deliver the vision. Although the LA also operate outside the Tactical Level of transition management, this is the level where the transition agenda or strategic plans are developed therefore the LA is depicted in the framework driving the strategic planning process as the one activity cannot exist without the other when attempting to transform urban water systems towards sustainability in a city.

Strategic Niche Management (SNM) provides the scope and pathways for a transition to occur. They expose the stakeholders to the possibilities that new technologies can offer for solutions to persistent problems. New technologies are often developed and refined over the course of many years and it is this aspect that is referred to as reflexive governance by Grin et el (2010): modulating 'hopeful monstrosities' towards more sustainable directions. The SNM approach facilitates the creation and nurturing of innovative niches which are protected spaces for new technologies, ideas, concepts and legislation (Loorbach 2007). The SWITCH demand led science such as the City Water Tool, and City Water Economics and demonstration projects such as the Blue Green Network concept in Lodz and Reuse of Urine and Treatment of Waste Water for Urban Agriculture in Accra are the result of applying the SNM approach and niche development by the city LA. The results of this research is categorised into three key knowledge areas which are represented as tools for transitioning. The knowledge areas were identified at project inception as the areas where most knowledge gaps existed for transitioning water systems to the city of the future and they include: technical; financial; and governance issues. The tools provide a means of knowledge transfer to water managers and practitioners that will increase efficiency and cost effectiveness when evaluating the potential uptake of innovative techniques.

Visioning Processes

Visioning and scenario planning for sustainable pathways is an extremely important part of the transitioning process. It is not an easy process and is often the beginning of the transition journey. Decision makers require a clear vision for future objectives to deliver sustainable urban water management systems through the development and implementation of strategies and plans. Visioning promotes stakeholder dialogue as it provides stakeholders with an opportunity to exchange and debate opinions and aspirations for future water services and the urban environment. Visioning processes are empowering, inclusive and highly participatory. Visioning helps stakeholders to think beyond the day-today reality of problem solving, and to imagine an achievable medium to long-term future for which they can plan at the community level and the city level. A vision must be realistic and achievable. In summary, visioning helps: to: encourage constructive discussion and understanding amongst a diverse group of stakeholders; promote active involvement of stakeholders in developing and implementing water management strategies and plans; provide a target or benchmark against which the success or failure of the strategies and plans can be monitored; stakeholders look forward rather than be bogged down in current problems; a statement of intent that can attract the attention and enthusiastic support of the media and the general public.

As already discussed, Monash University has developed the powerful visioning tool that can be used by stakeholders in the transition arena at the strategic level - the conceptual Urban Water Management Transition Framework (Brown, Keath and Wong 2008). When planning for a sustainable future, stakeholders need to know where they want to arrive at in order to plan the pathway to get there and this framework provides a benchmark or reference point that shows stakeholders where their starting point is and where (potentially) they can go. The framework proposes attributes that would enable more sustainable city phases along the transition pathway (Brown et al., 2008; Ison et al., 2009).

The first three phases described in the framework (water supply, sewered and drained cities) identify attributes that are considered typical of the evolutionary socio-technological changes within urban water management practices over the last 200 years in Australia. The water supply city underpins the first type of formal ‘hydro-social contract’ that satisfied the need for a safe and secure water supply usually through the extraction of large water supply schemes and incorporating centralised infrastructures to service expanding populations. The sewered city underpins the ‘contract’ that satisfied the need for public health protection through delivery of sewerage services which directed waste flows to receiving watercourses. The drained city phase underpins the ‘contract’ that satisfied a need for flood protection services through stormwater conveyance to watercourses in order to facilitate urban expansion.

Attributes assigned to the waterways city, are considered to be indicative of the current urban water management phase for many cities that are moving towards more sustainable options. This ‘contract’ moves away from previous phases which did not consider environmental impacts. Water planning functions are becoming more important as the desire for visual and recreational features are embedded into service requirements. This is resulting in regulation of polluted discharges through innovative technologies that protect receiving watercourses.

Attributes assigned to the water cycle city are mainly at the academic and rhetoric levels; they reflect the need for social, economic and environmentally sustainable approaches which apply an integrated concept to management of the whole urban water cycle. Attributes assigned to the water sensitive city are based on contemporary futurist research which highlights that the ‘hydro-social contract’ would be significantly different from that underpinning conventional urban water management approaches indicating that a major socio-technical overhaul is required. Technologies, infrastructure and urban landscapes would appreciate the links between society and technology resulting in engaged communities and practitioners that were supportive of sustainable lifestyles.

The sign that many cities are shifting towards the waterways city scenario as they adopt urban water management practices that offer more sustainable solutions, indicates that a transition take-off phase may be underway. There is no example of a water sensitive city but there are cities around the world that are leading the way with approaches that resemble the water sensitive city phase.

The Leapfrogging Concept

The leapfrogging concept is an important issue that was raised at the SWITCH led Global City Water 'Futures' Summit in Delft 2009. This concept has primarily been applied to developing countries and newly developing cities. 'Leapfrogging' is the idea that developing cities could find new paths to growing their water infrastructure that are considerably more sustainable than those found in developed cities. The intermediate steps that have shaped the developed world may thus be avoided. By implementing new technologies and innovation the mistakes and limitations of the slow and cost intensive route to embedding water infrastructure networks can be bypassed. This slow route has resulted in the existing incumbent regimes and all their associated problems, not least their inherent unsustainability in the long-term. Experimenting with innovations is the cornerstone of leapfrogging - not just identifying new technologies but finding new ways to apply existing ideas.

However, there is no reason why developed nations should not to attempt to "leapfrog" also. Why should it not be possible to operate "parallel" systems whereby infrastructure may be replaced by new generation systems once it had reached obsolescence instead of undertaking expensive conventional retrofit solutions?

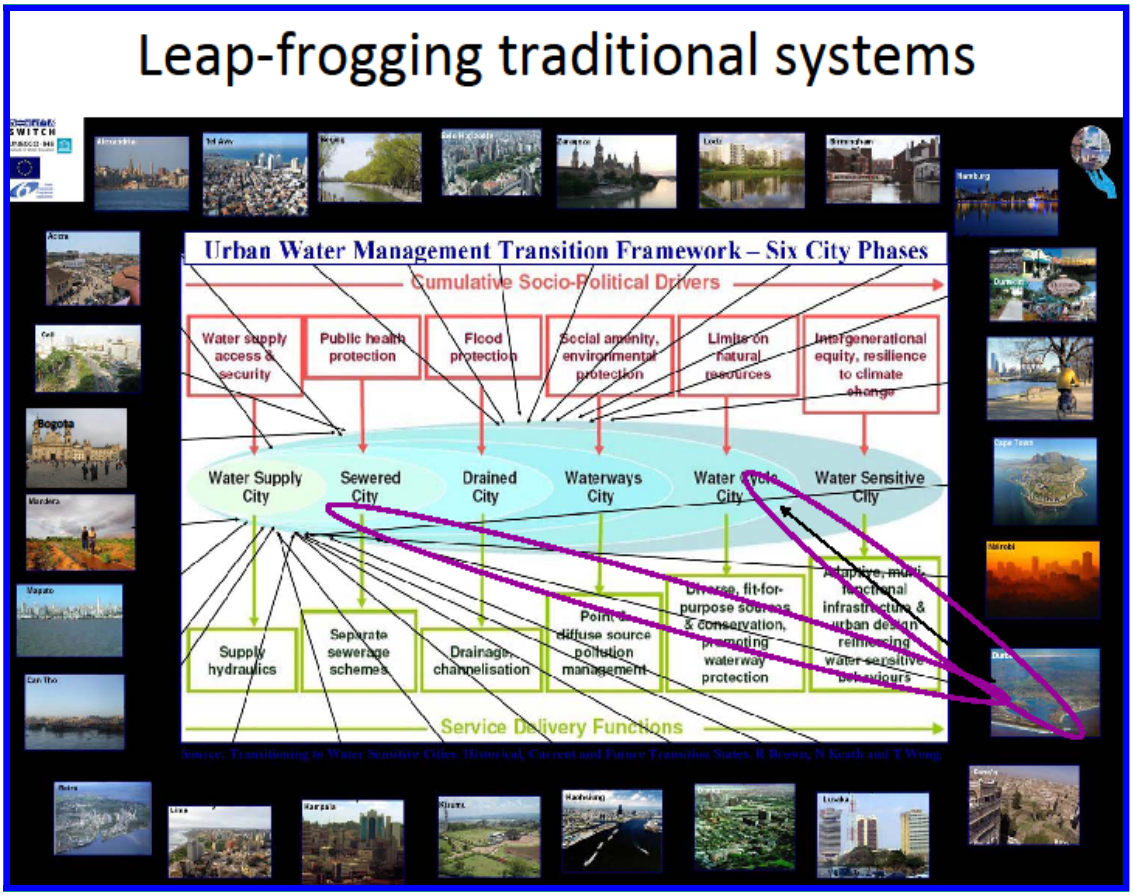


Figure 7 Benchmarking developing and developed cities in the UWM transition framework and illustrating the leapfrog concept. Image courtesy of Carol Howe – SWITCH Project Manager

Conventional Water System City

The urban water management transition framework was used to benchmark the developing and developed cities that attended the Global Water Futures Summit (Figure 7). The benchmarking process was based on city water profiles that had been provided to the summit organisers. The cities were placed within the framework depending on the water service provision that was available at the time of the Summit. An example of the rationale behind the benchmarking process: it was felt that a city that provided 80% water supply services but only 35% sanitation services and 50% drainage services could not in reality be benchmarked at the drained city phase, this city would be benchmarked in between the water supply and sewered city phase.

It became clear that a linear, conventional approach to urban water management is not the path that many developing cities are following as implementation of innovative and adaptive solutions is already underway. The starting point for moving away from the conventional phased progression of water service provision could be from any one of the advocated water supply, sanitation and drainage city phases i.e. many developing cities are already 'leapfrogging' the conventional approach to water management by adopting innovations that move their city in a more sustainable transitional trajectory.

