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ASSESSING SUSTAINABLE APPROACHES TO SANITATION PLANNING AND IMPLEMENTATION IN WEST AFRICA

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LIST OF PAPERS

This thesis is based on the following papers that are appended:

I.   Kvarnström, E. and McConville, J. (2007). "Sanitation Planning - A Tool to Achieve Sustainable Sanitation?" Proceedings of Water Supply and Sanitation for All (ed. Wilderer et al.), conference held in Berching, Germany, Sept 26 - 28, 2007.

II. McConville, J.R. and Mihelcic, J.R. (2007). Adapting Life Cycle Thinking Tools to Evaluate Project Sustainability in International Water and Sanitation Development Work. *Environmental Engineering Science*, **24** (7), 963-974.

III. McConville, J.R., Kain, J.H., Klutsé, A., and Kvarnström, E. (2008). "Perceptions of Local Sustainability in Planning Sanitation Projects in West Africa". Proceedings of Sanitation Challenge conference held in Wageningen, Netherlands, May 19-21, 2008.

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ABSTRACT

The challenge of achieving global sanitation targets is that it requires application of both technology that is appropriate and a supporting organizational structure. The interactions between the two begin during the planning/decision-making process and continue throughout the system lifetime. During the last decade, strategic planning frameworks have emerged in the water and sanitation sector that reflect a shift from traditional, top-down planning to a more participatory, bottom-up approach. Despite this shift and in light of the continuing challenge of achieving widespread sanitation in the world, it is necessary to question if a knowledge gap exists between the global sanitation frameworks and local stakeholder priorities. This licentiate thesis presents the first phase of a research project whose objective is to study the global models and compare them with existing local planning and decision-making conditions. It focuses on establishing the global context with regard to strategic planning tools and perspectives on sustainable sanitation. In general, there is close agreement on methodology and processes recommended by international planning frameworks; however the use of the term "sustainable sanitation" is highly variable. In general, the findings of this thesis show that improving sanitation conditions requires tools based on participation, social marketing, and process approaches for planning, capacity development, and feedback. Continuation of this research will investigate the local context regarding current planning practices and perspectives on sustainable sanitation in order to assess potential differences between the global and local context and make recommendations for improving adaptation of planning strategies for bringing sanitation to scale.

KEY WORDS: Decision-Making, Implementation, Planning, Sanitation, Sustainable

1. INTRODUCTION

There is an increasing need for improved sanitation systems in many areas in the world, particularly in West Africa. Improvements in sanitation coverage have been targeted by the United Nations Millennium Development Goals (MDGs) because of their strong links to issues of environmental and public health, economy, and human dignity. An estimated 1.6 billion people must be able to access improved sanitation services before 2015 in order to meet the MDGs target of halving the percentage of people without access to improved sanitation (United Nations, 2007). However, much of the world is not on track to meet these goals due to compounded problems of population growth, urbanization, and historically inefficient service provision. West Africa in particular is struggling to meet the demands for sanitation. This region has witnessed relative stagnation in sanitation coverage since 1990, when total access to basic sanitation was 32% (WHO & UNICEF, 2006a). However, these regional figures hide significant differences between countries, for example sanitation coverage in Burkina Faso was only 13% in 2004, while in Mali it was 46% (WHO & UNICEF, 2006b). The inability of sanitation efforts to keep pace with population growth has resulted in an increase of over 110 million people in West Africa without access to sanitation. Globally if such trends continue, the world will miss the sanitation target by 600 million people (United Nations, 2007).

Due to the increasing demand and historically low success rate of sanitation projects, there is an increasing need to develop methods for scaling-up sanitation projects. There is a growing awareness of the sanitation problem within the international development community and initiatives such as the International Year of Sanitation (2008) mean that an increasing amount of funds will be invested in the sector over the coming years. Yet, the challenge of the MDGs is not only to achieve statistical improvements on paper (i.e. number of toilets constructed), but to do it in a sustainable manner that will lead to lasting positive change for the entire community. It is important that these funds are invested in sustainable sanitation systems, since providing sanitation systems that are

not sustained is a very costly short-term solution. Strategic planning for the implementation, operation, and maintenance of community-wide sanitation systems is therefore a critical component to increase the efficiency, scope, and longevity of investments.

1.1 Sustainable Sanitation

The term sanitation refers to the process of disposing of human excreta in a manner that protects public and environmental health. The WHO/UNICEF Joint Monitoring Programme (JMP) defines improved sanitation as systems in which excreta are disposed of in such a way as to reduce the risk of fecal-oral transmission to users while ensuring a clean and healthy environment (WHO & UNICEF, 2006b). However, as a fundamental part of daily life, sanitation systems are closely linked to societal issues of culture, technology preference, and economics. Therefore, some definitions adopt a more inclusive definition of "sustainable sanitation" as a system which protects and promotes human health, does not contribute to environmental degradation or depletion of the natural resource base, and is technically and institutionally appropriate, economically viable and socially acceptable (Bracken *et al.,* 2005). This definition is used as a reference point for discussions of sustainable sanitation in this thesis. However, the term "sustainable" is widely defined by different groups of stakeholders, and one of the objectives of this study is to explore the various perspectives regarding the use of this term and how to achieve it. Therefore, just as the metadiscipline of sustainability supports a number of parallel and distinct discourses (Mihelcic *et al.,* 2003; Redclift, 2005); this study also supports and explores differing definitions in an attempt to capture the main threads of discourse surrounding sustainable sanitation.

1.2 Historical Perspective

Since the start of the modern international development movement in the 1960s, development workers have recognized the need for appropriate technology and improved project planning to overcome the historically low success rates of water and sanitation pro-

jects (Feachem *et al.,* 1977; Cairncross, 1992; Pickford, 1995). Yet, within the water and sanitation sector it is widely agreed that past project interventions have not done enough to improve the situation. Numerous project evaluations have cited a variety of roadblocks, including economic, cultural and political obstacles. Financial institutions blame the continued low access to sanitation on funding constraints, insufficient return on investments, or high hardware subsidies that lead to unsustainable supply chains (Wright, 1997; WSP, 2005). A lack of effective social intermediation and a failure to account for user needs means that projects consistently fall into disrepair because communities do not feel they are responsible or do not have the capacity to maintain the systems (Breslin, 2003; Ratner & Gutierrez, 2004). Project planners also fail to understand local cultural and political situations, or place undue emphasis on getting projects constructed without enough attention to selecting appropriate technology or planning for long-term sustainability (Howe & Dixon, 1993). This has often led to a fragmented institutional approach where no one claims responsibility for monitoring and ensuring project outcomes.

In general, the constraints quoted in literature for large-scale sanitation implementation are related to low prioritization of sanitation, financial limitations, lack of managerial capacity, and insufficient institutional coordination. In response to these constraints, the emerging trend in the sanitation sector is to incorporate participatory processes in awareness raising and capacity building, along with institutional incentives and demand-driven policies for economic viability. Reports from successful projects often show combinations of community-based efforts, use of social marketing tools to encourage local ownership, and decentralized government programs that stimulate political support (WSP, 2005; Oldfield, 2006). Many of these holistic approaches have been incorporated into the emerging planning principles and frameworks promoted with the sanitation sector that are explored in this thesis.

