water for a few
a history of urban water and sanitation in East Africa

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preface

Why a study on the history of urban water and sanitation in Africa? Doesn't the continent offer enough problems to study in the present, without having to spend years of research digging in the problems of the past? Well, after having worked with present day's problems of water and sanitation in sub-Saharan Africa for six years, it dawned on me that maybe the current shortcomings had a connection with the past. Perhaps some of the structural deficiencies and the general inability to cater for the most vulnerable in society had their roots in things that took place long before. Myself coming from an engineering background, I could see that it was not lack of technical solutions that had left so many poor townspeople in constant want of pure water, good health and dignity. There had to be other hidden causes, and not only the economists' mantra of state failure. When I got in contact in 2002 with Professor Arne Kaijser at the Royal Institute of Technology (KTH), I realised that History of Technology was the academic field that could help me unveil some of those hidden causes. Two years later we received funding from Sida/SAREC and u-landsforskningsrådet for a research project called “The evolution of institutions for urban water and sanitation in East Africa”. Thanks to the research grant, I could take up my doctoral studies at KTH in April 2005, first as part-time studies while combining with my job as adviser at Sida’s Urban Development Division. I can say that this has been, professionally, a most inspiring and progressive period and I think combining research and more applied work is mutually beneficial. My personal scientific ideal is that science should be applicable, or at least it should emanate from contemporary challenges in society. Unfortunately, much research is being made without identified avenues for putting new knowledge to work. There is all too often a gap between the academicians and the practitioners, between those whose quest is knowledge, and those in pursuit of action. I hope my contribution will be able to fill a small part of that gap. If not, I have at least contributed to the mapping of the history of urban water and sanitation in East Africa, although this story still remains largely untold.

I should have achieved none of this, however, without the support and assistance from others. My biggest Thank You goes to my greatest fan, my wife Lova. I am also grateful to my former boss at Sida, Pelle Persson, who encouraged me in my research plans right up from day one. Other colleagues at Sida that gave valuable input and helped me
along the way were Mikael Söderbäck, Ingvar Andersson and Jonathan Francis. I am of course indebted to my supervisor, Professor Arne Kaijser, who early on welcomed me to his department and then has been extremely supportive and encouraging all along. I am also grateful to my co-supervisor Dr. Jan-Olof Drangert at Linköping University, and to Dr. Johann Tempelhoff at North-west University in South Africa, Dr. Gordon McGranahan of IIED in London, Dr. Ezekiel N Nyangeri at the University of Nairobi and Dr. Marianne Kjellén at Stockholm University. Co-operating and exchanging ideas with all of you has been a tremendous help. Thanks to Eldridge Adolfo, for checking some of my Swenglish, and to all my colleagues at KTH's division for History of Technology and Science who provided a highly stimulating environment that has meant a lot to me. Furthermore, a historian is not much without his data, and I owe a great deal to all the helpful people I have met while touring the archives around the world: Brian, Alan and Moses at the University of Nairobi, Antonio Lourenco and the other staff at the library of Nordiska Afrikainstitutet in Uppsala, and all the helpful people at the National Archives in London and Nairobi. Thanks, all of you!

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East Africa

Map of East Africa. Source: www.lib.utexas.edu/maps
Urban water and sanitation: the background

Wherever human settlements exist, people have to arrange for provision of water. A reliable water supply is simply indispensable and throughout the history of humankind, there has always been a close connection between water and civilisation. In the urban setting this becomes even more obvious, as the denser population puts higher pressure on local water resources through water use and through increased risk for pollution. In urban settlements, people have simply been forced to find ways of organising collective systems to manage water. Economic activities and the daily life of the people in the urban centres have generated flows of water and waste products, which also have necessitated collective systems for taking care of the residues in order to protect public health and the water resources.\(^1\) With the rapid urban growth of the industrial epoch, the sanitary situation became appalling in cities such as London and Paris.\(^2\) The city of Stockholm, which nowadays prides herself for having the cleanest of water and urban environment, was among those with the worst sanitary conditions in Europe.\(^3\) Before 1861, when Stockholm’s piped water supply was opened, the city was repeatedly ravaged by cholera outbreaks and the mortality was so high that reportedly it exceeded nativity.\(^4\) By the second half of the 19\(^{\text{th}}\) century, the cities of Europe were busy creating collective systems for water supply and sewerage.\(^5\) Water and sewerage networks were being built at large public expenditure and sometimes after great political bickering, negotiation and pressure from the public.\(^6\) Today, with universal, cheap and reliable water and sewerage services of high quality throughout the cities of Europe, the history of these fundamental urban service systems is easy to forget.

If we turn attention from Europe and the industrialised world, towards the countries in sub-Saharan Africa, the present situation is very different indeed. According to the United Nations, in the year 2000 about 85% of the urban population had “access to improved

\(^1\) Tarr 1996, p 9.  
\(^2\) Goubert 1989, pp 41-51.  
\(^3\) Gullberg 1998.  
\(^4\) ibid; Cronström 1986, p 18.  
water supply and sanitation” in Africa.7 However, these figures are often based on very dubious data.8 To start with, the definition of ‘access’ is first and foremost a geographical measure. If an urban household has a public standpipe within 100 m from home, then they are considered having access to an improved water supply, regardless if they have to wait for hours at the tap, or if the tap is out of order. On average, only 43% of the urban households have a connection of their own for water, and not more than 18% are connected to the sewer network.9 “Improved water supply” means that the water is protected or treated in one way or another although this provides no guarantee that the water is safe. At the same time, cities in Africa are growing faster than anywhere else, which makes it difficult for the public service systems to keep in step with urban growth.10 The situation has therefore deteriorated over time. Those who can access the public systems have to spend more time now than thirty years ago, queuing for water at the public standpipes, or if they have a connection in their homes, service has become less reliable.11

Looking at the African situation from the outside, it could be tempting to seek explanations for the grave situation in such factors as scarcity of water and lack of funds. Indeed, in some areas of Africa, water scarcity is a real problem. And yes, poverty is rife in Africa. However, these generalisations will not lead us to a correct interpretation of the problems, which are much more complex. As an illustration, I relate to my first visit to the city of Kisumu in 2001. Kisumu is the third largest town in Kenya, situated on the shore of Lake Victoria. The town has a water supply and sewerage network, first established in the colonial period and later on expanded largely with assistance from donors. But a large share of the population lives in unplanned settlements with very limited access to piped water and under very poor sanitary conditions. The people living in these low-income areas instead have to buy water from water kiosks and private water vendors. But even the more wealthy customers with access to the piped supply (including myself) received only erratic and intermittent supply of water at the time of my visit. The sewage from one half of the town was not coming through to the treatment plant, as the pumps had been stolen from the sewage pumping station, and the untreated effluent ran straight into the lake. At any rate, water

8 Satterthwaite 2003.
10 Fay & Opal 2000.
scarcity would hardly offer a plausible explanation to the unsatisfactory water supply in Kisumu, as we are talking about a town sitting on the second largest freshwater reservoir in the world. And the unequal distribution of services in Kisumu could not only be attributed to the low income levels: the poor people in the slums pay much more for each litre of water than the more wealthy do. As this example illustrates, problems with water and sanitation in Africa cannot easily be reduced to only a matter of scarcity of water and wealth.