From a conceptual perspective this emerging reality does not entirely agree with the Monash Urban Water Management Transition Framework. However, it must be remembered that the first three phases of this framework were developed from analysis of mature (technologically locked-in) urban water systems that have been evolving for two centuries in developed countries. Developing cities are attempting to follow this pre-defined path, however with the development of new innovations they are discovering smarter ways of service delivery that are more holistic, cost effective, adaptive, flexible and sustainable. Based on this finding the first three city phases have been combined and named the 'Conventional Water System City' phase in order for the SWITCH Transition Framework to be applicable to a global audience.

The SWITCH Visioning Approach

Based on analysis of feedback from the SWITCH Global Water Summit, the Monash UWM Transition Framework was adapted in order to illustrate a visioning concept in the outer layer of the SWITCH Transition Framework which better reflects current global urban water management practices as a starting point for a sustainable transition trajectory. By using the Water Sensitive City as a central theme or objective, equal focus is now assigned to the 'conventional water systems city' phase (which will always include water system services provision to varying degrees) and the Waterways and Water Cycle City phases (Figure 8).

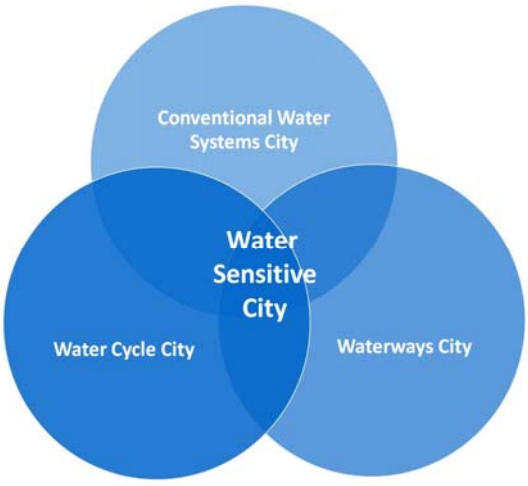


Figure 8 The SWITCH Integrated Visioning Approach

In addition and in light of existing and future local and global pressures, it is felt that even developed cities will not continue to follow the linear water service delivery pathway but will strive to incorporate attributes assigned to both the waterways and water cycle city phases as they attempt to transition towards a water sensitive city phase. This approach also highlights the participatory and integrative activities required between stakeholders and activities to reach a sustainable goal for urban water systems.

The Learning Alliances and Strategic Planning

Learning Alliances

The idea of LA has recently emerged in the water sanitation and hygiene (WASH) sector, especially in agro-enterprise development in response to the widespread failure of much conventional research to have significant impact. *The LA build the structures required to bring stakeholders together to analyse and address problems, face the challenges of mismatched expectations and interests, and jointly learn how to find solutions. They also aim to bridge the gap between people on the ground, organisations at district or provincial level with responsibility for service provision and support and national policy makers* (Smits et al (eds)). It is also in response to recognition that new products and processes are brought into use, not just by the activities of researchers, but through the activities of a number of widely different actors and organizations. This group of interconnected players typically includes public sector (e.g. line ministries, utilities, regulators, educators, research institutes), private sector (e.g. industry, financial services), and civil society players (e.g. NGOs, media, professional bodies and unions, advocacy organizations) (SWITCH Briefing Note 1: An introduction to Learning Alliances).

Figure 9 The Learning Alliance and Strategic Planning Relationship

In SWITCH, the LA is a stakeholder platform that attempts to bridge the gap between science and urban water practitioners. The LA introduce new ideas, techniques and innovations to a city – they are the Transition Arena driving the transition process through implementation of a transition agenda which promotes transition experimentation. The LA should aim to operate at national, city and local levels, enabling it to organise the essential components required to begin or sustain a transition journey if the city is already moving forwards with an IUWM agenda. The LA commissioned projects should demonstrate to other decision makers the positive impacts of the technology or methodology being promoted.

The defining characteristic of the SWITCH project is that its research findings and insights will influence practice and policy. SWITCH believed that the LA process could maximizes the potential for impact on practice and policy. The LA process attempted to create effective multi-way knowledge transfer to ensure that knowledge could be targeted to appropriate user groups to develop water sector focused policy. In addition the LA process attempted to ensure that broad information was provided for other user groups to ensure connectivity between associated policy development areas. SWITCH outputs from several cities transition agenda's are poised to contribute to policy development at some level if formalised.

As the SWITCH project progressed it was found that the LA in many cities had managed to bridge the gap between researchers and practitioners. Many researchers were clear that without a LA it would be very difficult to engage the important players within a city with a view to getting their research into practice (Sutherland and Darteh, 2008).

Strategic Planning

Two key outputs of the SWITCH LA were to develop and implement a transition agenda that would guide a city towards sustainable outcomes for water systems and services. To this end the processes involved in developing a strategic plan are intrinsically linked to the transition arena; the LA drives or engages the strategic plan and delivering a sustainable strategic plan is integral to the activities and ultimate success of the LA (Figure 9).

The strategic planning process for IUWM is a planning process with a long-term strategy at its core. A strategic planning process provides the framework that encourages the shift in existing water management practices, technologies and governance that IUWM requires: It gives stakeholders the motive and the mechanisms for making the desired changes. The process consists of the development and implementation of a flexible strategy that holistically considers all areas of the urban water cycle as well as other urban management sectors. It facilitates the optimisation of the entire urban water system and the selection of solutions that are more viable in an uncertain future. A strategic planning process typically consists of a number of steps, the outcomes from which are reviewed on a regular basis.

Different perspectives such as cultural aspects, values, motives and perceptions must be considered when developing a strategic plan. Agreement on collective issues and goals will only be reached when there is agreement on the diverse perspectives for an integrated approach. This should not be seen as a consensus on all values, norms and beliefs, but an agreement that the issues are a shared problem and that there is a need to act upon the problem(s). Problem structuring is an intrinsic and crucial element when developing policies and strategies in the transition arena to move a transition forward.

Strategic Niche Management and Tools for Transitioning

Strategic niche management (SNM) is an important if not vital part of the transitioning process as it provides the scope and pathways for a transition to occur. Many types of socio-technical transitions are as a result of niche development (Loorbach, 2007). SNM is the creation of technological niches where stakeholders such as representatives in a LA provide a protected space for experiments such as environmentally sound practices. These will be aligned with future visions so that they may develop and mature with the result that the innovation may become embedded into the existing regime.

Strategic Niche management requires the nurturing of technological innovations by the SWITCH LA. The concept of a niche has its origins in ecology but the idea is relevant in many complex systems. In ecology it is; 'The role an organism plays within the structure and functions of an ecosystem, and the way it interacts with other living things and with its physical environment' (www.nelson.com/).

The niche might be a process, a piece of equipment or an innovation which plays a role in the overall system. Many demonstrations were developed in the SWITCH project and it is

important to see what lessons were learned in changing the management of water systems in the cities. The purpose of a demonstration is to show how an experiment will work throughout the city. A demonstration might take a number of forms, each one capable of bringing something new to the city.

SWITCH Tools for Transitioning

The 'tools for transitioning' are primarily based on outputs from the wide ranging research that was developed and the demonstrations that were implemented during the SWITCH project. The tools provide a diverse range of best practice 'tools' that support and facilitate the implementation of the transition process based on state of the art practices and methodologies that have been tailored specifically for the water and urban planning sectors. They focus on three key knowledge areas: technical; financial; governance / institutions and provide an easier means of knowledge transfer to managers and practitioners whilst also increasing efficiency and cost effectiveness for the uptake of innovative techniques. They provide insights and direction for decision making processes to integrating novel techniques with existing systems and practices along the transition journey. The application of the strategic niche management concept through SWITCH science and demonstrations has facilitated the development of the tools for implementing and managing a transition in the urban water cycle. The key knowledge areas are shown overlapping with the SNM concept to illustrate the contribution that they make to delivering transition pathways (Figure 10**)**.

The toolkits primarily consist of SWITCH science and city demonstration research outputs which are the result of niche development within the cities and are focused in three key knowledge areas. The toolkits provide a means of knowledge transfer to water managers and practitioners that will increase efficiency and cost effectiveness when evaluating the potential uptake of innovative techniques.

- Technical transitioning tools include wide ranging water sector focused technological methodologies that have been developed such as: CWIS, the combined water and information system; SUDSloc – a BMP decision support tool.
- Financial transitioning tools include useful techniques to evaluate different new generation systems as applied to water networks such as the City Water Economics model and the Economics of Rainwater Harvesting tool.
- Governance transitioning tools include the SASIW tool which is designed to lead conflict resolution for marginalised communities where their activities impact on marginalised communities.

Figure 10 Strategic Niche Management and Tools for Transitioning

8. Next Steps

Following the development of the SWITCH transition framework from the SWITCH Approach, four SWITCH cities were chosen to find out how they have historically transitioned their urban water systems to current status and how they have attempted to transition urban water management practices during the SWITCH project and whether this was influenced by the SWITCH Approach or not. Progress within the case study cities during the project has highlighted transitioning strengths according to the transition management cycle which were assessed to provide examples that indicated the barriers and opportunities that existed which enabled or blocked the uptake of practices and methodologies that is assisting the city to switch towards their sustainable vision.

Historical, Current and Future's Analysis of Water Services Delivery

The transition case study for each city is split into three research phases (Petri et al, 2005, Brown et al, 2008). Phase one involved reconstructing historical urban water management transition pathways for each city. This phase analyses the development of urban water services from early 20th century to the beginning of the 21st century. The second phase involved analysing progress within a city as it attempts to move towards more sustainable practices in urban water management from 2000 to 2010. This phase is designed to analyse the transitioning impact of the SWITCH Approach which commenced in 2005 and is considered a relatively short time-scale from a transitioning perspective. Phase three involved 'future's' research which projects one or several trajectory paths that a city could take towards delivering more sustainable urban water management practices for the city of the future. This phase is not about predicting the future.