1.3 Research Objectives

During the last decade, strategic planning frameworks have emerged in the water and sanitation sector that reflect a shift from traditional, top-down planning to a more participatory, bottom-up approach. In addition, increasing awareness of sustainability issues has led to numerous life cycle assessment studies and the identification of criteria for sustainable sanitation. However, it is unclear to what extent these frameworks are being implemented in the field, or how current practices might be merged with these innovative approaches. In order to understand the requirements for bringing sanitation to scale, it is necessary to closely examine the strengths and weaknesses of the approaches that are currently used in the field, and the potential and/or desirability of changing these approaches to match international recommendations. One method for achieving this understanding is to explore the knowledge gap that may exist between the global sanitation frameworks developed by academics and international development experts, and the priorities and practices of local stakeholder. This gap can be articulated by the following assumptions and corresponding questions:

1. There are differing perspectives on sanitation requirements.
   - How is "sustainable sanitation" defined in literature?
   - How do stakeholders in different contexts define sustainable sanitation?
2. Local planning practices are missing criteria deemed necessary from the "global" perspective.
   - What determines the technology preferences of users/institutions?
   - What information is available/used in decision-making?
3. Theoretical frameworks are missing connections with the realities of the local context.
   - What information do the frameworks require? Is it available?
   - What management/process capacity is required?

The objective of this project is to test these assumptions by comparing the global models with existing local planning and decision-making conditions and procedures. A comparison of the approaches within both local and global contexts will focus on interactions between stakeholder perspectives of requirements for successful sanitation (sustainability) and the planning/decision-making process. A clearer understanding on the perspectives and needs driving both local and global stakeholders will assist the development of better adapted planning strategies for bringing sanitation to scale.

This licentiate thesis lays the groundwork for comparing global and local conditions and evaluating the above assumptions. It defines the global perspective regarding requirements for planning and implementing improved sanitation systems, and conducts an initial assessment of local perspectives through interviews with sanitation actors in Burkina Faso and Mali. This region was chosen due to the pressing needs for improved sanitation and familiarity of the researchers with the area and culture. Although it is recognized that the results of such a study will not lead to globally applicable theory, it is hoped that it may indicate trends in knowledge gaps so that global theories can be better adapted to various local contexts.

2. BACKGROUND

The background theories guiding this research include organizational learning and processes for societal change, sustainable development and strategic planning. Implementing sanitation systems, especially in areas of West Africa, often requires behavior change on behalf of the users; either stopping practices of open defecation, improving hygiene practices, or changing the ways that users perform operation and maintenance of the system. Therefore, it is important to understand some of the social science theories for creating change, and how they can support the more central themes of this thesis, sustainable development and strategic planning.
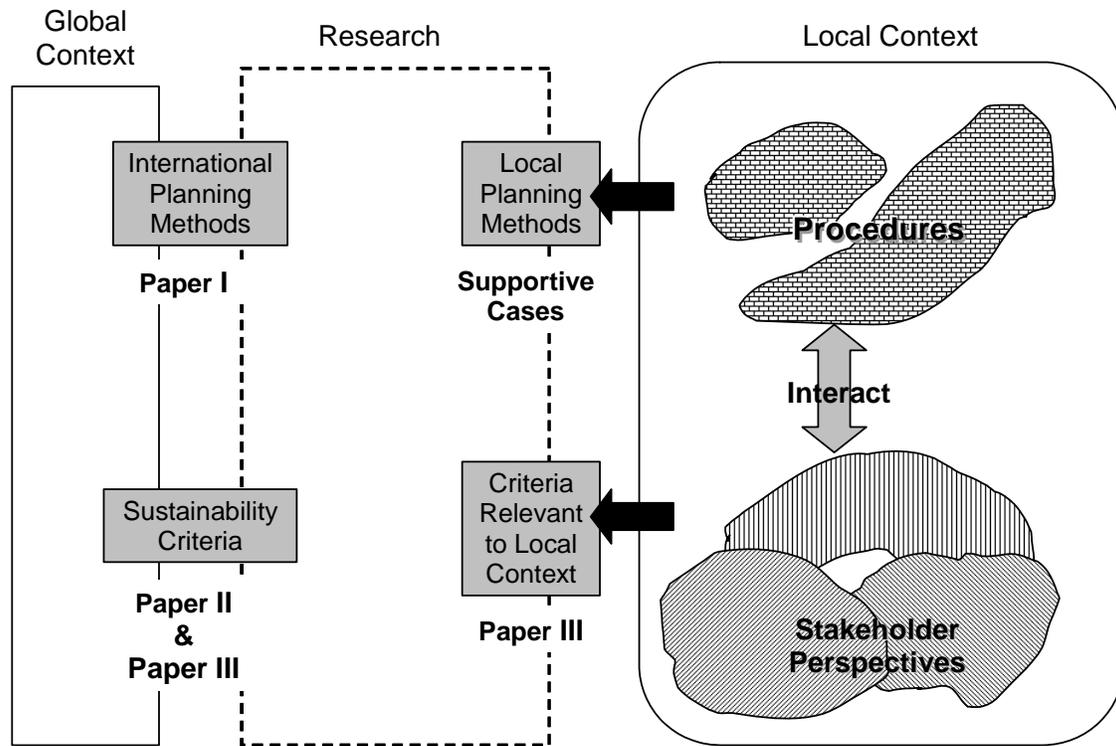
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Figure 1: Schematic overview of research approach

2.1 Processes for Societal and Behavior Change

Improving sanitation is not only about installing technological systems, but also about changing the hygiene and defecation practices of the local population. The challenge of achieving global sanitation targets is that it is a process which requires application of appropriate technology, supporting organizational structures, and awareness-raising campaigns for sustained behavior change. There is an abundance of literature documenting the importance of employing behavioral change theory and social-marketing techniques for achieving health benefits from sanitation programs (Esrey *et al.,* 1990; Stanton *et al.,* 1992; Elder, 2001). Yet there is also ample evidence within the sanitation sector (Section 1.2) and in social sciences of the difficulty of motivating individual and organizational change on a more general level (Schön, 1971; Kotter, 1996; Cars *et al.,* 2002). Research on societal change processes shows that both individuals and institutions are often resistant to change due to perceived

threats to routine, or costs in terms of time and money (Schön, 1971; Pierson, 2000).

Studies of organizational transformation recognize that creating social change requires flexibility, feedback, and organizational transformation (Schön, 1971). These themes are increasingly being picked up by the sanitation sector as it recognizes that achieving improved sanitation conditions is something that must be addressed at both an individual and community level (Eawag, 2005). To achieve behavior change the sector is borrowing theory and practices from the social and behavioral sciences, and many of these ideas are advocated in sanitation practice; such as participatory decision-making and social marketing tools for raising demand for sanitation products.