A key to understand the situation is to look at public institutions and their role in service provision. Today, public service systems for water and sanitation are not, in essence, public in many African countries. These systems are mainly serving the middle and upper class in urban societies while the poor are left to small-scale private providers. Often these providers belong to the “informal sector” and buying water from these informal providers is generally much more expensive than buying from the public water supplier. In Dar es Salaam in Tanzania, the water that the poor without a water connection buy from the water vendors costs up to 15 times what the better-off people pay to the public water company.

In order to improve the situation, many African countries have been carrying out institutional reforms of service provision for water and sanitation in recent years. Such reforms – especially where they have included elements of privatisation - have been subject to heated international debate. However, the reforms and the accompanying debate are characterised by a near total lack of historical perspective. Sometimes, the history of urban water supply and sanitation in Europe and the USA are promoted as sources of inspiration and learning for the developing countries. Without doubt, such historical comparisons and analogies may be important to bridge the seemingly disparate experiences and world-views of North and South. However, putting the reforms in the context of the African countries’ own history, and tracing the historic trajectory of these systems, is virtually never done. One plausible explanation for this lack of local historical perspective is that there has been so little research done on

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12 Collignon & Vézina 2000.
13 Kjellén 2006, p 173.
the history of the urban water and sanitation systems in developing countries. For a long time, the historians of technology have neglected Africa, and other disciplines have instead made more headway for exploring the interconnectedness of society, technology and time. It is my argument in this thesis that institutional reform cannot be carried out in a historic vacuum. Only with a proper knowledge of the starting point, as well as of the long-term social and technical processes involved, can sustainable improvements be made. The history of urban water and sanitation in Africa therefore needs much more attention.

This thesis aims to make a contribution to the mapping of the history of urban water and sanitation systems in Africa and to contribute to an improved understanding of how these social and technical systems evolve in a historical context. Hopefully such knowledge can feed into the ongoing processes of reforming service systems in order to make them more sustainable and more equitable. This licentiate thesis reports on the first phase of a doctoral research project called “The Evolution of Institutions for Urban Water and Sanitation in East Africa”. The project is based at the Royal Institute of Technology in Stockholm, Sweden, and is funded by the Swedish Government through Sida/SAREC. The project is carried out in co-operation with researchers in East Africa.

There are two main parts in this licentiate thesis. This framework narrative forms the first part, while the second part is a compilation of three separate articles, attached as an appendix. The framework narrative has the following structure:

Chapter two defines the research problem more in detail. Chapter three offers a more comprehensive discussion on related research and I there also outline the theoretical framework for my studies. The fourth chapter summarises the three articles underlying this thesis. In chapter five I try to pull the three articles together through a synthesis of the findings and arrive at my main conclusions. In the final chapter I discuss my conclusions in the wider context of policy implications and future research.

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Staudenmeier 2002; Arnold 2005.
Research Problem and Definitions

The research problem for my thesis is defined in the following way:

*How is history constraining and influencing the space of decision today in the public sphere, regarding provision systems for urban water and sanitation services in East Africa?*

Certain definitions and delimitations are needed here:

‘Space of decision’ refers to the options of policies and strategies that governments may implement to achieve their objectives within the public realm of urban water supply and sanitation, including institutional, organisational and technological options. If history is without significance for the problems experienced today, then the space of decision is only constrained by limitations in the present, such as finance, capacity or technology. But if history matters – which I will argue it does – then the available policy options are framed by decisions and processes earlier in history, and policy-makers must be aware of the influence of history in order to develop sustainable provision systems.

A ‘provision system’ in my interpretation is an organised way of delivering services for which there is an articulated demand. With this wide definition I have, for the purpose of this thesis, narrowed the scope of the study to the formal and state-controlled service provision systems. I am aware that informal service provision is a very important complementary system and any attempt to make comprehensive historic analysis regarding the status and coverage of services at the consumer level in East Africa will need to include informal provision systems. Instead of focusing at the consumer level I have deliberately focused on the institutional and organisational level (see next chapter for a definition of these terms). Obviously, also technology features in my study as the interface between institutions and organisations on one hand, and the consumer on the other. Where I have used data at the consumer level, I rely on the work of other researchers and public authorities etc. Given my research problem, I believe this approach can be justified.

With ‘urban water and sanitation’ I mainly refer to domestic water supply and the removal of excess (used) water and human faeces in
urban areas. What constitutes an ‘urban’ area arouses debate from time to time, but for the purposes of this thesis I do not see the need to make an exact definition. Solid waste management in general is not part of the scope, however, I have not restricted myself to only study water borne sewerage but also other sanitation services.

I have limited my studies to the present national states of Uganda, Kenya and Tanzania, representing the parts of East Africa under substantial British influence during the colonial period. These territories were all under British administration between 1919 and 1961 and therefore they are assumed to share features deriving from a common colonial legacy. In this licentiate thesis I have manly studied Kenya and Uganda while in-depth studies of Tanzania may be undertaken in a subsequent phase. Clearly, colonialism and international development aid have influenced the development of water supply and sanitation in East Africa and where relevant, I have included these aspects. However, my studies have emphasised the local perspective rather than the global, as I think this has been a more adequate starting point.

The time boundaries for my studies have been broadly defined to the 20th century. The period starts with the establishment of the first piped urban water supply systems in East Africa and goes up to the enactment of institutional reforms for public water services, currently going on in all three countries.

\[\text{**Footnote:** for a discussion of definitions of urban areas see Tannerfeldt & Ljung 2006.}\]
Theoretic framework and method

In this chapter I will invite the reader to share with me the literature and theoretical framework I have used to contextualise and analyse the history of urban water and sanitation in East Africa. There are two academic disciplines with which I would like to associate my studies. The first one is obviously the history of technology. The second discipline is that of economics and more specifically a tradition often referred to as New Institutional Economics. In my opinion these two disciplines are mutually benefiting from, and complementing, each other in a very interesting and fruitful manner. At least when the objects of study are public service systems with a dominant technical component, such as public infrastructure, the full potential of a cross-fertilisation between these two disciplines is still to be discovered despite some innovative pioneering work. My modest ambition in terms of theoretical contributions lies in showing the potential of this combination and hopefully being able to further the understanding of the problems at hand.