The purpose of futures research is to map out a range of possibilities to achieve sustainable outcomes and help cities become smarter. Scenarios show where a future intervention may assist in achieving goals i.e. how to potentially shape the future by providing a pathway to the possibilities and encouraging a change in thinking.

Transitioning Management Strengths developed during SWITCH

Transition management strengths for the four cities are highlighted in Figure 11. It must be remembered that this was only a five year project and the transitioning strengths gained during this timescale surpassed expectations in most cases. Accra gained the most from LA activities during the project, although an integrated urban water management trajectory is yet to be realised. This was primarily due to the way in which activities in the transition arena were embraced by the stakeholders and the facilitation capabilities provided. Alexandria had many delays in setting up the arena and implementing experiments. This made it difficult for the members in the arena to realise transitioning strength potential in the timescale available. However a trajectory towards IUWM solutions has potentially been developed. Belo Horizonte has '*always been a city of the future*' and has had an environmental trajectory which focuses on integrated catchment planning as a strategy for delivering IUWM since the 1990's. To this end the LA were able to build on existing opportunities to move this agenda forward. An institutionalised arena has been developed with the addition of key stakeholders who have helped strengthen a transition research agenda. Skills were not developed for evaluation and learning during SWITCH which is an important part of the transition management cycle. Lodz also had an existing research trajectory with its sights set on IUWM. SWITCH introduced a package of measures that assisted in developing transitioning strengths which resulted in breaking down barriers by forming an LA that was capable of putting this agenda firmly into the institutional and public domain.

An interesting observation is that transition trajectories are being driven more by a top down approach in Accra and Alexandria and a more bottom up approach in Belo Horizonte and Lodz.

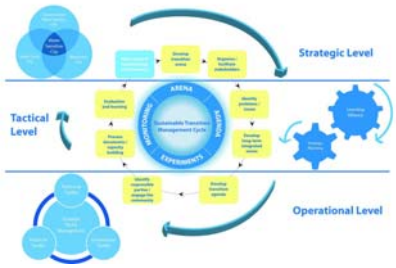
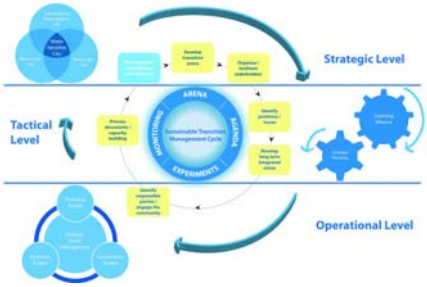
<table>
<tr><th>Accra Transitioning Strengths</th><th>Alexandria Transitioning Strengths</th></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>✓ Transition arena developed.
✓ Key organisations and water issues identified
✓ Improving service delivery vision, scenarios and transition agenda developed. Strategies identified to improve water supply and sanitation services
✓ Responsible parties / stakeholders identified and media briefings to facilitate the vision and implement strategies
✓ Process documentation, evaluation methodologies and capacity building programme developed to facilitate transitioning process
NEXT round of transitioning should focus on further experimentation with innovations</td><td>✓ Key organisations and water issues clarified and documented
✓ IUWM vision agreed with two further detailed visions for water supply and sanitation. Scenarios developed.
✓ Process documentation developed, responsible parties identified and media briefings to raise stakeholder and public awareness
NEXT round of transitioning
✓ Finalising and delivering the transition agenda
✓ Implementation of transition experiments
✓ Develop monitoring and evaluation methodologies</td></tr>
<tr><th>Belo Horizonte Transitioning Strengths</th><th>Lodz Transitioning Strengths</th></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>✓ Vision developed with a strong focus on IUWM
✓ Strong IUWM transition research agenda
✓ Responsible parties / stakeholders identified.
✓ Strong media engagement encouraging ownership of innovative methodologies implemented
✓ Process documentation and capacity building programme strengthened.
NEXT round of transitioning
✓ Continue up-scaling innovations across the city and other municipalities.
✓ Develop evaluation and learning methodologies</td><td>✓ Transition arena strengthened with key players
✓ Strong vision and IUWM transition research agenda
✓ Transition agenda almost complete
✓ Responsible parties / stakeholders identified and media briefings to go forward with the vision
✓ Process documentation, capacity building, evaluation and learning programmes strengthened
NEXT round of transitioning
✓ Sustain up-scaling innovations across all rivers
✓ Complete IUWRM transition agenda</td></tr>
</table>

Figure 11 Case Study Cities Transitioning Strengths gained during the SWITCH Project.

The Transition Curve

A significant movement along the Transition Curve during the SWITCH project was evident in all cities Figure 12. Accra is posed to move into the take-off phase if the transition momentum instigated by SWITCH is sustained. Alexandria is technologically locked-in with culturally dominant stable infrastructures operated and managed by stakeholders who are resistant to change. However stakeholders in the Alexandria City LA have begun to realise just how unsustainable the water systems are in light of additional pressures that the city may be exposed to. The initiation of integrated strategies in Alexandria combined with a commitment to niche development through the proposed demonstrations is evidence of a change in mindset towards more sustainable solutions. Both Accra and Alexandria have

greatly benefitted from the transition strengths that they have gained during the project. The results of these processes has lead to clearer understanding of the issues (and costs related to these issues), barriers and constraints that they face as individual organisations and those which other stakeholders face as they attempt to improve their city for the future together; they are beginning to realise that together they can make a difference and reach the desired goal (a change in mindset is happening). Belo Horizonte and Lodz already had several strong transitioning strengths to build on and continue transitioning trajectories during the SWITCH project. Sustaining momentum is the biggest challenge for both cities.

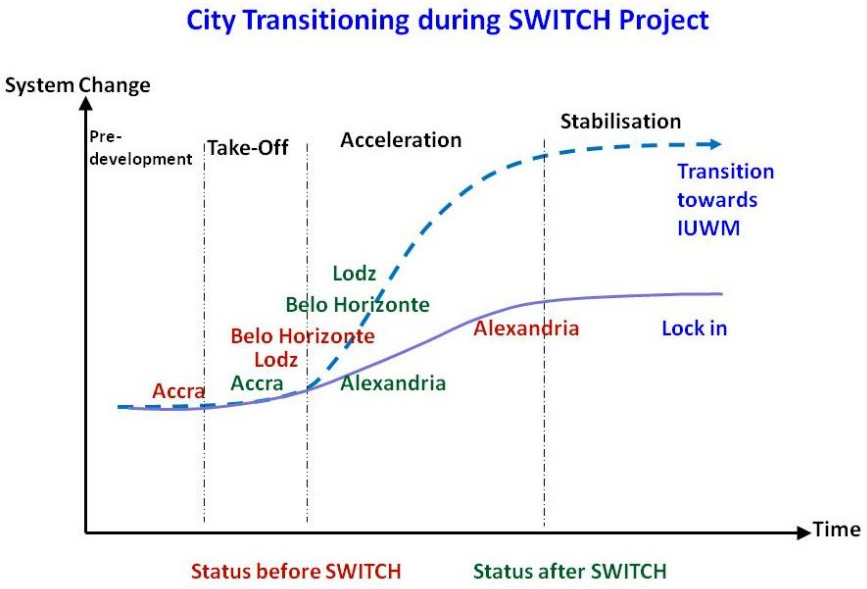


Figure 12 Movement of SWITCH cities along the 'transition curve'

9. Conclusion

The SWITCH transition framework is the result of analysing transition management concepts and consolidating key processes with the SWITCH approach in order to better guide a SWITCH in cities towards sustainable urban water management practices. The transition manual shows how to implement the framework and includes examples from SWITCH cities where 'SWITCHING' or transitioning techniques to sustainable urban water management practices is successfully being applied. Transitions are structural changes that are usually long term processes that occur due to the co-evolution of several societal, economical and technological processes. The SWITCH transition framework is not meant to be a deterministic tool in that it can predict the course of a transition. This is not possible when there are many so many fundamental uncertainties surrounding not just transitioning but the concept of sustainability. The manual provides an overview of the underlying driving forces and mechanisms behind the processes and actions that may guide or influence change. The SWITCH project has been a short-term global socio-technical transition experiment. It has attempted to guide and even accelerate the co-evolutionary and participatory processes required to move the cities towards transitioning their urban water planning and operational practices in a very short timescale in transitioning terms. There are very positive results from the cities which have embraced the LA approach; this is testimony that the potential to influence a change towards more sustainable outcomes through transitioning principles is possible and that the LA is a successful vehicle for facilitating an urban water paradigm shift. Using the SWITCH LA approach as a practical example of applying the transition management cycle and strategic niche management concepts, the manual can be used to focus any city, despite its location or cultural norms, on sustainable transition end goals. The manual should help to identify and analyse transition strengths and weaknesses in a city that is attempting to manage its urban water systems in a better way. When using the manual, gaps may be identified by a city and strategies developed that address the issues during the next round of transitioning.