Stakeholder engagement and participation is a popular concept in many disciplines, from environmental management to international development work. A participatory decision-making process brings together people with a diverse set of interests in an open, authentic discussion of possible solutions in order to arrive at a mutually beneficial solution (Hajer

& Wagenaar, 2003). The participation paradigm is now widely accepted as "best-practice" by development agencies, and there is increasing promotion of collaborative design and policymaking among academics and politicians as a way to increase the adaptivity and sustainability of society through a process of co-evolution (Murcott, 2007).

In addition to participation for policy and design, application of social science methodology from the marketing and management sectors can help to motivate behavior change and make it permanent. A process recommended for leading major institutional change within the business sector involves establishing a sense of urgency, developing a vision, communicating it, empowering action, keeping motivation high, and anchoring the changes within the culture (Kotter, 1996). These steps are echoed in methods for behavior change and social-marketing recommendations for creating demand for sanitation (WSP, 2000; Scott, 2005). Social marketing is a tool to encourage transactions between actors, in this case between the household and the service provider/public sector. This in turn facilitates the supply chain while stimulating demand from users. Social marketing uses marketing theory to create bridges between households and providers; thus encouraging the development of a market where sanitation transactions are more widespread and occur more frequently (Scott, 2005). The application of such guidelines and tools for behavior change within the sanitation sector has great potential for increasing sanitation coverage. However, many of these tools also require organizations to change the way in which they plan and implement sanitation projects. Overcoming societal inertia and motivating change in hygiene and sanitation behavior requires the critical assessment of current behavioral and organizational practices in order to identify how technologies, knowledge, and policy can act as catalysts for change.

2.2 Sustainable Development

The concept of sustainable development is increasingly gaining recognition and importance in all areas of human activity around the world. The founding doctrine of the sustainability movement comes from the Brundtland Report which defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). The report stressed that sustainability could only be achieved by taking into account the interrelationships between people, resources, environment and development. These relationships have been formalized as the three pillars of sustainability: social, economic, and environmental (United Nations, 2002). However, such a holistic approach to the concept of sustainability leaves the term open to ambiguity and multiple interpretations (Redclift, 2005). The industrial sector tends to focus on the business ethics of sustainability, referring to it as the triple bottom line (Elkington, 1998). While in international development work, a sustainable project may mean one that the community can continue on its own, without outside support (CIDA, 2002; Peace Corps, 2002). Engineers in development work often define it as appropriate technology, which "can be made at an affordable price by ordinary people using local materials to do useful work in ways that do the least possible harm to both human society and the environment" (McGraw-Hill, 2003). So, even while the need for 'sustainable sanitation' is recognized, it still appears necessary to explore how this concept is defined and used by different actors.

To give an example of the debate surrounding the definition, one may consider the root of the word 'sustainability' and the implied question of what is to be 'sustained'. Some people argue for sustaining natural capital and operating on a scientific mass balance that maintains environmental functions (Ekins, 2003). Yet this natural capital is usually owned by individuals, so it becomes closely linked with social capital, and hence corresponding legal and politically issues (Redclift, 2005). Another approach, the sustainable livelihoods concept focuses on sustaining a quality of life and the capabilities, assets, and activities that support it (Toner & Franks, 2006). From either perspective, tak-

ing action towards the goal of sustainable development involves the challenging tasks of recognizing interconnected trade-offs, weighing priorities, and reaching a balance between sustaining culture, social capital, material well-being, and environmental resources. There is no unique or easy solution to such a challenge, which has led some authors to suggest that the real power of the concept of sustainability lies in the discourses surrounding it (Redclift, 2005).

In order to discuss issues of sustainability and examine their occurrence in literature and practice, it is necessary to understand the tools and vocabulary commonly used. Much of the work done on sustainability theory is based on a "systems-thinking" approach. Systems-thinking is a meta-discipline that has evolved as a challenge to scientific reductionism as certain disciplines have struggled with the limitations of science to handle complexity. Systems-thinking is the belief that the components of a system will act differently in isolation than they will as part of the whole. It recognizes a hierarchy of complexity within the systems, and linkages for communication and interaction between the components of the systems. The application of a systems-thinking approach is used to gain an understanding of how these interactions work and how they affect the whole (Checkland, 1999). In practice, the term "life-cycle thinking" is also used to describe such a holistic approach, one that considers sustainability factors over the entire life of a product or process, from conception through use and disposal. The use of life-cycle thinking is considered a prerequisite to any sound sustainability assessment, as it does not allow for shifting of detrimental effects to other timeframes or phases in the life cycle (Klöpffer, 2003). In terms of sanitation systems, this means that assessments should consider planning, implementation, use and mainte-

nance, and final disposal/reuse of the waste products.

Recognition of the need for such a holistic perspective in the design of human systems has led to the development of tools such as life cycle assessment (LCA) and environmental impact assessment (EIA). Most of these tools are based on the use of sustainability criteria that recognize the environmental, social, and economic factors in human activities. In the field of sanitation, the criteria used attempt to describe the complex relationships between society, water, and sanitation systems. Based on the definition of sustainability given in Section 1.1, several researchers have proposed lists of criteria necessary for a sanitation system to be sustainable (Table 1), which include indicators for health, environmental, economic, technical and socio-cultural aspects (Hellström *et al.,* 2000; Balkema *et al.,* 2002; Bracken *et al.,* 2005). These criteria have been incorporated into sustainability assessments and decision-support models using tools such as LCA and cost-benefit analysis (Lundin, 2002; Van der Vleuten-Balkema, 2003). A comparative approach has also illustrated how sustainability criteria could be used for the selection of alternative wastewater treatment systems (Lennartsson *et al.,* 2008).

This thesis applies the concepts of life-cycle thinking and categorical assessment of criteria to determine the scope of information collected and to provide structures for presenting the information gathered. However, it also recognizes that discourses surrounding sustainability issues do not exist in isolation from beliefs, social relations, institutions and power relations (Harvey, 1996). Therefore examination of the sustainability rhetoric used by various actors within the field of sanitation is also used to identify some of the fundamental norms that drive the differences between groups.

Table 1: Examples of criteria for sustainable sanitation, adapted from Balkema et al., 2002; Dunmade, 2002; Bracken et al., 2005.