As mentioned in the introduction, the industrialising countries in Europe spent vast amounts of capital, time and other resources on establishing large networked systems for water supply and sanitation in their cities. This historic process has been extensively studied for many industrialised countries. Many researchers link the establishment of water and sewerage networks with the sanitary movement from the mid-1800s, where public health and hygiene was a key driving force. Although health reasons dominate as a motive in the literature, water for industrial purposes and for fire fighting were also important in some cities. But not until the end of the 19th century, with the germ theory, was there a proper understanding of the pathways of disease. Before that, it was generally thought that disease was transmitted through the foul odours; the so called ‘miasmas theory’. The solution lay in flushing out the faeces in a closed pipe system and thus the modern sewer was born.

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18 see e.g. Ostrom, Schroeder & Wynne 1993; Kaijser 2002.
popular and soon it was a sign of high status and social enlightenment
to have a Water Closet at home. As argued by Goubert it was not only
a matter of increasing service production; the establishment of the
large-scale systems was also accompanied by a major change in social
attitudes, behaviour and norms.\textsuperscript{22} The establishment of the citywide
networks also required a number of social and institutional obstacles
to be overcome in the second half of the 19\textsuperscript{th} century. First, there had
to be an administrative platform for citywide administration,
something that sometimes lacked. From the need of a public sewer
system sprung the metropolitan board of London in 1855, the first
institution to co-ordinate activities on a citywide level in what then
was the world’s largest city.\textsuperscript{23} Managing these large projects was made
easier by a new and stronger role of local governments also in
countries like Sweden and USA.\textsuperscript{24} The establishment of large-scale
municipal infrastructure also prompted the development of new
financial instruments such as municipal bonds in the mid-1800s.\textsuperscript{25}
Furthermore, to enact such bold collective undertakings as citywide
water or sewerage networks, the processes needed backing from the
polity and key civil actors. Coalitions within the city had to be formed
in order to muster sufficient political and financial support. Hence, in
parallel with investing capital in physical infrastructure, these
investments assumed the formation of social capital to bond together
the citizens in such collective undertakings.\textsuperscript{26} It should be stressed
that services in European and American towns were far from
universal in the 19\textsuperscript{th} century and these cities also had their service
segregation and their slums. It would take time and much social strife
before all citizens could enjoy access to safe water and adequate
sanitation, also in what is today the developed world.\textsuperscript{27}

After this brief overview of the history of large-scale water and
sanitation systems in the industrialised countries, it should be clear
that there are important social dimensions of these technical systems.
Within history of technology there is one school of thought that
concentrates on Large Technical Systems (LTS). The LTS approach
owes much to the path-breaking study “Networks of Power” by
Thomas P Hughes. In his study, Hughes analysed the establishment
of large-scale systems for electricity in USA and Europe in the late

\textsuperscript{22} Goubert 1989, pp 255-257. \\
\textsuperscript{23} Halliday 2001. \\
\textsuperscript{24} Kaijser 1986, p 177; Melosi 2000, pp 120-121. \\
\textsuperscript{25} Cutler & Miller 2004. \\
\textsuperscript{26} Szreter & Wollcock 2002. \\
\textsuperscript{27} Tarr 1988; Hallström 2002, p 203.
1800s and early 1900s. Hughes identified a number of key phases in the development of an LTS. The initial phase of establishment requires development efforts where entrepreneurs and innovators are important in order to form the system in its local economic, physical and social setting. In the next two phases systems are transferred to other physical and social contexts and – where transfer is successful – they are rapidly expanded. When systems have grown to a certain stage, the development process is characterised by what Hughes labels ‘momentum’. Hughes uses the analogy of ‘momentum’ from the world of physics: a certain mass is built into the system, which has both a velocity and a direction. In this phase, systems therefore tend to continue to expand in a manner of ‘more of the same’. Finally, the system enters a mature phase where it expands more slowly and where optimisation of the system’s economy and management issues prevail. 28

A central assumption in the LTS-approach is that these systems cannot be reduced to technology alone: they require organisation and they require institutional framework, with which they reciprocate. Given the large physical scale and the massive capital invested, the state generally has had an important role in the history of many LTS. But Hughes also showed that other factors in society have been decisive, factors such as the structure of the economy, how capital markets work and cultural aspects. 29 Therefore, LTS are often referred to as ‘socio-technical systems’ where society and technology interacts and mutually define and support each other. 30 I will henceforth regard water and sewerage networks of citywide scale as an LTS. 31 Moreover, the concept of socio-technical systems, where institutions, organisations and technology interact, is central to my studies.

These large-scale technical systems, such as citywide water and sewerage networks, are highly resistant to change, especially in the latter phases when they have gained ‘momentum’. 32 In my second article I have described this resistance to change as ‘inertia’, a term which is also borrowed from physics. 33 Inertia is a property that will

28 Hughes 1983.
29 ibid.
31 This view is also supported by Kaijser 2003.
make a socio-technical – or any other - system slow to respond to external forces. The concepts of momentum and inertia are closely related, and defining the difference might look like splitting hairs. However, it may be worthwhile to note a small distinction based on the classic physics: momentum is measurable in terms of direction and velocity, whereas inertia is a property that is not depending on movement. Whereas the momentum for a certain system may be zero, it may still exhibit inertia due to its mass, and hence offer resistance to change from the status quo. In my context, even an old run-down water supply system will be subject to inertia, whereas the momentum of such a system is more difficult to detect. I have therefore found it more relevant to use the concept of inertia in my studies.

Also the more abstract components associated with large-scale technical systems, such as technical knowledge, design standards and norms can be subject to inertia. Design standards and norms are in essence codified knowledge about the problems and their “appropriate” solutions, and such knowledge tend to develop in a paradigmatic manner. Although there may be more than one way to solve a problem, one solution tends to get a dominant position that cannot easily be challenged. In my study, I will use the paradigm concept to denote the domination of one technical approach – or ‘culture of technological systems’, as Hughes put it – over other technical approaches.