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11. Transition Framework Websites / Links

KSI is the Dutch Knowledge network on System Innovations where many researchers are working together to understand, identify and influence the process of transitions to a sustainable society.

http://www.ksinetwork.nl

The National Urban Water Governance Programme. Monash University. This is a social research programme aimed at facilitating progress towards water sensitive cities in Australia.

http://www.urbanwatergovernance.com/publications.html

Science at the Shine Dome. An annual 3 day event held by the Australian Academy of Science. In 2002 the public symposium covered the environmental, economic and social aspects of sustainability.

http://www.science.org.au/events/sats/sats2002/symposium.htm

NeWater. studied and fostered Adaptive Integrated Water Resources Management as a concept guiding theory and practice. A guiding principle in NeWater was co-developing and co-applying knowledge and tools with stakeholders and scientists.

http://www.newater.info/

INECO. The aim of INECO is to establish a Mediterranean network of research institutes, public authorities and stakeholders for coordinating research, and to analyse decision making practices regarding the application of institutional instruments in the water sector.

http://environ.chemeng.ntua.gr/ineco/Default.aspx?t=10

Urban Water. The vision of Urban Water was to develop a holistic and generally systemic approach for sustainable water management in urban areas. The partners worked together on solutions to integrate spatial planning and water management.

http://www.urban-water.org/cms/

AQUASTRESS. A project delivering interdisciplinary methodologies enabling actors at different levels of involvement and at different stages of the planning process to mitigate water stress problems. The project draws on both academic and practitioner skills to generate knowledge in technological, operational management, policy, socio-economic, and environmental domains.

http://www.aquastress.net/

MATISSE aimed to achieve a step-wise advance in the science and application of Integrated Sustainability Assessment (ISA) of EU policies. The core activity of the project was to improve the tools available for conducting Integrated Sustainability Assessments.

http://www.matisse-project.net/projectcomm/

Appendix A

Developing a Framework to guide Urban Water Systems Transitions - Frameworks Examined

Contents

1. The Water Framework Directive.

Directive 2000/60/EC

The Water Framework Directive established an analytical framework for sustainably managing the protection and enhancement of all water bodies in EC member countries. It consolidated previously fragmented Directives that managed the water environment (Spiller et al 2007; Directive 2000/60/EC) and also introduced public participation as key to successful policy implementation (Article 14).

The Directive is a prescribed list of strategic actions that must be undertaken in planning cycles by members to deliver water body status reports and implement monitoring and remediation programmes to restore water bodies to good status as set out to standards outlined in the Directive.

'*The Directive requires that all surface waters and groundwaters within defined river basin districts must reach at least 'good' status by 2015. It will do this for each river basin district by:*

- *Defining what is meant by 'good' status by setting environmental quality objectives for surface waters and groundwaters.*
- *Identifying in detail the characteristics of the river basin district, including the environmental impact of human activity.*
- *Assessing the present water quality in the river basin district.*
- *Undertaking an analysis of the significant water quality management issues.*
- *Identify pollution control measures required to achieve environmental objectives.*
- *Consulting with interested parties about the pollution control measures, the costs involved and the benefits arising.*
- *Implementing the agreed control measures, monitoring the improvements in water quality and reviewing progress and revising water management plans to achieve the quality objectives'.*

As a framework, the Directive is easy to follow, however it has not proven so easy to implement within the timelines given. There are several criticisms that primarily relate to a general lack of clarity with the policy statements which led to uncertainty and an initial resistance to adoption at the strategic level (Spiller, 2009; McIntosh et. al. 2009). However, the Water Framework Directive is now acting as a legislative stimulus for instigating change in the area of water governance with its demands for integrated approaches and technical and managerial innovation.

For the purpose of this review, the framework received a score of 9 out of 12. The framework does not propose any mechanisms for financing actions that must be taken, nor does it recommend a systemic approach to achieving objectives.

2. A Framework for systems analysis for sustainable urban water management.

Hellstrom , Jepsson & Karrman (2000).

The Swedish National Research Programme 'Sustainable Urban Water Management' developed a framework for systems analysis of sustainable urban water management. The aim was to provide knowledge of how sustainable development should be attained and how the sustainability of various technical systems should be assessed in order to deal with the increasing demand for sustainable development. This would have a profound impact on all types of urban infrastructures especially urban water systems. A set of sustainability criteria covering health and hygiene, social and cultural aspects, environmental aspects, economy and technical considerations were developed.

The framework involves applying multi-dimension criteria and the concept of separating the entire system into modular blocks made up of model cities, system structures and scenarios that can be combined in any fashion to allow for a wide range of different management systems to be analysed and compared when exposed to different situations. Scenarios represent influencing factors on a system structure over time i.e. water shortage, energy shortage, environmental and behavioural changes, and availability of economic resources. If an analysis shows poor results with regard to the sustainability criteria set for a given situation at the initial investigation stage then there is no need to continue the investigation.

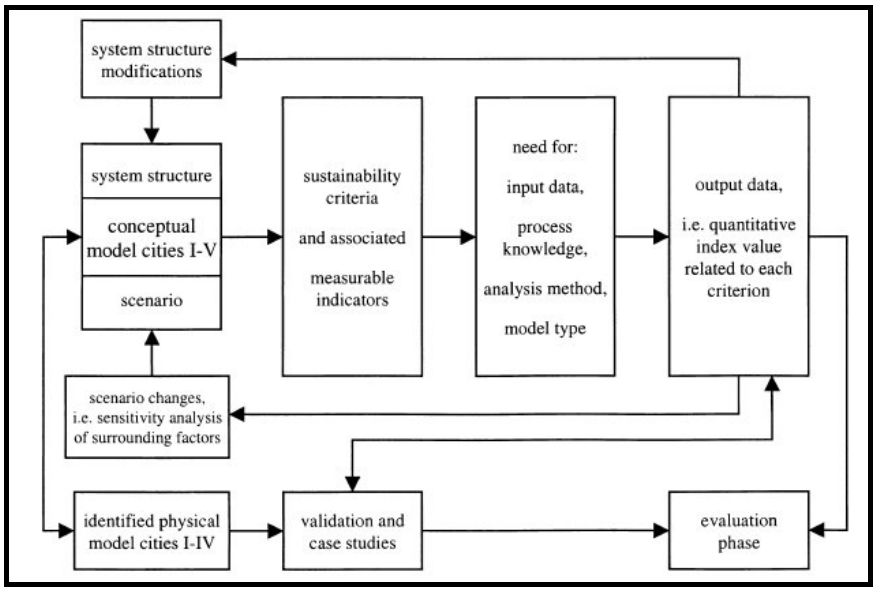

Figure 1. Framework for systems analysis of sustainable urban water management.

For the purpose of this review, this framework received a score of 11 out of 12. The framework does not evaluate governance / cultural issues – in fact the authors recognise that there is a need for further work in this area whereby methods for evaluating social-cultural criteria need to be developed.

3. Receptivity Framework.

Sustainable Urban Stormwater Management in Australia: Professional Perceptions on Institutional Drivers and Barriers. Brown R. and Farrelly M. 11ICUD.

The concept of *receptivity*, as developed in 'innovation and technology transfer policy' studies by Jeffrey and Seaton (2003/2004), was applied by Monash University as the analytical framework for assessing the professional community's readiness to improve urban stormwater quality management practices in three Australian cities. The results were obtained by using an online survey which was designed to foster an understanding of what drives and limits the adoption of new technologies. Receptivity philosophy uses the principle that for the uptake of new technologies, the approach must be designed from the end-user or recipient's point of view. The receptivity assessment concept is useful in that it assists with indicating policy mechanisms that are required to improve practice. Receptivity comprises four key attributes that policy makers and strategists should take into account that considers the recipient's perspective;

1) **Awareness** - individual/organisation is aware of problem and need for a solution.

2) **Association** - potential benefits are recognised to expend effort to apply solution.

3) **Acquisition** –skills, capacities and support are available to implement a solution.

4) **Application** - incentives are available to encourage implementation of a solution.

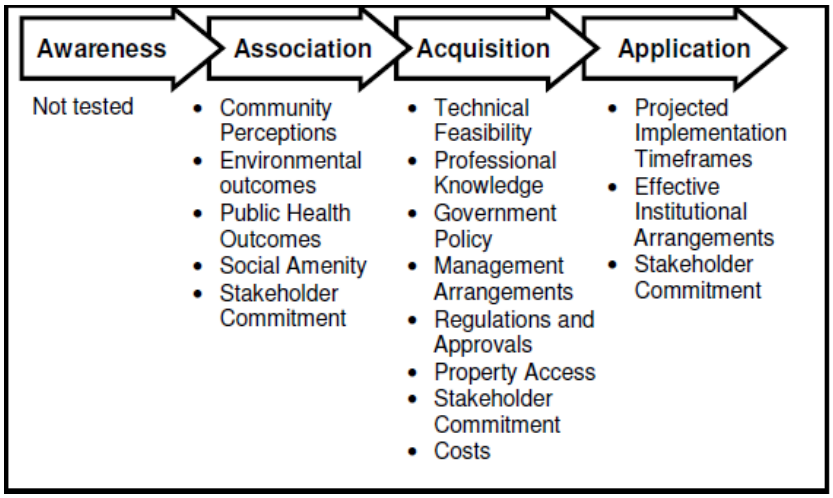

Figure 2. Receptivity Framework

For the purpose of this review, this framework received a score of 7 out of 12. The framework is a basic list of variables that should be considered to improve the uptake of sustainable practices amongst the water professional community for improving the quality of receiving watercourses. There is mention of WSUD and the need for stakeholder relationships in the introduction however the framework itself focuses on the socio-institutional barriers and drivers to the uptake of innovation only. Actions such as reflexivity as a learning process in order to adapt approaches or the systemic analysis of water infrastructure are not considered in this research.

4. LIUDD Capacity Building Framework.

Challenging the norm: The capacity of local government to implement 'low impact' design practices. V.R.Heslop, and J.E.Dixon. 11ICUD.

A conceptual capacity building framework has been developed at the University of Auckland to support and facilitate change with particular focus on local government. The framework provides guidance for the implementation of low impact urban design and development (LIUDD) which is a concept that aims to improve and manage water quality and quantity more effectively through sustainable urban management of natural and physical resources, research and the active participation of stakeholders. The framework is based on five inter-related spheres:

1. **Human resource capacity.** Individuals involved in the process of implementing

LIUDD will require specific knowledge relating to the design approach, the technological aspects of devices, policy tools and integration, and economic analysis of conventional practices versus LIUDD.

2. **Intra-organisational capacity**. A common barrier to integration is the 'silo' mentality where individuals or groups within an organisation solely focus on their tasks and do not integrate with others internally.