Criteria	Indicator
Health	
Risk of infection from pathogens	Risk assessment or
Risk of exposure to hazardous substances	Qualitative
Environment	
Resource consumption *(land, energy, materials, water)*	$(m^2$, MJ, kg, L)/pe
Environmental releases to water, air, soil	$(m^2$, MJ, kg, L)/pe/yr
Resource conservation *(reuse, recycling)*	% of consumption
Impact on biodiversity, land fertility, natural systems	Qualitative
Compliance with environmental standards	Qualitative
Economics	
Affordability (*annual and capital costs, O&M*)	Cost/pe/yr
Willingness/capacity of users to pay	Disposable income/pe
Local development (*resources for O&M, reusable parts*)	Qualitative
Technical	
System robustness (*risk of failure, endure shock loading/abuse*)	
Durability/Lifetime	
Local competence for construction and O&M	
Local serviceability (*accessible parts, technical expertise*)	Qualitative
Ease of system monitoring	
Compatibility with existing systems	
Adaptability to user needs and environmental conditions	
Socio-cultural	
Perception of system (*importance, compatibility*)	
Institutional requirements (*policy, organizational structure*)	
Current legal acceptability	Qualitative
Acceptability in current local cultural context	
Convenience (*comfort, smell, attractiveness*)	
Ability to address awareness and information needs	

2.3 Strategic Planning

The traditional method of planning for sanitation was a highly structured process of written rules and procedures, with a top-down planning flow, narrow participation profiles, and budgetary focuses (Pyburn, 1983). The priority needs and necessary service levels were determined by well-meaning officials based on their own perceptions of what was needed for the "target beneficiaries". The projects therefore tended to be "supply-driven" and the beneficiaries themselves often had little say in the matter (Eawag, 2005). In contrast, the strategic planning frameworks that have emerged out of the past fifty years of international development work fo-

cus on more participatory, bottom-up methodologies. The emphasis is on "demand-driven" approaches where planners solicit the participation of a variety of stakeholders in a democratic planning process.

The emerging frameworks integrate many of the principles and theories presented in the previous sections. They begin to merge technical and social aspects, and apply sustainability-thinking to multi-stakeholder, participatory processes for the planning and implementation of projects. These participatory and holistic methods for sanitation planning are believed to increase the potential for system sustainability through better management of the numerous risk-factors, and capacity development within the local domains

for continued operation and maintenance of the systems (Kvarnström & af Petersens, 2004; IWA, 2006). In addition, they are intended to help decision-makers in selecting appropriate technology to satisfy the functional requirement of the various stakeholders. International organizations such as the Asian Development Bank and International Water Association have developed/are promoting planning frameworks for sanitation based on the assessment of user priorities at different levels of decision-making (ADB, 2006; IWA, 2006). Some of these frameworks are specifically tailored to sanitation, while others are more general in nature. The Swedish International Development Co-operation Agency (Sida) points out that although these frameworks may appear as common sense, they act as a logical structure for developing dialogue, creating participation, and guiding the planning process (Örtengren, 2004). They provide the logical steps to answer the three basic questions in planning:

1. Where are we now?
2. Where do we want to go?
3. How do we get there?

The process of answering these questions based on sound predictions and realistic analyses of options is at the core of strategic planning.

3. METHODS

In order to understand the complexities of sanitation planning, this research project aims to use information on strategies and criteria for sustainability from both the global and local perspectives. The research framework collects information from the global context through the review of international literature and from the local context through cases of existing projects (Figure 1). The main focus of this licentiate thesis is on exploring the global context through literature reviews of internationally recommended planning methods and sustainability criteria. The results of a literature review of the global context of sanitation planning are presented in this summary and in Paper I (appended). The global context of criteria for sustainable sani-

tation was explored in three separate literature reviews, which are presented here and in the appended Papers II and III. Finally, an interview study with sanitation actors in Burkina Faso and Mali yielded initial insights into the local context regarding sustainability of sanitation projects (Paper III). In each of these studies, specific cases of planning and implementing sanitation projects were used as examples to illustrate how criteria and planning procedures are used in practice.

The work presented here is the first phase of a larger research project. As such, it defines the theoretical background and research framework that will be the foundation for a more detailed case study of sanitation planning and implementation practices in two West African countries (*Phase II*). While the focus of *Phase I* is on the global context, the second phase will emphasize the local context. The combined results of *Phases I* and *II* will enable the researcher to test the assumptions laid out in the research objectives.

Phase I: Review of global situation and initial scoping in Burkina Faso and Mali

1. Literature review of planning approaches and criteria for sustainable sanitation.

2. Interview study on local criteria for successful sanitation with key stakeholders.

3. Supportive cases of specific sanitation projects.

Phase II: Case studies of sanitation projects in West Africa (future work)

3.1 Literature Reviews

Literature reviews were used extensively to gather information regarding the global context of sanitation planning and criteria for defining sustainable sanitation. To meet the research objectives of this project, it was necessary to identify common themes and prevailing theories pertaining to sustainable sanitation in the global context. Therefore, literature reviews of planning frameworks and criteria attempted to synthesize results through clustering of common steps and categories.

This methodology worked well when applied to sources where there was general agreement on basic themes and key steps. For example,

a review of planning frameworks showed that most strategic planning frameworks identify a number of steps to guide the process. The number of steps varied between frameworks, with some frameworks placing more emphasis in certain areas than others, but overall each framework identified the same essential components of planning steps. However, it is still important to specify the source of the literature and consider how differing perspectives may influence the material they are presenting.

Literature reviews were used in all three papers. A general review of strategic planning tools is presented in this summary, and tools specifically related to sanitation planning are presented as part of Paper I. Criteria related to the sustainability of sanitation were explored through three separate literature reviews, each with a different perspective: criteria for planning (this summary and Paper I), sustainable project guidelines for implemen-

tation (Paper II), and those specifically addressing sustainable sanitation (Paper III). Since these literature reviews were conducted at different stages in the research project and for different purposes, the sources of information for each of these three studies varied (Table 2).

3.2 Supportive Cases

Since this research project has positioned itself between the global and local context, each paper also includes empirical evidence from specific cases to illustrate the material synthesized from the literature reviews. These cases are not full case studies, in the sense that they did not follow the in-depth and pre-specified procedures defined by case study methodology (Stake, 1995; Yin, 2003). Rather they focus on specific aspects of the cases to illustrate the practical application of some of the planning tools and criteria discussed in the text. For example, Paper I pre-

Table 2: Examples of information sources for literature reviews related to categories for criteria in sustainability (either for planning or selecting sustainable sanitation)

Criteria specific to Planning Frameworks	Development Project Guidelines (Paper II)	Specific to Sustainable Sanitation (Paper III)
EcoSanRes Programme (Kvarnström & af Petersens, 2004)	Canadian International Development Agency (CIDA, 2002)	Eindhoven University of Technology, Germany (Balkema et al., 2002)
GHK Research and Training Ltd. (GHK, 2002)	Engineers Without Borders (EWB, 2005)	Federal University of Technology, Nigeria (Dunmade, 2002)
International Water Association (IWA, 2006)	Paris Declaration on Aid Effectiveness (Paris High-Level Forum, 2005)	German Development Cooperation (GTZ) & EcoSanRes (Bracken et al., 2005)
International Water and Sanitation Centre (IRC) (Moriarty et al., 2005)	United Nations (2002; 2007)	World Bank Water and Sanitation Program (Wright, 1997; WSP, 2000; 2005)
Swedish Water House (Norström, 2007)	United States Peace Corps (Peace Corps, 2000;2002)	
Swiss Federal Institute of Aquatic Science and Technology (Eawag, 2005)	Water, Engineering and Development Centre, UK (Pickford, 1995)	
UK Overseas Development Administration (Choguill, 1996)		
UNDP-World Bank Water and Sanitation Program (Wright, 1997)		

sents a review of three planning frameworks that are currently recommended by expert organizations in the field of sanitation. The two corresponding cases provide examples of their use in project planning, one in Sweden and the other in Ghana. Information for these cases was obtained through a review of documents from the projects and personal correspondence with the consultants involved in the planning processes.