In certain stages of the development of an LTS, as mentioned, the systems tend to be transferred to new settings. The systems may – or may not – become successful, depending on the social context in the new setting. In this aspect, the LTS approach connects to theories of technology transfer. Transfer of technology for water and sanitation between industrialised countries has been dealt with in the literature. The body of literature on transfer of these technologies to the developing countries is much smaller, and for Africa there are

34 Chatzis 1999; Ertsen 2005.
35 This is a very simplified definition of the paradigm concept in comparison to that originally developed by Thomas Kuhn (1962), but I believe this definition has its merits and explanatory value in my context; On culture of technological systems, see Hughes 1983, p 363.
36 Hughes 1983, p 77-78.
37 see e.g. Isgård 1998 pp 13-14; Melosi 2000, pp 58-65; Bertrand-Krajewski 2005.
only a few accounts. When dealing with urban water and sanitation technologies in East Africa, the transfer of technologies from Europe is overtly present and cannot be completely ignored. A correct understanding of how public objectives and preferences of certain user groups have been translated into service systems in the colonial setting require at least to acknowledge the presence of a transfer process from the central power to the colonies. In the pioneering work of Daniel Headrick technology is given a central role in empire building: technology is not something that diffuses out through colonial channels of command, but is a prerequisite for empire and colonial control. Also the influential essay of Edquist & Edqvist on social carriers of technology has served as a source of inspiration for understanding how water and sanitation technology has been implanted in the colonial setting. I do acknowledge that water and sanitation systems in East Africa embody a legacy of colonialism and technology transfer and I have dealt with some aspects of technology transfer in my articles. However, I have opted not to heavily emphasise technology transfer or post-colonial theory for my research problem. In doing so, I may attract criticism from those who prefer to see Africa’s situation only from a perspective of post-colonialism, as well as from proponents of technology transfer studies. Nevertheless, I believe my research problem, at this stage, can be better analysed using other theories. The reconstruction of East African history should start from its core: from actors and processes at national and local level, rather than from a structuralistic view from the outside.

When it comes to historical studies of the water and sanitation systems in their colonial and post-colonial context, the body of literature is awkwardly thin. The recent history of urban water and sanitation services in East Africa was mapped in the widely acclaimed Drawers of Water II study, which essentially was a follow-up study of the pioneering work of Gilbert F White, David J Bradley and Anne U White from the 1960s. Both these studies are more within the social and medical science tradition, but provide very important insights into the current service status at a consumer level as well as its development over time. Within the field of history, there are few studies available, although more are constantly trickling in. Headrick, in his book “Tentacles of progress”, discuss urban planning and

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38 For transfer of urban sanitation to West-Africa and Hong Kong, see Headrick 1988; large-scale hydropower in Tanzania, see Ohman 2005 and forthcoming; for transfer of iron-making technology to colonial India see af Geijerstam 2004.


sanitation in Africa in a colonial context, where urban systems for service and settlement are formed to support racial segregation. In recent research, there is an emphasis on the establishment phase of the large-scale systems and their relation to public health, during the colonial time in the end of the 19th and early 20th centuries. The studies of Cape Town by Kevin Wall and of Saint-Louis-du-Senegal by Kalala Ngalamulume serve as good examples here. Ben Page has studied how historical narratives on water are used in contemporary debates in Cameroon.\textsuperscript{41} For East Africa there is very little history written on urban water supply and sanitation, although historic aspects are sometimes found in studies that primarily have a more contemporary focus.

Turning now to my second theoretical platform, I must start with a caveat: I will make no attempt to define what the term ‘New Institutional Economics’ (NIE) embodies, or give an exhaustive account of which scientists that should rightly be associated with this school of thought. A key thematic interest in the NIE is exchange - economic or other - under imperfect market conditions, thus directing focus of the studies to collective action and the role of institutions. A central problem is that of incentive structures, as eloquently pointed out by Garret Hardin in his famous article “The tragedy of the commons”. If the incentive structure surrounding a commonly held resource promotes self-interest and discourages cooperation, the whole system will be under-optimised. The classic example is that of over-grazing of cattle on commonly owned pastures. Difficulties in controlling and allocating grazing ground efficiently may result in individuals acting to secure short-term private economic benefits, with over-utilisation and ecologic collapse as the ultimate result. In such a system, all actors stand to lose their productive resources in the end.\textsuperscript{42}

These types of collective action problems have been at the core of the work of the renowned NIE scholar Elinor Ostrom. Ostrom has studied the incentives that derive from institutional structures and transaction costs in collective action problems. Transaction costs are the costs relating to an exchange process, be it of material or immaterial type, and are closely connected to information access. In the example of the commonly held grazing area, transaction costs include acquiring and collecting information about the physical

\textsuperscript{41} Wall 2005; Ngalamulume 2005; Page 2005.
\textsuperscript{42} Hardin 1968.
properties and carrying capacity of the area. Furthermore, taking the stock there for grazing and looking after them entails a cost. If a collective decision is made on how the grazing should be allocated within the group of herders, this “contract” must be enforced and followed-up so that no one will breach the contract. Such contract enforcement will also entail a transaction cost. The social purpose of institutions is, according to Ostrom, to reduce the transaction costs for collective action and to alter the incentives structure of exchange in order to enable more efficient resource allocation.\textsuperscript{43}

At this point it will be appropriate to define the term ‘institution’. ‘Institutions’ in society must be seen as separate from ‘organisations’ according to Douglass C. North, another influential scholar associated with the NIE. Whereas institutions make up the rules in society, organisation means how actors are structured and grouped. Institutions can be both formal, such as legislation and regulations, and informal such as beliefs and cultural norms. Institutions are also essential for the political exchange where people transfer power and resources to a ruler in exchange for certain collectively provided services. This whole ‘institutional scaffolding’, to use North’s term, evolves in societies over time with the purpose of reducing the transaction cost and ultimately to reduce uncertainty in our environment, both the physical and the social environment. However, whereas formal rules can be changed with the stroke of a pen, informal rules and beliefs take much longer time to change. Furthermore, institutional change always involve individuals and organisations, and as organisations depend on an established institutional structure for their existence, there will always be resistance to change from individuals with vested interests in the organisations. Therefore, societies show ‘path dependency’ where old institutional patterns and preferences will persist even when societies – at an external glance – should be ripe for change.\textsuperscript{44}

As the NIE centres on issues of collective action and efficient resource allocation it also touches on the area of public sector economics from which have evolved the Public Goods theory. Certain areas of public sector economics, especially those dealing with public utilities, infrastructure and welfare services, essentially stem from collective action problems under imperfect market conditions. Utilities or

\textsuperscript{43} adapted from Ostrom 1990; Ostrom, Schroeder & Wynne 1993; Ostrom & Walker 1997.
\textsuperscript{44} adapted from North & Thomas 1973; North 1990, 2005.
services that are non-excludable, i.e. for which it is not easy to exclude someone from enjoying their benefits, are generally under-produced and over-consumed under a system of market provision. If these services shall be efficiently produced, a collective institution such as the state has to assume responsibility to oversee their production.\textsuperscript{45} The same applies for activities that entail substantive effects for others than the one carrying out the activity. Environmental pollution is a typical example of such an ‘externality’: the cost of the pollution will be born by someone else, be it the ecosystem or a downstream water user. Externalities are closely linked to the problem of establishing effective property rights for certain goods and services.\textsuperscript{46} I have dealt with the Public Goods theory at length in my first article and applied it to the area of water and sanitation, hence I will not go further into details here. It will suffice here to point out the existence of certain collective action problems in relation to water and sanitation services in the urban setting. There are a number of public health benefits stemming from water supply and sanitation, benefits that it will be difficult to exclude others from enjoying. The same applies to water for fire fighting purposes: with improved ability for fire fighting, everyone will enjoy enhanced security of life and property. These services, like pollution abatement, are hence associated with large externalities. To overcome these collective action problems and avoid under-production of safe and adequate water and sanitation services, public institutions are of key importance.