4. **Inter-governmental capacity**. Development of networks between councils facilitates the exchange of information amongst local government.

5. **External rules and incentives.** Legal and policy changes will be required within local, regional and central government to promote the implementation of LIUDD.

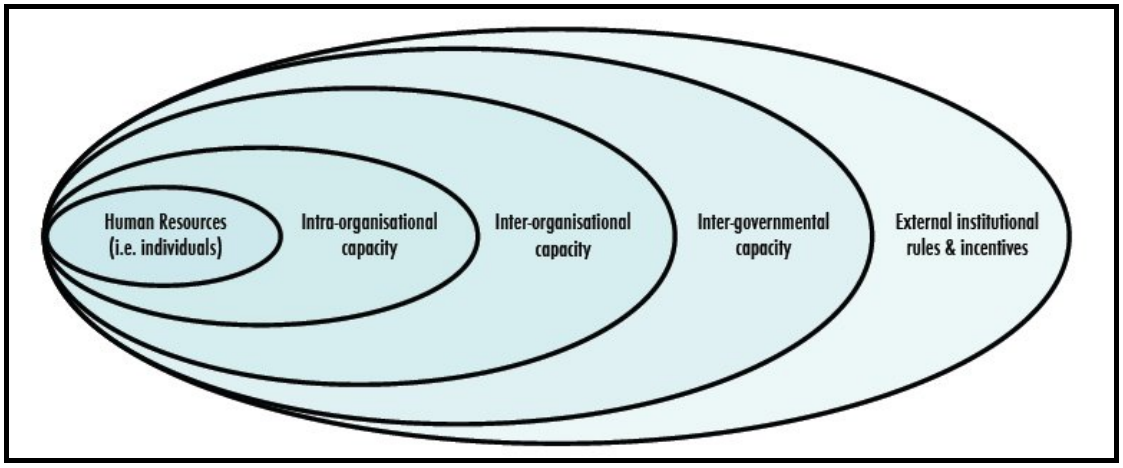

Figure 3. LIUDD Capacity Building Framework

For the purpose of this review, this framework received a score of 10 out of 12. The framework focuses mainly on policy development and capacity building to influence change and overcome barriers to the uptake of more innovative approaches. A systemic approach for achieving objectives or reflections on progress and new interventions to allow for adjustments to future actions is not considered in this research.

5. Framework for assessing infrastructure systems.

Developing sustainability criteria for urban infrastructure systems. Sahely, HR., Kennedy, C.A., Adams, B.J. Can. J. Civ. Eng. 32: 72–85 (2005).

This framework for assessing infrastructure systems is a generic framework put forward by the University of Toronto to help define the infrastructure system and understand its interaction with environmental, economic, and social systems. When examining infrastructure systems, it is important to consider service provision efficiency per unit of physical resource input and dollar input. It is essential to consider the feedback mechanisms inherent in the framework because they have important sustainability implications, both environmental and socio-economic.

Adopting a systems approach and considering the urban water system as a whole offer many advantages for decision makers. It can be seen how changes to one part of the system can have various system-wide impacts.

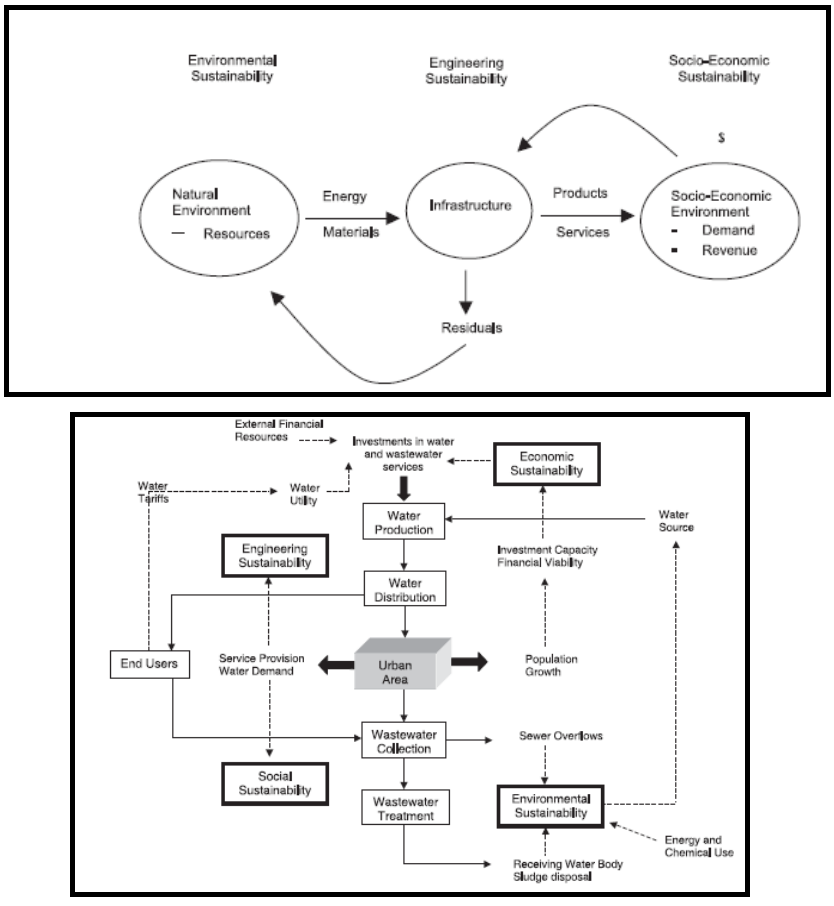

Figure 4. Framework for assessing water systems (top) and an example of its application (bottom). Adapted from Soares and Bernardes 2003)

Solid lines represent water flows, and broken lines represent relevance to sustainability

For the purpose of this review, this framework received a score of 10 out of 12. The framework does not encourage system innovation directly.

6. The Australian Integrated Resources Planning Framework.

Guide to Demand Management July 2008. Water Services Association of Australia. ISBN: 1 920760 26 1

'*Planning water resources and services is a complex task involving multiple (and often conflicting) objectives, stakeholders, options, risks and uncertainties'.* The Water Services Association of Australia has developed a structured, systematic and iterative approach to decision-making. Key principles that apply in practice in the Australian context are derived from the characteristics of Integrated Resource Planning: Planning Orientation (resource options, resource ownership and control, scope of planning, assessment criteria, resource selection); Planning Process (nature of the process, judgement and preferences, conflict management, stakeholders and their roles); Planning Issues (support reliability, environmental quality, cost considerations, role of pricing, efficiency, trade-offs, risk and uncertainty)'.

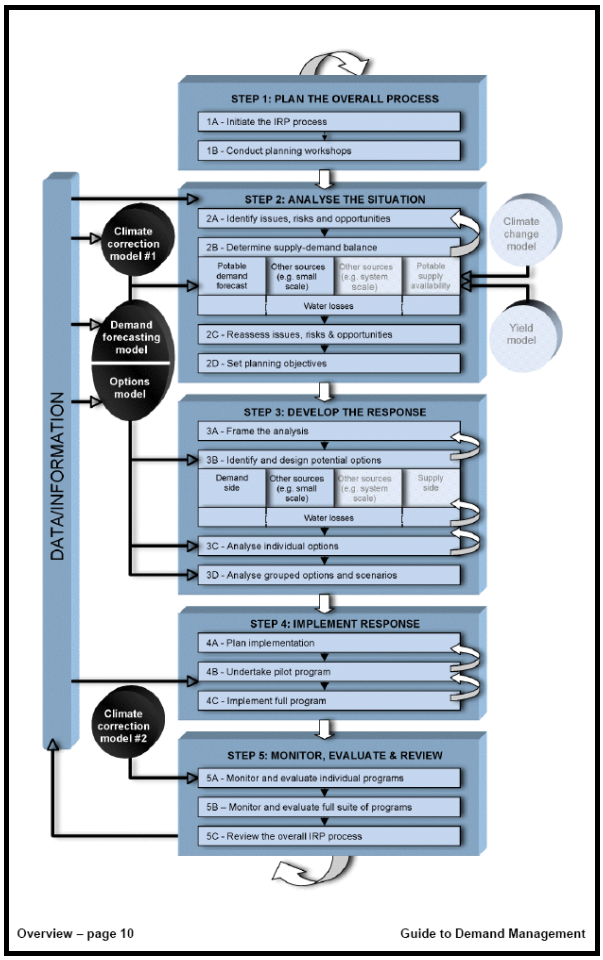

Figure 5. Integrated Resources Planning Framework

For the purpose of this review, this framework received a score of 10 out of 12. The framework meets all of the criteria but overall it is slightly more complex than the purpose required for the exercise of developing a framework for non specialists involved in urban water management decision making that the SWITCH framework is aimed at.

7. Integrated Management and Transition Framework.

NeWater (New Approaches to Adaptive Water Management under Uncertainty). Co-ordinating Author, Claudia Pahl-Wostl. Task 1.7.1 and 1.1.4. www.newater.info

The Integrated management and transition framework (MTF) was developed by a team working on the NeWater project. There are three major components of the MTF and their relations. (A) Generic MTF that serves as a template for further conceptual development and application to analyse management regimes and transition processes. (B) MTF as applied to specific cases in the NeWater basins. (C) Case Implementation Process documenting the process in the basins.

The combination of these three modules allows integrating empirical insights at the case level in a comparable fashion, a condition to extract general patterns regarding the understanding of management regimes and processes of change and to evaluate the research design (Case Implementation Process). Emphasis is given to processes of learning, decision making and institutional change in actor networks.