In Paper II, examples from community-level projects in Mali, illustrated the use of the matrix tool that was developed for evaluating water and sanitation projects (McConville & Mihelcic, 2007). In this case, the author was personally involved in the implementation of these projects, but the evaluations were also supported by project planning documents and progress reports.

Similarly, the third paper used two cases of sanitation planning, one from Burkina Faso (strategic sanitation plan for the city of Ouagadougou) and one from Mali (municipal water and sanitation planning process assisted by WaterAid) to link responses from an interview study with planning practices in the field. Information for these cases was gathered from published literature, planning and evaluation documents, and personal correspondence with key informants.

3.3 Interview Study

Although the main focus of this licentiate thesis is on the global context, an initial interview study was conducted to begin exploring the local perspective of sustainability. It applies a research interview approach to obtain descriptions of the world-view of the interviewees in order to interpret the phenomena in question, i.e. sustainable sanitation projects (Kvale, 1996). Interview studies have long been used in qualitative research as a structured method for capturing a multitude of stakeholders' views on a theme, and several techniques have been developed for content analysis (Miles & Huberman, 1994; Kvale, 1996).

The interview study consisted of 20 interviews with key informants in Burkina Faso and Mali who were asked to define sustain-

able sanitation in the local context. The interview format varied slightly depending on the situation, but in general the interviews were semi-structured, based on a list of guiding questions (Kvale, 1996). The topics covered in the interview were related to project planning, technology choice, and sustainability. In some cases, the interviewee was provided with a copy of the questions to be asked, and at other times the interview was conducted less formally as a conversation. The interviews were primarily conducted in French, although in a few cases English or Bambara was also used. The interviews were not recorded, but rather summary transcripts were written following each interview, based on notes taken during the meeting.

Ten of the interviews were with personnel from the *Regional Centre for Low-Cost Water and Sanitation* (CREPA) and 10 with individuals from other institutions involved in sanitation. CREPA serves as an educational and research resource for the water and sanitation sector in French-speaking West Africa and has extensive experience working with communities to implement on-site, low-cost sanitation projects. By conducting additional interviews within this organization, the study was able to obtain perspectives from people with diverse roles and training: project managers, research specialists, technicians, and sociologists. The remaining 10 interviews covered the perspective from the other institutions involved in the sanitation sector: governmental agencies, international NGOs, local NGO, and international donor organizations. The responses from the interviews were analyzed using a "meaning categorization" approach with the aid of the qualitative research software HyperRESEARCH 2.8. Meaning categorization implies that the interviews are coded into different categories in order to reduce and structure the information (Kvale, 1996). The interview transcripts were coded in HyperRESEARCH based on categories of sustainability identified in advance from the literature reviews and also on ad hoc categories that arose during the analysis. From these codes a number of sub-categories were discerned and eventually separated into

four main categories of criteria for sustainable systems.

4. RESULTS AND DISCUSSION

The results of the various literature reviews and cases are presented here in relationship to the overall research framework (Figure 1). The first two sections focus on planning procedures (top half of Figure 1), while the later sections explore the various definitions of criteria for sustainable sanitation (bottom half of Figure 1). In each section, results from both the global and local context are presented.

4.1 Review of Strategic Planning Tools

A literature review of the strategic planning frameworks that are currently promoted by various development agencies was conducted to gain an understanding of the theory and processes used in international planning. Some frameworks are specifically tailored to sanitation, while others are more general in nature; however there are enough similarities between them to identify a set of generic planning steps. The six main steps in a strategic planning framework are (1) Problem Identification, (2) Define Objectives, (3) Identify Options, (4) Selection Process, (5) Action Plan for Implementation, and (6) Monitoring and Evaluation (Friend, 1992; Ridderstolpe, 2000; Örtengren, 2004; Eawag, 2005; ABD, 2006; IWA, 2006). A comparison of several prominent frameworks shows that the majority of them cover these basic components (Table 3).

The main differences between the frameworks lie in the emphasis that they place on each step. Some organizations emphasize certain basic steps more than others by breaking them into multiple steps in their respective frameworks (e.g. Household Centred Environmental Sanitation (HCES), Logical Framework Approach (LFA), and Sanitation 21). The emphasis on stakeholder input varies between frameworks as well. Frameworks such as HCES specify participatory, bottom-top planning approaches, while others such as the Asian Development Bank (ADB) framework are more general and could be applied in either top-down or bottom-up planning situations. Still others, such as the LFA and Sanitation 21, include identification of stakeholders as a specific planning step (these steps are excluded from Table 1), but are less specific about the continued role of stakeholders throughout the rest of the process. The final step of monitoring and evaluation is also not included in all of the frameworks.

Step 1: Problem Identification

This step defines the context of the current situation and the scope of the problem to be addressed. It is the core of the first question in strategic planning, "Where are we now?" It requires an understanding of the existing sanitation structures, as well as, stakeholder attitudes and institutional realities. Here planners also need to identify external and internal risk factors and assumptions. Useful tools during this stage include Political, Economic, Social, and Technological (PEST) and Strengths, Weaknesses, Opportunities, and Threats (SWOT) analyses (Örtengren, 2004).

Step 2: Define Objectives

This step defines a vision of the future by answering the question "Where do we want to go?" It requires participatory approaches to identify the interests and priorities of the various stakeholders. Planners will need to recognize potential conflicts and competing priorities between interest groups. Reaching an acceptable consensus on objectives often requires compromise and equitable treatment of all interest groups (Hajer & Wagenaar, 2003). The objectives themselves must meet

Table 3: Comparison of Water-Sanitation Planning Frameworks. Here framework terminology can be seen to match the generic planning steps given at left.

Generic Step	Strategic Choice Approach (Friend, 1992)	Open Planning of Sanitation System (OCCA) (Ridderstolpe, 2000)	Logical Framework Approach (LFA) (Örtengren, 2004)	Household-Centred Environmental Sanitation (HCES) (Eawag, 2005)	ADB Terms of Reference (ABD, 2006)	Sanitation 21 (IWA, 2006)
Problem Identification	Shaping of problem structure	Identify problem and boundary conditions	Analysis of context, problem situation, risks and assumptions	Assessment of current status and launch of planning process	Analysis of existing sanitation services	Understand external drivers, existing systems, management capacity
Define Objectives		Terms of Requirement	Objectives analysis	Assessment of user priorities	Identify priority needs	Identify interests of key groups
Design Options	Designing available courses of action	Analyze possible solutions		Identification of options	Identify what options are available	Identify potential systems and management requirements
Selection Process	Comparing actions against significant criteria + Choosing the preferred alternative and how to reach it	Choose most appropriate solution		Evaluation of feasible service combinations		Match potential systems with objectives and management capacity
Action Plan for Implementation			Plan activities and resource use	Consolidate and finalize plans	Develop policy and proposal	
Monitoring and Evaluation			Measure objectives with indicators	Monitoring and Evaluation		

the requirement for sustainable sanitation. They should also be transparent, measurable and clearly stated. Useful tools during this step include participatory assessments, such as Participatory Hygiene And Sanitation Transformation (PHAST) and Community-Led Total Sanitation (CLTS), and setting Terms of Reference (ToR), (Kvarnström & af Petersens, 2004).