With this theoretic background as my point of departure, I now arrive at the nexus of the two main theories in my studies. NIE and LTS emanate from disparate disciplines and in many respects they focus on different problems. Nonetheless, at the interface of the LTS and NIE approaches there is a common field of inquiry, regarding how modern societies structure themselves in order to efficiently provide collective services. Whereas the NIE provides valuable insights into the relationship between institutional structures, collective action problems and public objectives, it generally falls short of showing how these institutions are manifested in actual service provision and in technical systems. Conversely, the LTS-approach can explain the development over time of technical systems and relate the technical systems to the institutional framework, but it seldom explains how these institutions relate to the collective action problems. The LTS

\textsuperscript{45} Stiglitz 1988, p 71-81.

\textsuperscript{46} Tietenberg 1996, pp 41-51; Dasgupta 2001, chapter 7.
offers a dynamic view on socio-technical systems, especially
technological change, but its theory of institutional change is less
robust than that provided by the NIE. Therefore, I believe that a
combined approach of LTS and NIE will be useful for bridging these
respective shortcomings. It should be particularly useful for studying
socio-technical systems that provide collective services that entail
large externalities, or otherwise are produced under highly imperfect
market conditions. I will return to this discussion in the final chapter.

Other researchers might have chosen another theoretical framework
for this study and I will not argue that my approach is the ultimate
one. After all, the world and the lives of men and women is an over-
determined equation. I have chosen a set of variables and
relationships that - in my eyes - makes sense and which helps me to
understand the complex web of man, nature and time.

Method description

In addition to establishing the overall theoretic and contextual
framework described above, I have made three separate studies, each
presented as an article (see section four and appendix). The published
articles have been subject to peer review through independent
referees. The first study has a predominantly theoretical approach in
which I set out to lay a theoretical foundation for the subsequent
work, through assessing the usefulness of the Public Goods theory for
my studies. As a consequence, the first article holds little new
empirical data, and is mainly based on literature studies.

The second study is a historic case study of water and sanitation in
Kampala, the capital of Uganda. I have not able to find any existing
study or report on this topic and the article therefore contributes
essentially new empirical findings, based on primary data. The
purpose of the study was to trace how the large-scale water and
sewerage systems were established under the colonial period. This
corresponds to the two first phases in Hughes’ sequential chronology
for an LTS, and I also included some aspects of technology transfer in
my study. During my preliminary investigations about where to find
relevant data I learnt that finding data for Uganda in the government
archives in Kampala might well be a futile and time-consuming work,
especially for the 1960s and 1970s.\(^{47}\) Reportedly, many files have been

\(^{47}\) pers comm Helena Ledje, Lund University, January 2005 and Jan-Olof Drangert,
Linköping University, 2005.
destroyed or lost in Uganda’s turbulent past.\textsuperscript{48} Therefore, I decided that my study of Uganda should focus on the colonial period. Fortunately, I was very successful in finding primary data for the colonial period in the other end of the old colonial hierarchy: London. I spent a week in 2005 in the archives of the Public Records Office, within the British National Archives in Kew, London, and copied thousands of pages of original documents dating from 1925 to 1962, from the files of the Colonial Office. The documents were mainly administration reports, legislation, consultants’ reports, correspondence with the colony and with other government entities, and internal memos and circulars. Only in a few instances did I find remnants of communication with non-official actors.

The Colonial Office’s files provided a wealth of data, but the lack of historic data from other sources than the British Government is somewhat problematic. Firstly, the despatches sent to the colony only remain in a draft form in London. However, the economic historian Torbjörn Engdahl, who has had the opportunity to compare some of the draft despatches from Colonial Office with originals kept in Uganda, has concluded that generally there are no deviations between draft and final versions.\textsuperscript{49} Secondly, the reports and correspondence may be suspected for a biased view on the events they are reporting on. Therefore, statements of qualitative and normative nature have been handled critically, and not just accepted as a true representation of the nature of things. Data of economic and technical nature, however, I have accepted as more reliable. Thirdly, there are almost no voices from the public, whether Africans or non-Africans. Therefore it is difficult to describe how the relationship between the public, the government and the public service systems actually worked, or what the preferences of the people looked like. To compensate for this I have endeavoured to ‘read between the lines’ in some of the official documentation over time. I have also tried to combine the qualitative statements with economic and social data to create a more nuanced view of events and processes. In general, I have tried to handle the data in such a way that the empirical contributions that this data has made possible are not compromised by an unbalanced interpretation.

The third study was made in co-operation with Dr. Ezekiel Nyangeri Nyanchaga, of the Civil Engineering Department at the University of

\footnote{Engdahl 1999, p 24.}
\footnote{ibid, p 26.}
Nairobi. We decided to collaborate on a history of Kenyan national water politics, based on official documents from Kenyan sources. The study spans from 1895 to 2006 but the main focus is on 1945 to 1990. Of particular importance has been to analyse any discontinuities or continuities in connection with independence, which came to Kenya in 1963. We have applied a wide approach, covering aspects of economy, demography and governance in addition to sector-specific issues. Given the width of our scope, we decided to concentrate on water supply and leave sanitation aside in this study. We have mainly taken our primary data from the National Archive in Nairobi, Kenya and from Dr Nyangeri’s private collections. In March 2006, I spent some days in Nairobi, retrieving data from the National Archive and at the Government Printer. Furthermore I found much data at Nordiska Afrikainstitutet (Nordic Africa Institute) in Uppsala, Sweden. The data we have used in our study involves government reports and memos, development plans, correspondence and various reports from consultants and donors. We have applied a critical approach to the data similar to that for the Kampala-study. Official statements have been taken to represent exactly that: official statements, and not necessarily to be a “true” account of the situation. Economic data have been awarded more empirical gravity. Here it has also been somewhat easier to assess the primary data, as there exist a number of studies on related topics. For the latter part of the period studied it has been possible to compare our picture of the historic landscape with other, more contemporary, views. Our pool of data regarding actual service delivery coverage or local data at the consumer level is still fragmented and partly inconsistent, but as the study concentrates on a national policy level this has not been a major problem at this stage.