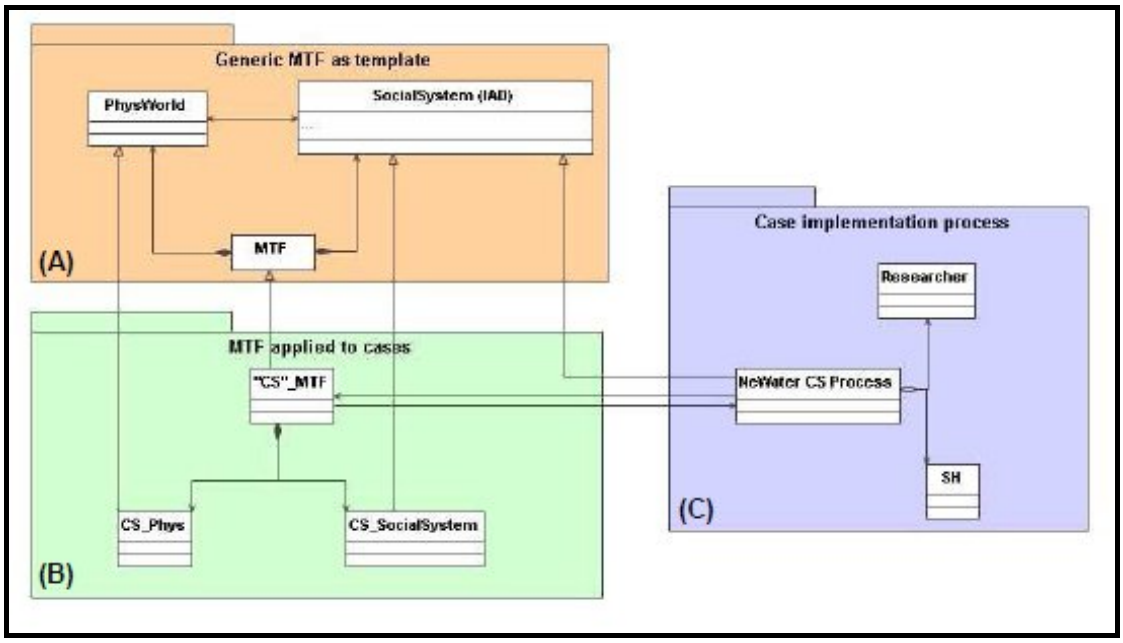

Figure 6. Management and Transition Framework

For the purpose of this review, the framework received a score of 10 out of 12. There is a much more detailed diagram of the framework which represents the dynamics and links with the formal management process and the informal process of initiating structural change. The two processes become linked at the beginning where dissatisfaction triggers the initiation for change and at the latter stage when windows of opportunity may develop for innovative approaches can inform the formalised management process. This is all very informative but is a highly complicated representation of the transition management process.

8. Frameworks for Adapting to Flood Risk: Experiences from the EU Flood Resilient Cities Project.

Ashley, Blanksby, Maguire, Leahy. 1st European IAHR Congress. May 2010.

The FloodResilienCity project has developed a flood risk framework following an extensive review of the wide range of frameworks available in Europe that provide guidance as to the best way to prevent and manage flood risks and recover from flooding. The outcome of the review was that no matter how complex or comprehensive the framework there are basic themes which must be taken into account when attempting to implement an adaptive management approach that delivers adequate resilience to cope with future uncertainties.

The framework was developed to illustrate the highly regarded Scottish Four A's framework and approaches flood risk from the perspective of an emergency planner. This includes modelling for risk assessment associated with spatial planning to develop flood event management plans which are enhanced by using real time modelling techniques coupled with rainfall prediction and use of real time analysis of calls for assistance from the public.

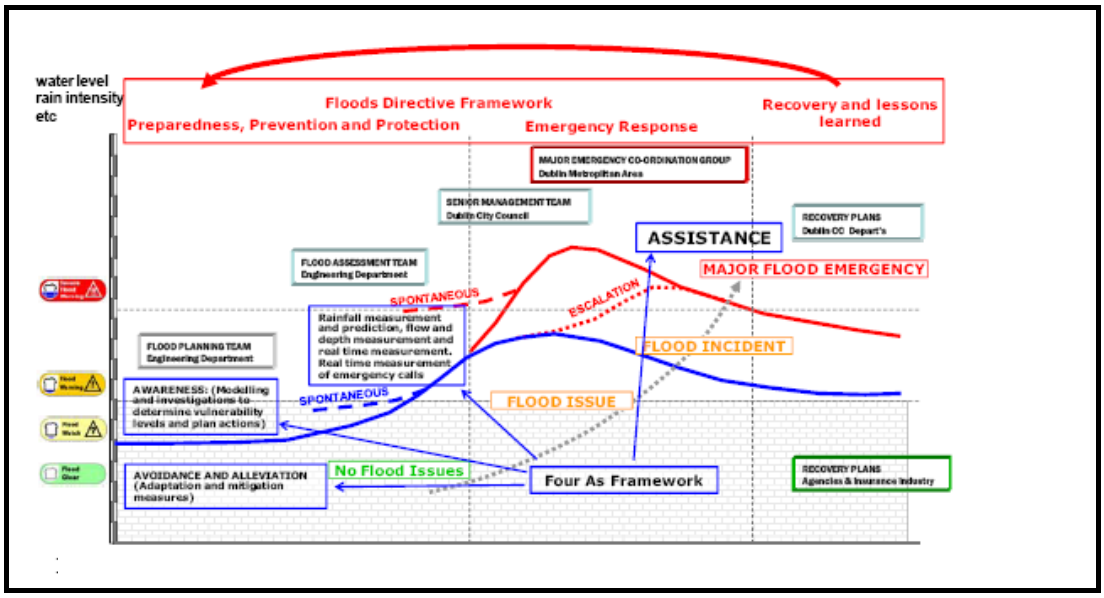

Figure 7. The Four A's and the Flood Directive framework from the perspective of an emergency planner

For the purpose of this review, this framework received a score of 8 out of 12. The framework is highly informative and detailed. However, this adds up to a complicated representation of the key themes that the framework is trying to ensure that the user understands. Financial issues for implementing the process are not discussed and a systemic approach is not fully explored.

9. Conceptual framework to water stress mitigation in an industrial catchment

Water Stress Mitigation : The AquaStress Case Studies. 2005-2009 AquaStress Project Consortium.

The framework presented here is one of four case studies developed by the AquaStress researchers where the goal was to support the transition to a more sustainable, integrated and adaptable approach to water management in a region that undergoes industrial transformation caused by economic and political drivers. The case study represented gave special attention to the improvement of the effectiveness of industrial wastewater treatment using three tools: quantitative-qualitative balance modelling for the impacts on water resources; water body monitoring for priority substances; and use of BREF/BAT documents to identify and implement integrated strategies for preventing industrial pollution.

Specific objectives were the identification of focal points and ineffective users. Recommendations are made for efficient wastewater treatment and reuse, and a suitable monitoring network is proposed. These tasks were integrated with recommendations which were grouped into the three categories outlined above plus ‘others’.

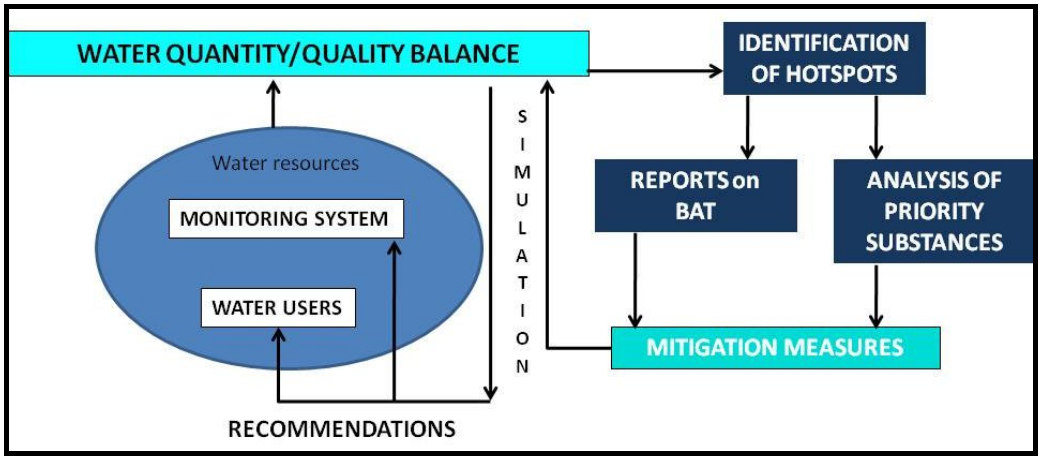

Figure 8. Conceptual Framework to water stress mitigation in an industrial catchment

For the purpose of this review, this framework received a score of 10 out of 12. The approach does not cover the relationships that could be developed by stakeholders to implement improvements to systems. Financial issues for implementing new process are not directly illustrated in the framework, although this is one of the specific objectives of the project.

10. The RIDA framework

SWITCH Briefing Note 12: Strategy Development. 6. Batchelor, C., Butterworth J., (2008)

The SWITCH LA Strategy Development Briefing Note uses the RIDA (Resources, Infrastructure and Demand / Access) Framework to illustrate the integrated urban water management concept with emphasis on stakeholder dialogue, data analysis and modelling. The RIDA framework is based on the understanding that water resources are linked by supply (and water treatment) infrastructure, and that each of these three system elements (resources, infrastructure, users) has its own set of institutions, boundaries and other characteristics.

There are several generic steps to be followed to develop a RIDA Framework. It is recommended that this is an iterative process as a well conceived framework will help to bring order to the complexity and at times paradoxical issues surrounding IUWM. The framework will assist in adding structure to stakeholder dialogue.