Step 3: Identify Options

The next three steps work to answer the question of "How do we get there?" The first part of this is to identify possible solutions. This step relies heavily on the principle of technical flexibility in order to generate a wide range of potential solutions. Potential options should be generated based on a systems perspective of required functionality. Therefore, both centralized and decentralized systems with the potential to meet the objectives should be considered (Ridderstolpe, 2000). It may also be possible to mix technologies that serve different demographic domains, or different waste flows (i.e. greywater, urine diversion, and solid waste), (IWA, 2006). There are a variety of sanitation technology databases that can be explored during this phase for idea generation (i.e. SANEX™ Version 2.0)

Step 4: Selection Process

The selection process includes feasibility studies and critical comparison of the potential solutions. The chosen solution must be matched to technical objectives, affordability, and managerial capacities in the local context. A variety of analytical and decision-support tools exist to aid in these feasibility assessments (e.g. LCA and EIA). Multi-Criteria Decision Support Systems (MCDSS) are also commonly used when there is a need to identify trade-offs between of a variety of information, often including both quantitative and qualitative data, as is the case with sanitation. The advantages of using MCDSS in decision-making are that it can increase transparency, stakeholder participation, and optimization by application of several criteria in the decision process (Wiwe, 2005). The selection process should also be a participatory process

and include stakeholder input on potential designs.

Step 5: Action Plan for Implementation

This step is not explicitly stated in all planning frameworks, however it is the core outcome of the previous steps as it translates the decision process into a direct plan on how to reach the agreed objectives (Örtengren, 2004). The action plan is the actual planning document which details how to implement the chosen technologies and supporting capacity building exercises. It will include a timeframe for objectives to be met, as well as the roles and responsibilities of the stakeholders.

Step 6: Monitoring and Evaluation

Ensuring the success of a sanitation system requires feedback loops and monitoring the system so as to be able to correct any problems that arise (Mugabi *et al.,* 2007). Mechanisms for monitoring and evaluation should be discussed and implemented during the planning process. This includes identifying measurable indicators for monitoring, but also a system of incentives to encourage investment in sanitation and ownership of the outcomes.

4.2 Challenges and Potentials for Sanitation Planning (Paper I)

A more in-depth study of planning frameworks specifically for sanitation formed the basis for Paper I. The paper drew on background information regarding existing planning frameworks and selected three of the most prominent ones for detailed study (Open Planning, HCES, and Sanitation 21). Again, these frameworks were compared so as to identify common steps and planning approaches (Table 4). It is important to note that these steps still follow the six generic steps identified in the review of strategic planning. However, since a smaller number of frameworks were compared and they were more closely related to each other, the level of detail in the common steps increased, allowing for more specificity in the description of each step. Therefore, the following detailed steps were used in this paper:

Table 4: Common steps in the planning frameworks from Paper I and recommended actions.

		Open Planning (Ridderstolpe, 2000)	HCES (Eawag, 2005)	IWA Sanitation 21 (IWA, 2006)
Problem Identification	**Recognition of Planning Domains**	Identification of affected stakeholders.	Differentiate zones within urban environment. Problems should be solved close to their source.	Identify key actors in each decision-making domain.
	Analysis of External Drivers	Identification of boundary conditions.	Assessment of current situation. Enabling environment.	Understand external factors.
Define Objectives	**Analysis of Objectives/Interests**	Stakeholder participation in problem identification. Terms of Requirement .	Stakeholder participation in determination of needs and priorities.	Identify the interests of key groups.
Design Options	**Analysis of Technical Options**	Define sanitation system boundaries. Terms of Requirement.	Define system boundaries and current capacities. Identify a wider range of options.	Analysis of existing systems and new systems.
Selection Process	**Assessment of Management Requirements**	Terms of Requirement.	Assess current capacities and responsibilities of organizations. Need to ensure support from municipalities.	Identify capacities within each domain for implementation and long-term management. Identify management requirements for technical systems.
	Critical Assessment of Feasibility	Choice of most appropriate solution based on Terms of Requirement	Evaluation of feasibility of service combinations	Assess whether systems meet the objectives in each domain. Assess whether systems can be managed in each domain.

(1) recognizing the existence of different domains within the planning area, (2) analysis of the interests driving desire for sanitation services from stakeholders across the domains, (3) analysis of external drivers and local context that impacts behavior in each domain (4) analysis of technical options, in relation to findings on context and criteria, (5) analysis of management requirements for proposed technical options, (6) critical assessment whether the proposed system is fit for the intended purpose.

The frameworks highlight the need for inclusion of a variety of stakeholders in the planning process, as well as a focus on the technical and managerial requirements of the sys-

tems. Stakeholder input is therefore solicited through surveys, interviews, or other participatory tools. In each framework, the planners recognize that different zones of interest groups or economic domains may exist within the planning area. Through recognition of different stakeholder and planning zones, the frameworks also emphasize that different technologies may have to be applied at different levels within the city (IWA, 2006).

The paper also used two specific cases of sanitation planning to illustrate the advantages and challenges of using these methods. The planning frameworks emphasis the need for a participatory approach in order to suffi-

ciently assess the situation and have accurate information for technology selection. However, application of the Open Planning method in Lambarö, Sweden (see appended Paper I), showed the difficulty of reaching a consensus between multiple stakeholder groups, as well as the cost of such an approach in terms of time and resources. In contrast, the sanitation planning project in Ghana illustrates the potential to overcoming such challenges by integrating methods for participatory monitoring, capacity development and social marketing. Together the cases indicate that sanitation planning frameworks have potential to improve the way in which sanitation services are selected and provided to needy populations, but that it is also important to understand the context in which the planning in taking place and if an appropriate enabling environment exists.

4.3 Principles for Successful Sanitation Planning and Implementation

In addition to identifying common procedures and steps within the strategic planning frameworks, the literature review looked at the principles behind the frameworks. Through synthesizing recommendations from international development literature and planning frameworks (Wright, 1997; GHK, 2002; IWA, 2006; Norström, 2007), it was possible to categorize common criteria or approaches necessary for achieving sustainable sanitation projects. This process lead to the identification of five key principles behind successful planning and implementation can be identified: (1) participation, (2) capacity development, (3) economic efficiency, (4) technical flexibility, and (5) feedback (Figure 2). These principles are not logical steps such as those found in the reviews of planning frameworks, but rather ideology that will influence the format of the steps and the decision-making process itself.