Through the third study, it is possible to connect the colonial history of urban water and sanitation in Kampala, described in depth in the second article, with the more general history of urban water provision in Kenya. Through such a two-step approach, I try to arrive at a broader historic pattern for urban water and sanitation in East Africa. Although Uganda and Kenya cannot be assumed to have an identical history, I have worked from the premise that there are similarities in the colonial past as well as in recent developments of both countries that merit such a two-step approach. However, this assumption must be qualified, and I will return this discussion in the chapter “Synthesis and Conclusions”.
Summary overview articles 1 – 3

In this chapter I will give a brief summary of each of the three articles forming the basis of this licentiate thesis. In doing so, I will give particular emphasis to themes and issues that relate closely to the overarching research problem. I will not give the original references below, for references see articles in full in the appendices.
Article 1:

The main purpose of the first article is to provide a theoretical model of how water and sanitation services relate to social objectives, institutions and the state. The article sets out to develop a model using Public Goods theory, and to assess the relevance of this theory for studies of modern history of water supply and sanitation services in East Africa. The article arrives at this assessment through a three-step approach: first it defines the key concepts and the theoretical framework, secondly it tests these concepts using a few contemporary and historic examples of urban water and sanitation provision and thirdly it discusses the usefulness of the Public Goods theory for studies of water and sanitation.

All goods (taken to mean goods and services) can be classified as public goods, private goods or mixed goods, according to their consumption characteristics.

A pure Public Good has two distinct properties:

- it is non-excludable, meaning it is not feasible to exclude anyone from consumption;
- it is non-rival so that the consumption of the good by one individual does not decrease consumption by another individual.

A pure Private Good has the opposite characteristics and is both excludable and rival in use. The intermediates between pure Public and pure Private are often called ‘mixed goods’. The two major types are Club Goods and Common Pool Resources. Club Goods are goods that are excludable but non-rival in use. For a typical club good, access is controlled through an exclusion mechanism in order to keep the good non-rival within the ‘club’. Common Pool Resources (CPR) are goods where exclusion is impossible or too costly, but consumption is rival. From the foregoing it should be clear that the possibility for exclusion from the good is a fundamental property, which is also related to the phenomena called ‘externalities’.
An externality occurs when:

- the activity by one part imposes a cost on another part without his consent, called negative externality, or;
- the activity by one part confer benefits to another part for which he is not obliged to compensate the first part, called positive externalities.

Mixed goods, public goods and large externalities all are associated with significant market failure: these services will not be efficiently produced under a regular market structure.

Next, I investigate the characteristics of water and sanitation services on the production side. I note the distinction between the provision and the production of services, as well as between facilities, or provision systems, and the flow of goods within them. Furthermore, it is often argued that water supply and sanitation constitute a ‘natural monopoly’, which is a type of market failure on the production side. A natural monopoly occurs when the existence of competing systems in any given geographical space is either impossible or non-economic thus blocking competitive markets from occurring. However, the argument of water and sanitation supply as a natural monopoly is only valid for large-scale technical systems such as networks on a citywide scale. Finally, I discuss cost, value and pricing of services, and relate it to the international debate on water as a ‘social good’ or an ‘economic good’. This debate is also related to the human rights approach, which I discuss in the context of water and sanitation.

Most water and sanitation services are mixed goods and hence are subject to market failure. In order to understand where the role of public institutions is most pivotal to achieve social objectives through reducing market failure, I focus on two particular properties of water and sanitation services described above: their excludability and the severity of associated externalities. I make an attempt to classify water and sanitation services according to these properties.

Thereafter I briefly apply the concepts and the theoretical model defined above on some documented cases on urban water and sanitation provision from USA, Sweden and East Africa. I put particular emphasis on the collective action-problems that have occurred due to the mixed goods-properties of water and sanitation, and on the importance of public institutions for overcoming them.
The main conclusions I arrive at in the article are the following:

- The Public Goods theory provides useful concepts for an in-depth understanding of the characteristics and nature of water and sanitation services for historic as well as contemporary situations;
- Urban water and sanitation services make up a broad array of services with differing properties on both consumption and production side. Most of the services constitute ‘mixed goods’ for which public institutions for service provision have been, and still are, very important in order to achieve social objectives. This is particularly the case for services with high externalities such as sanitation, sewage treatment and water for fire fighting;
- Reform of public institutions for water and sanitation in East Africa must review social objectives and the role of institutions. This also calls for breaking away from old technological and institutional patterns, such as monopolistic and large-scale provision, and to instate service provision systems and institutions that are better designed for public objectives of today.
**Article 2:**
“A heritage of un-sustainability? Reviewing the origin of the Large-Scale Water and Sanitation system in Kampala, Uganda”, Environment & Urbanization 18:2, October 2006 pp 369-385

This article has two main objectives: firstly it provides an in-depth study of how - and why - the large scale systems for water and sewerage were established in Kampala in Uganda in the period circa 1920-1950 and secondly, it expands on the relationship between sustainability and inertia associated with an LTS.

Kampala, which today is the capital of the whole of Uganda, was a divided town during the colonial period, where one part was administered by the British Protectorate Government and the other part was under the King of Buganda. I have studied the service systems administered by the British. In the first decades of the 1900’s, water was provided through means of rainwater harvesting, groundwater and springs. Manually emptied latrines were used for removal of faeces. Claiming health risks associated with the old water supply, the Protectorate Government decided to build a piped water supply taking water from the Lake Victoria, some 10 km away. The piped water supply opened in 1930. The plan was to supply water to all customers in Kampala, non-Africans as well as Africans. As the customers had to pay for the full cost of the water supply, it was difficult to attract customers initially. However, consumption kept going up and from 1938 the water supplied recovered all its own costs including capital charges. The water consumption increased further with the new sewerage system, which was constructed in 1936-40 on the pretext of sanitising the city in accordance with modern ideals. For the sewerage system, costs were not recovered directly from the users, but subsidised from other revenue sources of the Government.

The conception and design of the systems was made by a small handful of colonial decision-makers and engineers without much formal consultation with the users. Officers and experts from other places within the British empire were engaged through the global network offered by the Colonial Office in UK. The designs also drew to a large extent on practice and norms from UK. The building of these large-scale systems of a citywide scale involved major capital investments. Roughly half a million British pound was invested over ten years in these systems, of which the sewerage and drainage system made up 80% of the capital cost. Although the Protectorate Government was able to recover the full costs for the systems, this
capital-intensive system also increased the recurrent cost for water and sanitation services with a factor ten from 1929 to 1939.