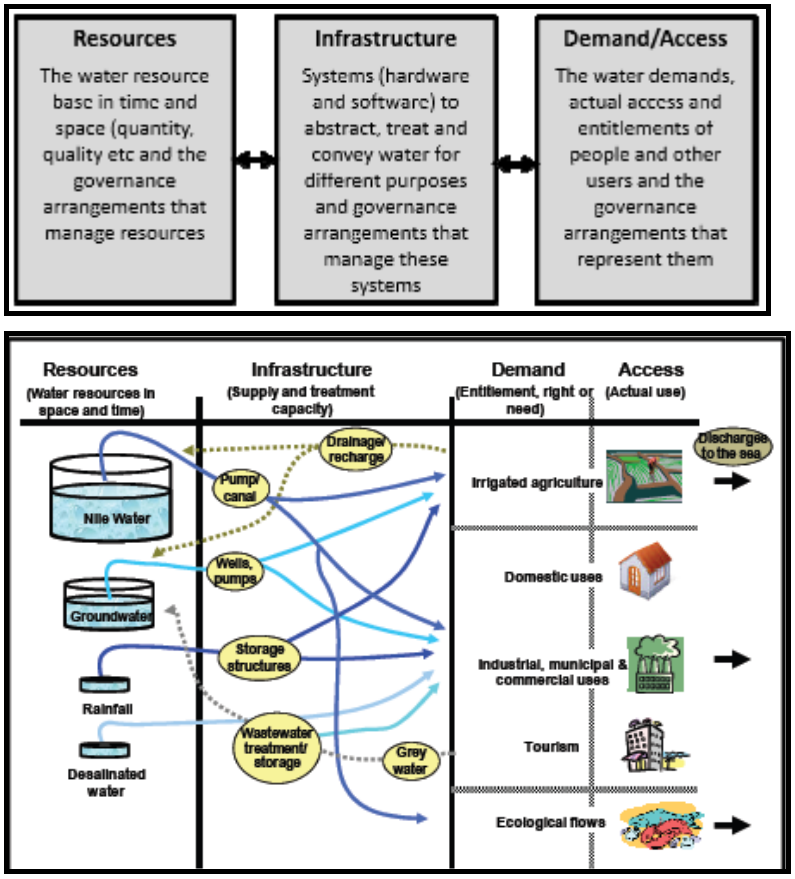

Figure 9. RIDA Framework (top) and Alexandria RIDA Schematic Diagram (bottom)

For the purpose of this review, this framework received a score of 11 out of 12. Although the framework advises that resources are in place to finance stakeholder collaboration, the framework does not directly cover financial issues surrounding the interventions that will need to be implemented to achieve the IUWM goal.

11. Decision Support Processes Framework

Sustainable Water Services A procedural Guide. SWARD 2004. IWA Publishing. ISBN: 1 84339 065 5

The SWARD (Sustainable Water industry Asset Resource Decisions) project developed a set of decision support processes in the form of a guidebook which allow water service providers to assess the relative sustainability of water / wastewater system asset development decisions. The guidebook takes the stakeholder through the decision support processes (DSPs) deemed essential to incorporating sustainability in asset investment decision making (Butler et al, 2003). The framework was based on the basic cost benefit analysis framework (CBA) as advocated by Wrisberg & de Haes (2002) which has nine stages. CBA is an economic tool for determining whether or not the benefits of an investment or a policy outweigh its costs. The resulting DSPs framework used in the SWARD guidance has seven stages which ensure that sustainability considerations are included in asset management decision-making processes in the water industry.

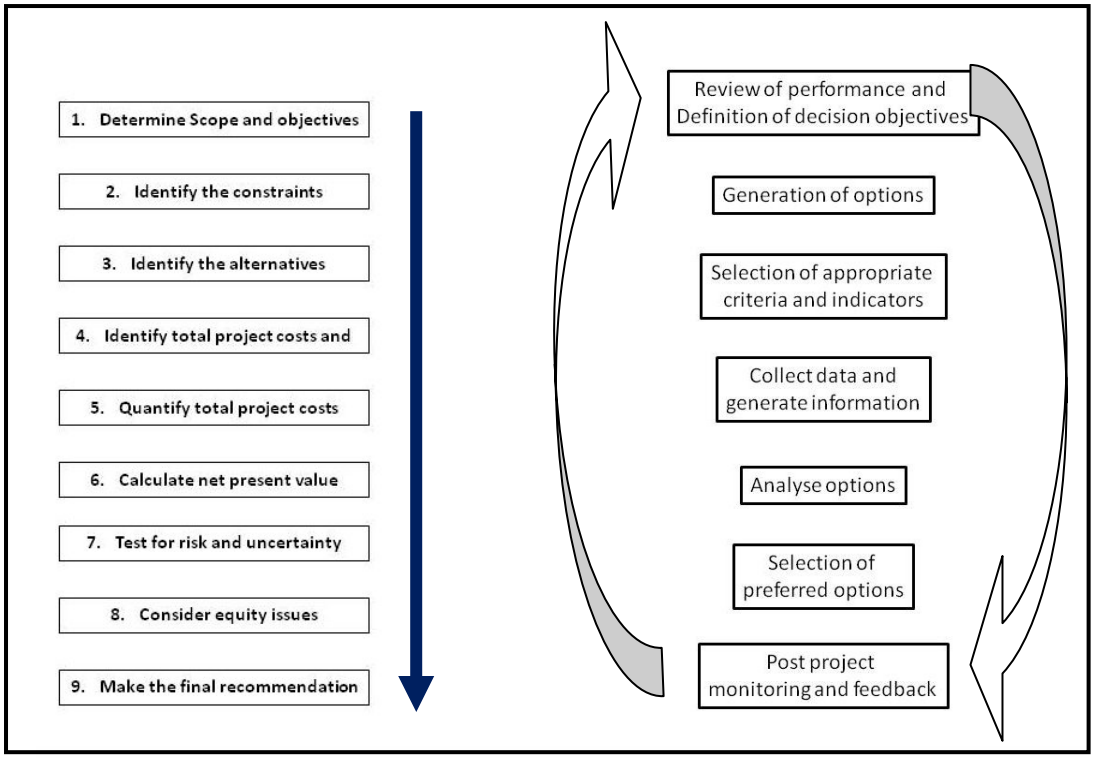

Figure 10. Wrisberg's CBA Framework (Left) and SWARD DSPs Framework (Right)

For the purpose of this review, this framework received a score of 11 out of 12. Issues of governance, including legislation are not directly tackled within the framework.

12. Sustainable Framework for Integrated Urban Stormwater Management

The team from Middlesex University have developed a framework for sustainable integrated urban stormwater management. The framework highlights the various components of the urban water cycle which need to be cost-effectively managed and the operational framework within which generic decision-making processes must be brought together to resolve the disparate issues associated with IUSM in order to bring about a paradigm shift.

Successful integration of the surface water, wastewater, groundwater and drinking water components of the urban water cycle can only be achieved through a shift in the current urban water paradigm which is currently based on the conventional “end-of-pipe” approach. This approach is often operated in semi-autonomous compartments and separately managed by a mix of public and private stakeholders. These variable institutional and governance arrangements, in turn, operate within planning and regulatory frameworks normally structured by national and/or state guidelines but frequently delivered at local authority or municipal level.

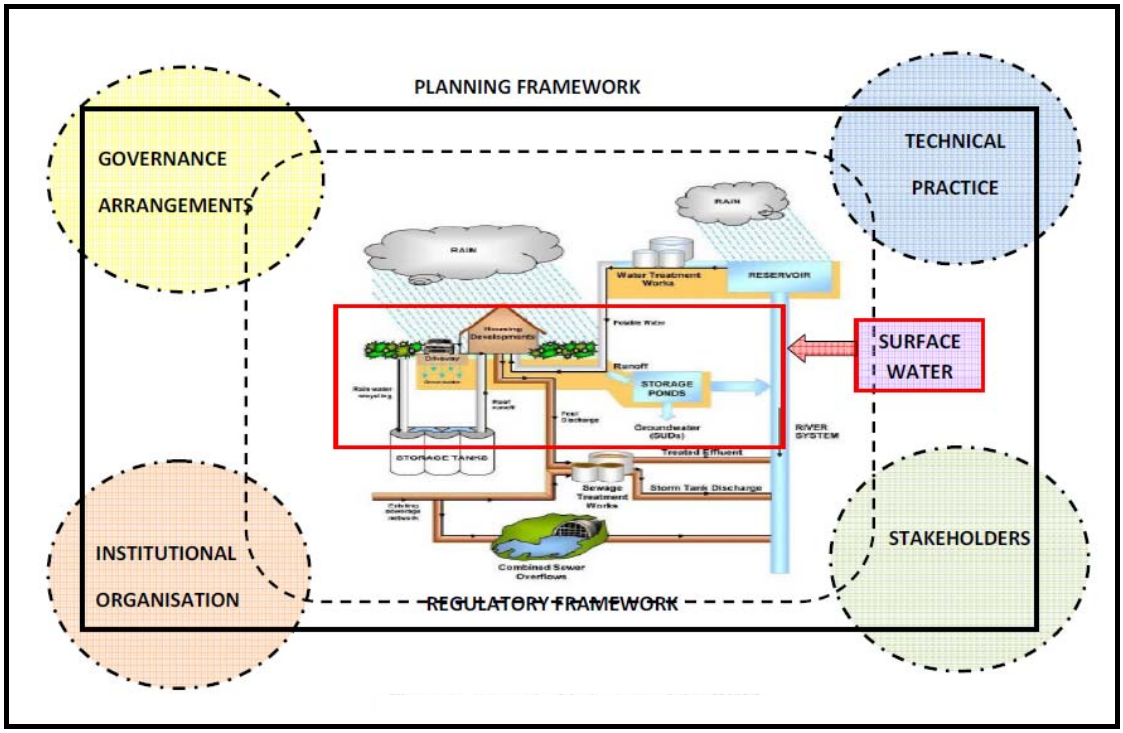

Figure 11. A Sustainable Framework for IUSM

For the purpose of this review, the framework received a score of 11 out of 12. The framework does not directly advocate an iterative, reflexive approach on progress at each stage where new interventions or techniques may enter the arena which would subsequently see adjustments being made to future actions.