Participation

As explained in section 2.1, the need for participatory development approaches is widely recognized. Community participation is championed as a way to develop ownership, community empowerment, and promote de-

mand-driven economic models for sanitation promotion. The participatory approach is often tied to a decentralized democratic process, which seeks to manage problems close to their source. Participatory planning requires recognition of different groups of stakeholders, each with their unique set of priorities and drivers for sanitation improvements (Sharp, 1999; IWA, 2006). Both the formal and informal sectors of society should be recognized (Choguill, 1996) and involved to an appropriate degree (GHK, 2002).
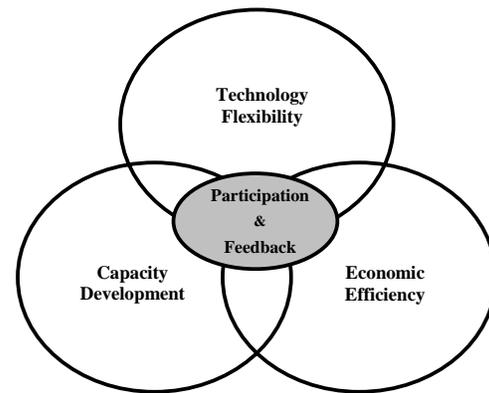

Figure 2: Diagram illustrating interconnected nature of planning principles.

Capacity Development

Two of the main impediments to improving sanitation conditions are lack of demand and lack of maintenance on existing systems. Capacity development both for users and managers of sanitation systems can address both of these problems through educational measures for awareness-raising and social marketing. Health education, social marketing and sanitation promotion efforts will increase awareness of the need for improved sanitation as well as the demand for it. However, it is also necessary to develop the technical and organizational capacity of communities to participate in planning, management and maintenance of sanitation systems once they are in place. This type of capacity development includes the training of politicians, architects, real estate agencies, managers, technicians, masons, and entrepreneurs in the formal and informal sector who will stimulate

the market. Capacity development requires effective communication and information sharing both during and after the planning process. Education and training initiatives should be linking into local and regional learning alliances so that the learning processes will continue after the initial project stimulus is gone (Moriarty *et al.,* 2005). By working closely with institutions and local communities during capacity development exercises planners will also be supporting participatory processes.

Economic Efficiency

Increasing economic efficiency requires a more holistic approach than the traditional one that is based on demand projections from demographic and income analyses. Marketing of sanitation services needs to respond to realistic assessments of demand, but should also be affordable for all levels of users (Wright, 1997). This will require the unbundling of investments, both geographically and by hardware components, so that services can more easily be adapted to meet demand. The demand-based economic models are therefore closely linked with both participatory approaches and capacity development since they rely on consumer input and social marketing strategies. The process of creating an informed public demand and listening to that demand at the planning level greatly increases the chances that the services offered will be appropriately matched with affordability (GHK, 2002). However, offering affordable technology will still need to be backed by equitable credit and financial arrangements that encourage investment through reduced up-front costs and cost recovery.

Technical Flexibility

The key to responding to consumer needs and making sanitation affordable for all is to consider a wider range of technical options. This often requires taking a wider view of sanitation itself, by considering the linkages with water supply and solid waste systems (GHK, 2002). Sanitation technology can either integrate these systems (i.e. waterborne sewerage and land filling of fecal sludge) or separate them (i.e. on-site dry toilets and di-

rect recycling of nutrients). Planning for the configuration of the systems should also consider the most appropriate level of service provision; large centralized networks, neighborhood systems, or household level. The advantages and disadvantages to each type of technology and system structure must be evaluated for the local conditions and matched with existing demand, managerial capacity, and user needs (IWA, 2006). Increasingly, technical flexibility means considering the functionality of the sanitation system rather than the technology itself.

Feedback

Closely linked to the process of participation is that of soliciting and responding to feedback. The feedback loop is an essential component for guiding the planning process and ensuring that the other principles are being met. The entire planning process should be linked in an iterative and participatory way, so that technical and socio-economic issues are assessed together throughout the process (Norström, 2007). Both the planning and implementation processes should take manageable steps towards intermediate objectives (GHK, 2002). Using such an incremental approach with feedback loops in between steps increases incentives to reach immediate goals, and keeps the project on track through consistent evaluation of progress (Friend, 1992; GHK, 2002; WSP, 2005).

4.4 Criteria in a Life Cycle Assessment of Sanitation Projects (Paper II)

The second paper in this thesis (Paper II) also studied sustainability criteria, although this time within the context of a life cycle assessment (LCA) framework. The result of this approach was a matrix assessment tool similar to that used in streamlined LCA (Graedel, 1998) that includes recommendations and guidelines for improving the effectiveness and viability of water and sanitation development projects. The matrix framework is defined by five life stages and five categories of sustainability criteria (see appended Paper II). The life cycle stages and sustainability factors form the axis of the matrix assessment tool that was subsequently

developed. Within each matrix element of the 5x5 matrix there are four recommended actions for sustainability, complemented with extended guidelines on how to meet these recommendations (McConville, 2006). These guidelines were derived from a review of best-practice literature (Cairncross, 1992; Pickford, 1995; Peace Corps, 2000; 2002; CIDA, 2002; EWB, 2005) and personal experience in development work.

The project life cycle was identified through a literature review of project documents from organizations such as the United States Peace Corps, German Development Service (DED), and Engineers Without Borders (EWB); and from general organizational and management theory (Wideman, 1991; Biggs & Smith, 2003). The life cycle of water and sanitation development projects can be divided into five stages: (1) needs assessment, (2) conceptual designs and feasibility studies, (3) design and action planning, (4) implementation, and (5) operation and maintenance. It is interesting to note how well these life stages resemble the steps used in planning frameworks even though they were drawn from a different set of literature (Table 5).

A similar literature study was conducted to define the criteria dimension of the matrix. The starting point for defining sustainability

Table 5:Comparison of steps used in planning literature versus those used in project management

Project Planning	Project Management
Problem Identification	Needs Assessment
Define Objectives	
Design Options	Conceptual Designs & Feasibility
Selection Process	Design & Action Planning
Action Plan for Implementation	Implementation
Monitoring & Evaluation	Operation & Maintenance

factors in this study was the standard definition of sustainable development, which recognizes three pillars of sustainability: economic development, environmental protection, and social development (United Na-

tions, 2002). Although environmental and economic sustainability are consistently defined throughout the literature, social sustainability includes a variety of widely varying factors (Estes, 1993; CIDA, 2002; Peace Corps, 2002; EWB, 2005; Dreyer, 2006). In order to clarify what is meant by this category, it was broken in to three factors for the purpose of this study: socio-cultural respect, community participation, and political cohesion. These three factors were determined through a cluster analysis of different social criteria from published literature and personal experience. Community participation aims to foster local ownership and managerial skills, while socio-cultural respect attempts to integrate the project into the existing fabric of society. The remaining social factor, political cohesion, accounts for the larger political environment in which the project takes place. It recognizes the call for coordinated development efforts by the international development community and the role that local politicians can play in project success. Therefore the five sustainability factors used in this assessment tool are: (1) socio-cultural respect, (2) community participation, (3) political cohesion, (4) economic sustainability, and (5) environmental sustainability (Table 7).