The main conclusions I arrive at in this article include:

- The main, clearly stated, motive for the introduction of the water supply and the sewerage and drainage systems in Kampala was to safeguard public health. Water and sanitation services were seen as services to be provided in the public interest, although on a cost recovery basis.
- The public service systems established were designed for the needs and preferences of the economically strong minority groups and the cost for the systems did not match the income level for Africans.
- The ideals and norms inherited from the developed world promoted large-scale development. Once the large-scale network for water supply was in place, the increased water consumption prompted development of a sewerage and drainage network.
- After the establishment of the large-scale, capital intensive systems, the public administration of Kampala would carry a vastly increased recurrent cost for a long time.

The article ends with a discussion on how large-scale technical systems are associated with inertia due to technical, institutional and financial properties, and how this inertia affects their sustainability. These systems should be regarded as socio-technical systems, and rapid changes in society may bring the socio-technical systems out of balance. The socio-technical system of water and sanitation in Kampala was exposed to a risk of becoming un-sustainable – both financially and socially - in case of rapid change in society. I ventilate a hypothesis that public service provision in Kampala in the post-colonial period developed into a zero-sum game where social sustainability (represented by equality in service distribution) and economic sustainability (represented by cost recovery) could not both be achieved, and that this has to do with the inertia of the socio-technical system in a rapidly changing society.
“Pipes and Politics. A century of change and continuity in Kenyan urban water supply” submitted to the Journal of Modern African Studies, October 2006. Co-author Dr E. N. Nyangeri, University of Nairobi

The objective of this article is to reconstruct the modern history of national policy for urban water supply in Kenya and to analyse the relationship between policy and the institutions, organisation and technology for urban water. Of particular interest is to identify possible discontinuities in connection with the transformation from a colonial to an independent state. The article also seeks to complement and deepen the current discourse on water sector reforms with a historic dimension and to stress the socio-technical nature of urban water provision.

The empirical basis of the article covers the period 1900-1990, concentrating on the post-WW2 period. In addition, we discuss the recent years’ reform in the light of our historical findings. The approach is to describe key policy processes at national level, the formal institutional framework, financing and organisation of service provision, as well as aspects of standards setting and the technological implications of policy. Urban water provision is also put into a context of demography, economy and politics.

In the early colonial period, the Uganda Railway played a key role as provider of water in urban centres in Kenya. Starting from the First World War, the state assumed more responsibility and by the end of the 1920s, most urban water supplies were run either by the Public Works Department, or directly by the local authorities. After the Second World War, the colonial government invested heavily in urban water supplies. Many new supplies were constructed and responsibility for operation was decentralised to local authorities whenever possible. Urban growth accelerated after the WW2 but little attention was given to services for Africans, despite the large migrations to urban centres from the countryside. Although the overall situation of urban water services was considered good at independence in 1963, there was a development backlog especially in terms of housing. The decade after independence saw several housing initiatives being launched by the government, but their progress was very slow. In 1970, the government declared a policy on “water for all by the year 2000”. This goal was to be accomplished through massive
increases in the water development budget, backed by donors and a strong economy, coupled with centralised service provision. However, already a few years later the investments had become financially unsustainable, and the Kenyan economy started declining. By the 1980s the financial situation had deteriorated even more and the infrastructure was decaying. Urban growth kept increasing the pressure on the service systems, but services were not expanded in pace with population growth. The prestigious international “Water Decade” 1981-90 saw a decreasing coverage of water and sanitation services in Kenyan towns. During the 1990s a reform of the sector was initiated and in 2002 a new Water Act was passed, with the purpose of instating a new sector structure based on state withdrawal from service provision and increased private sector participation.

Key findings of the study:

- The organisation of the state vis-à-vis its responsibility for urban water supply was more or less constant from the 1920s to 1988. The legislation was revised twice (in 1951 and 1972) but the implications of these changes were negligible for urban water services.
- A technological paradigm centred on piped individual connections evolved, which persisted even after the government declared it unaffordable from the 1970s. The high official standards for urban housing and the poor performance of the housing sector also made expansion more difficult. Appropriate technology and low-cost options never became a real alternative to large-scale capital-intensive systems.
- Throughout the period studied the official policy for pricing was based on full cost recovery from the users. However, starting from 1970, we have found a discontinuity in the implementation of this policy. Through a combination of institutional disincentives, mounting clientelism and the fact that policy became more oriented towards social objectives than economic growth, the stage was set for deteriorating cost recovery.
- The rapid urbanisation, the stagnation of the economy and the high inflation rate from the 1970s accelerated the financial erosion of the socio-technical system. As the costly technological paradigm persisted due to lack of incentives for change, the performance of the urban water systems deteriorated.
The current reform in Kenya needs better to acknowledge the historic processes in the sector as well as the marginal influence by official policy for e.g. cost recovery in Kenya. The actual sector performance is heavily influenced by informal institutions as well as political, economic and social processes outside the water sector. Furthermore, creating institutional incentives for developing low-cost public services must be made part and parcel of the reform if service coverage should increase substantially.
Synthesis and Conclusions

The large-scale networked systems for water and sanitation were established in Uganda and Kenya in the colonial period to cater for the small but rapidly growing urban populations. Through the agency of Uganda railway, Kenya saw the first piped urban water supplies being built already around the turn of the century. In both countries, the state assumed responsibility for expanding the water and sanitation services from the 1920s, motivated primarily by objectives of public health. In terms of technology, conventional piped networks were introduced based on predominantly British practice. The ideal was to connect each household with water (and sewerage, where possible) but the systems were also complemented with public standpipes for those without individual connections. In Kenya the colonial administration early aimed for individual metering whereas in Kampala in Uganda, the costs for water were recovered from the households mainly through a property tax. In colonial Kampala, the cost for the sewerage and drainage system was recovered through the general revenue of the Protectorate government. Regardless of cost recovery mechanism, both countries had policies of recovering the full cost of water provision from the users, which made the water supplies more or less financially self-sustaining.

In terms of organisation, different solutions were applied in the colonial period. In Kenya, central and local government entities both were involved in service provision, while in Uganda service provision was carried out by central government alone. The provision systems established in both countries were mainly targeting the high-income urban population segments, mainly Europeans and Asians, with service segregation along racial lines as a result. As systems banked on large-scale and capital-intensive technology, they entailed high recurrent costs for capital charges, on top of operations and maintenance costs. As I have demonstrated in the study of Kampala, the high per capita costs for these systems were far above what was affordable for the average low-income urban dweller in the colonial period. I have not found any indication that this situation did not apply also to the Kenyan context, on the contrary, it has been confirmed by the development in post-colonial times.