13. INECO Framework.

INECO. Guidelines towards the application of institutional and economic instruments for water management in countries of the Mediterranean Basin. EC 6th Framework INCO-CT-2006-517673

Stormwater as a valuable resource in the urban water cycle. Ellis, B., and Revitt, M., (2010). SWITCH Project Deliverable 2.2.4a

The INECO project aimed to introduce a disciplinary approach to water management by integrating three main areas: environment, economics and society. The project attempted to develop a social experiment in capacity building and policy building through the applying the framework to seven case studies with different water management issues. The main strategic goal was capacity building for promoting constructive stakeholder engagement for IWRM. The INECO output was based on the WFD principle 'towards integrated management at river basin level, recovery of water service costs, implementation of water pricing policies for achieving environmental objectives and public participation'. The project focused on sharing problems in the decision making process and deficiencies of current water governance structures. The framework motivates efforts towards constructive engagement in three areas (valuing water, governing water systems and sharing water) for discussing implications of alternative or complimentary institutional responses for water stress mitigation.

The OOPP method (Objective Orientated Project Planning) which is based on the logical framework approach was adopted to support urban participatory planning processes for case study development. The process was not implemented as a linear process as stakeholders do not move from one stage to the next in a forward direction as planning is an iterative and creative process with significant leaps in thinking often taking place.

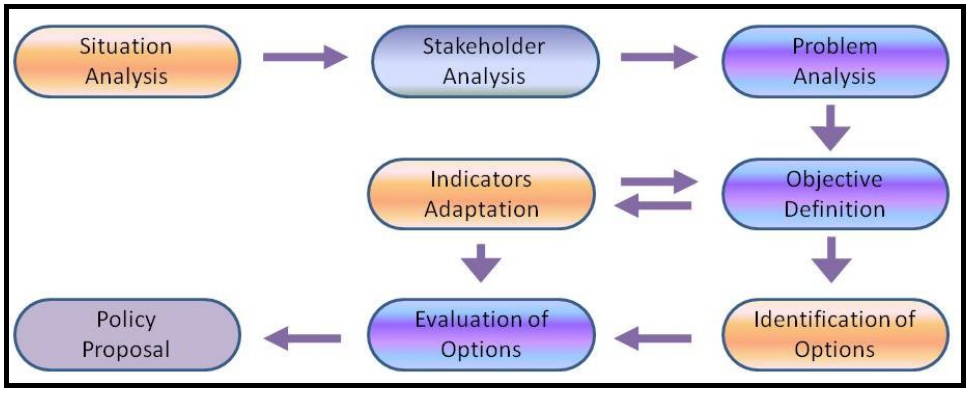

Figure 12. The INECO Framework for case study development

For the purpose of this review, this framework received a score of 11 out of 12. The focus of this framework is on cost recovery mechanisms and water pricing policies. The direct links or relationships with science and innovative techniques to achieve environmental objectives were not explored.

14. Surface Water Management Plan Framework.

DEFRA 2009.

The UK Department for Environment, Food and Rural Affairs (DEFRA) in England has developed Surface Water Management Plan (SWMP) Guidance document which has been developed to inform local authorities on how to approach a SWMP, particularly in areas at high risk from surface water flooding. The guidance reflects the roles of all the stakeholders that should be involved with developing a SWMP.

The SWMP is designed to provide a simple overarching framework and is illustrated through a cyclical diagram, identifying four principal phases: Preparation; Risk Assessment; Options; and Implementation and Review. It is based on a widely adopted generic approach to risk based decision making. Each phase is a section of the guidance document and is further subdivided into chapters and key headings. The process is largely linear and can be followed by starting at 12 o'clock and progressing clockwise.

A SWMP is linked to a variety of spatial planning, investment planning and flood risk management procedures. Many of these procedures and documents provide inputs to the SWMP, as well as being influenced by the outputs of the SWMP.

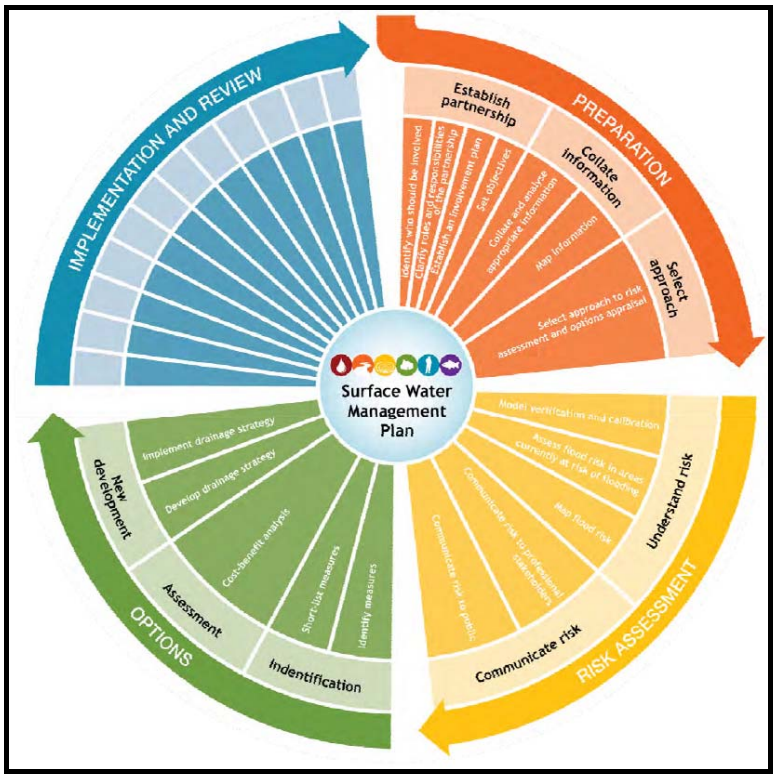

Figure 13. DEFRA SWMP Framework

For the purpose of this review, this framework received a score of 11 out of 12. Although the framework is cyclic in nature it is based on a linear approach which does not lend itself to reflexive actions during the process which could result in adopting new measures for mitigating flood risk from surface water.

15. WSUD Implementation Framework for Darwin. Discussion Paper.

Prepared for the Northern Territory Dept of Planning and Infrastructure. PO Box 2520 Darwin NT 0801

To assist local government to develop their strategic position on the adoption of Water Sensitive Urban Design (WSUD), the New South Wales Department of Environment and Climate Change (DECC) has prepared and is currently updating the Managing Urban Stormwater (MUS) Framework. The MUS Framework is a holistic suite of guidance documents and supporting "tools" aimed at delivering strategic structural and non-structural responses from regional and local planning authorities in relation to sustainable management of urban stormwater.

The MUS framework encapsulates the full hierarchy of guidance documents from high level management considerations through to detailed guidance for both the urban design and detailed technical design and implementation of WSUD techniques for both the construction and post-construction phases of urban development. The framework is colour coded to show the range of documents from high level planning guidelines to technical: Planning Guidelines are dark green, Multi-disciplinary conceptual design information is light green and Technical design guidelines are yellow. The guidelines and tools are largely intended for developers and their consultants to implement WSUD.

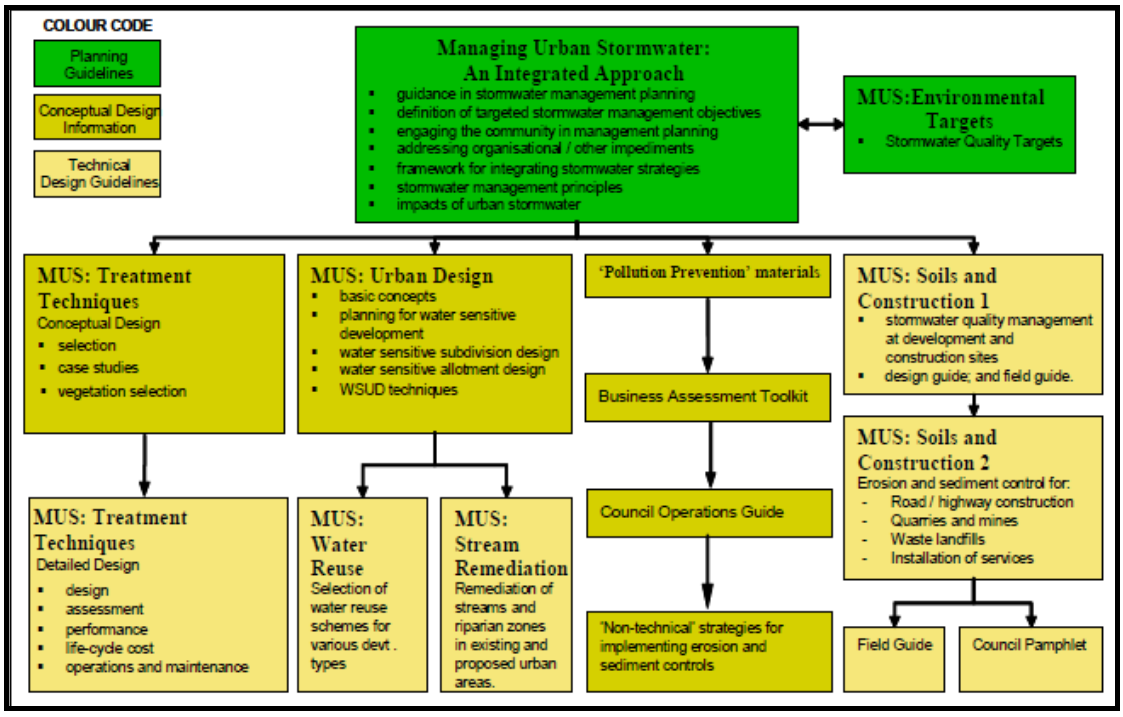

Figure 14. Managing Urban Stormwater documents and tools (draft framework, 2007)

For the purpose of this review, this framework received a score of 8 out of 12. The framework provides an extensive list of technical guidance documents and tools for implementing WSUD, however it is neither reflexive nor systemic

in its approach and appears to the user to be somewhat fragmented in its layout despite colour coding.