4.5 Perceptions of Local Sustainability (Paper III)

Finally, the interview study (Paper III) examined sustainability criteria from the perspective of actors active in sanitation interventions in Burkina Faso and Mali. An important observation from the interviews was that, although the international community tends to use the inclusive definition of sustainability defined in the background section of this thesis, among the local actors a simpler definition is often used, i.e. "*sustainable sanitation systems are ones that will endure and continue to provide benefits after the initial stimulus, support, and funding (NGO project, awareness campaign, subsidy, etc.) have ended.*" From this perspective, the interviewees stress the need to reinforce behavior change, develop local capacities and establish long-term financing mechanisms.

Table 6: Criteria for sustainable sanitation identified by interviewees in Burkina Faso and Mali

Category	Description
Socio-cultural	
Capacity Building	Organizational/Management skills,
	O&M performance (proper usage),
	Training for M&E ,
	Technology appropriation
Institutional Communication	Communication plan between institutions,
	Involvement of key leaders,
	Responsibility distribution
Laws and Policy	Functional Legal Framework,
	Institutional policy and politics,
	Compatible with decentralization
Cultural Acceptability	Compatible with local priorities and needs,
	Stigmas/perceptions of waste,
	Cultural value systems (dignity, gender roles),
	Adapt to local context (social calendar, priorities, social strata)
Awareness-Raising for Behaviour Change	Knowledge exchange/education for informed choice ,
	Communication,
	Creating demand and awareness,
	Motivating change (authorities, early adopters),
	Allowing time for behaviour change
Economics	
Affordable	Based on total life cycle costs ,
	Willingness to pay,
	Capacity to pay
Marketing	Creating demand,
	Showing the benefits/value of sanitation,
	Offering service packages,
	Creating markets, businesses, and jobs
Financial Management	Financing mechanisms (credit, subsidy, taxes),
	Cost recovery,
	Stability of financing,
	Capital and O&M costs,
	Locally available resources
Technical	
Adaptation to Local Community	Environmental constraints,
	Local capacity to replicate technology,
	Local resources (human/material) available for O&M
O&M Requirements	Local capacity/willingness to perform O&M,
	Convenience/ease of maintenance,
	O&M requirements appropriate in cultural context
Process	
Participation	Participatory approach ,
	Local organizations/leaders involved,
	User Choice, Ownership
Planning	Feasibility/appropriate technology,
	Life cycle perspective (especially considering O&M)
M&E	Feedback and follow-up,
	Flexible iterative approach

This view can be seen in the types of criteria they identify for sustainable sanitation: (1) socio-cultural, (2) economics, (3) technical, and (4) process (Table 6). The importance of process criteria in particular can be seen in how closely they link to methods for communication, capacity building, empowerment, understanding of cultural issues, and discussions leading to informed user choice (see appended Paper III).

The second part of this paper compared the results of the interview study with a review of how criteria for sustainable sanitation technologies are cited in literature. The criteria commonly found in international journals and conference papers tends to be more technically oriented and are often used as inputs into LCA or EIA tools. These criteria are grouped into five main categories: health, environment, technical, economic, and socio-cultural factors (Balkema *et al.,* 2002; Dunmade, 2002; Bracken *et al.,* 2005). It is interesting to note the focus on health and environmental criteria factors, since they were rarely mentioned related to sustainability in the interviews of local actors. This difference may be due to the different definitions employed for sustainable sanitation. Perhaps, by using the local definition, it is assumed that a functioning, sustainable system will provide these benefits, and that by fulfilling the other criteria, specifically technical ones, health and environmental improvements will be achieved.

Finally, Paper III reviews two cases of local sanitation planning processes to examine how the local actors are putting different criteria to use in the field. The first case was the strategic sanitation plan for Ouagadougou, Burkina Faso (PSAO) and the second was the planning process used by the international NGO, WaterAid, to assist municipalities in reaching water and sanitation targets. Both organizations integrate socio-cultural, technical and process criteria into the planning approach through the use of participatory planning techniques with technical baseline studies. However, neither has completely succeeded in achieving a balanced portfolio (refer to appended paper for specifics). WaterAid focuses on capacity develop-

ment but makes fewer provisions for technical and economic issues. In contrast, technical and financing measures are more clearly defined by the PSAO, although they still struggle with O&M issues and extending the program to reach all stakeholders.

5. CONCLUSIONS

The objectives of this thesis were to establish the background theory for future case studies and to begin assessing the assumptions of a knowledge gap between the global sanitation frameworks and local planning conditions (Section 1.3). It focused on establishing the global context that forms one side of the research framework (Figure 1). In general, there is close agreement on methodology and processes recommended by international planning frameworks (Tables 3-4). Literature reviews of sanitation planning and implementation experiences show a trend towards process-oriented approaches, holistic thinking, and criteria based decision-making. The focus of many of these frameworks is on functionality and managerial requirements for sanitation systems instead of purely on the technology itself (refer to Paper I and Table 4). This approach allows decision-makers the flexibility to consider many technical options that have the potential to meet the requirements defined by the stakeholders, but also increases the information and human capacity needed in the planning process (Paper I). Although evaluation of the research assumptions requires information from both the local and global context, the information gathered here provides one side of the equation for answering *Assumption 3.*

Although the global context appears consistent with regard to planning methodology, there is less agreement between the different studies relating to sustainability. The summary of categories of sustainability identified through the various studies employed in this thesis (Table 7) clearly indicates that different perspectives exist regarding definitions of sustainable sanitation and criteria for achieving it. These results lend credibility to the first assumption that stakeholders in different

Table 7: Comparison of categories of sustainability found within the context of this research.

	Planning Principles	Project Guidelines (Paper II)	Interviews (Paper III)	Technical Literature (Paper III)
Economics	x	x	x	x
Technical	x		x	x
Socio-cultural			x	x
Socio-cultural Respect		x		
Community Participation*		x		
Political Cohesion		x		
Process			x	
Capacity Development	x			
Participation*	x			
Feedback	x			
Health				x
Environment		x		x

Note that participation can be classified in both social-cultural and process categories

contexts have different perspectives regarding this terminology.

Therefore, the first phase of this research project has succeeded in assessing half of the original assumptions. The second phase will use case studies to investigate local planning practice and perspectives regarding sustainable sanitation in order to answer the remaining questions related to *Assumptions 2-3*, and make recommendations for improving adaptation of planning strategies for bringing sanitation to scale. The case studies will investigate the local planning and decision-making practices, management capacity of the organizations implementing projects, and the project results relating to user acceptability and preferences. They will focus on gathering the information necessary to verify *Assumption 2* and finalize assessment of *Assumption 3*. In addition, the case studies will be able to gather responds from a larger variety of stakeholders, so as to substantiate the conclusions around *Assumption 1*.

In summary, the overriding theme that can be seen throughout this study is the recognition that improving the global sanitation situation is not just a technical fix to be achieved through infrastructure development, but rather a process requiring learning, planning, and behavior change. From the findings in this thesis, it can be argued that achieving sanitation coverage targets set by the MDGs, and motivating the corresponding behavior change requires additional tools based on participation, social marketing, and process approaches for planning, capacity development, and feedback.

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