Independence from UK came to Uganda in 1962 and to Kenya the year after. In Kenya, the government started focusing on improving
the water services from around 1970, at a time when the country experienced not only very high urban population growth, but also enjoyed a sustained economic growth. The government’s strategy was to expand services through a state-led and supply-oriented development programme, primarily in rural areas, but also in towns. Under the motto of “Water for all by 2000” the government budget – propped up by international aid - increased rapidly. The main thrust of development lay in expanding the piped service systems and the aim was clearly set for individual household connections, and a paradigm of large-scale piped systems emerged. However, the economy of Kenya was on decline from the mid-1970s and inflation almost completely eroded the government’s budget increases. Cost recovery from the users was not effectively implemented and the expansion of services could not keep up with urban growth. Despite the enactment of a revised legislation in 1972 and several re-organisations after independence, the institutional framework for urban water supply and the general sector organisation were largely preserved from the colonial period. Although the government acknowledged that the large-scale service systems were too costly in the 1970s and 1980s, incentives for changing the technological paradigm were not present. Urban service systems started decaying and millions of urban poor have been forced to rely on informal provision systems, such as buying water from water vendors or through illegal connections to the system. Through the recent sector reform in Kenya, cost recovery is more likely to be achieved. However, whether the new institutional framework will create incentives for changing the technological paradigm and thus make public provision respond to the needs and preferences of the poor, is more questionable. The Ugandan history after independence has not been studied in depth, but from the work of others it is possible to claim that there are great similarities between Uganda and Kenya also in the more recent history.\footnote{50} Although recent years show a positive trend in Uganda of both cost recovery and service coverage in urban centres, the public actors’ efforts to develop services for the urban poor are still very small in comparison to their total involvement in the sector.\footnote{51}

Another general observation from the studies is the absence of a gender-sensitive policy in such a clearly gender-related issue as water in East Africa. Even during the colonial period the authorities were

\footnote{50} see e.g Tumwine 2002.  
aware of the role of women in relationship to domestic water and sanitation (see article two). Despite this, gender issues are completely left out of the policy or technology discourse during the colonial period. Gender issues do appear in some of the Development Plans in Kenya from the late 1970s but mainly as a blanket statement that increased water supply services will be important to ease the burden of the African woman. However, I should not draw too far-reaching conclusions from the Kenya-study as it mainly dealt with national policy issues, and did not include analyses at the consumer level.

What does this tell us about water and sanitation in East Africa today? Is it just another story of ‘state failure’ and a carte blanche for reform and privatisation? Can history say anything about the options available to present day’s decision-makers? Before relating back to my research question, I will return briefly to my first article. I there argued that water and sanitation services all are mixed goods and that most are associated with externalities, which calls for a certain degree of state involvement. In this context, and given the historical backdrop as portrayed in my study, it will be essential to look at the public objectives associated with state responsibility. The main objective in the colonial period was that the state needed to intervene and assume responsibility for reasons of public health. The public health issues were, economically speaking, externalities to the water and sanitation services. State involvement was a means to overcome market failure and ascertain a sufficient provision of these services of a mixed-goods nature, services that otherwise would tend to be under-produced. Customers were supposed to pay for the services on a cost-recovery basis, but not on a strictly commercial basis.

After independence, the stated public objectives instead focused directly on the service provision itself under the slogan “Water for all”. The objectives of public health and economic growth were intermixed with objectives of social equality. Government policy therefore took a supply-oriented stance. The supply-oriented approach was based on existing technology and little was done in reality to develop alternative technologies, especially since the lack of cost recovery in practice eroded the incentives for using more affordable technology. In short, the independent governments established new objectives but tried to achieve them with the old means. This constitutes what Mariken Vaa has referred to as “goal displacement” within water and sanitation policies in the 1970s and
1980s: the means became the end. What the result would have been with another technological paradigm, based on more affordable technical solutions, can only be subject for speculations. Keeping to facts, I have concluded that an old technical paradigm persisted and that incentives for effective change were absent. From what the LTS-school tells us about the dynamism of large-scale systems, we know that these systems are resistant to change. In the case of water and sanitation, technological alternatives did exist, as I have shown, but incentives for change in the institutional framework were virtually non-existent. As discussed in the third article, institutional disincentives for change stemmed from many sources: new policy objectives, lack of incentives for cost recovery, donor influence, path dependency and clientelism. This brings in the dimension of democracy as well as the human rights aspects on water and sanitation. If public institutions and service systems only serve the interests of a part of the population, are they then public? The United Nations universal declaration on human rights, article 21, states that: “Everyone has the right of equal access to public service in his country”. This definitely cannot be said to be true for the urban water and sanitation services in Uganda and Kenya today. Public service provision has failed in responding to the needs of the most vulnerable, and public objectives appear to have been displaced by the interests of a few. The inertia of the large-scale technical systems has in that sense over time accentuated a skewed distribution of service, and sometimes also served to legitimise the unequal distribution: as long as large-scale systems make up the norm, it is easy to blame the poor rate of expansion on lack of capital.

I now return to my research problem. Based on my findings, I argue that history frames and influences the space of decision for the water and sanitation in Kenya and Uganda mainly through two mechanisms:

1. Technological inertia

The large-scale physical infrastructure for water and sanitation is durable, capital intensive and with high sunk costs. Therefore, systems have a long lifespan and the citywide character of these systems make them difficult to change. Decision-makers will be bound for certain time to these systems and not even radical decisions will mean that these systems, nor the financial debt they may have

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52 Vaa 1993, p 20.
entailed, will cease to exist. Decisions will therefore be partly framed by the inertia of these large-scale systems. In this respect it is possible to talk of a physical colonial legacy, as these systems were initially established in the colonial period. This must not however be interpreted to mean that the systems cannot change, or that the existence of these systems is only problematic. The large-scale systems for water and sanitation in East Africa are public assets that provide opportunities, which also form part of the space of decision. Although the physical and technical configuration of an existing LTS may be difficult to change, the expansion of services at the periphery can be made through complementary technical systems of a small-scale character. To achieve this, also new institutions must be erected to manage the two different systems and the interface between them. I will return to this discussion in the final chapter.

2. Institutional inertia

The existence of citywide networks theoretically makes a case for monopoly provision, as such networks are natural monopolies. However, this also can make policy-makers think in narrow monopolistic terms about state responsibility and the role of the state, either as direct service provider or as a regulator and asset holder. Such a mental path dependency by politicians and policy-makers will risk impeding the development of a new role of the state and may hinder alternative, small-scale and less costly, provision systems that cannot easily fit into a monopolistic system. The technology and the institutional dimensions of technology hence are very closely related. Furthermore, coupled to the infrastructure is the set of norms, standards and practices that make up what I call a technological paradigm. There is a way of thinking about service provision systems and technology embedded in these norms and standards. In Kenya, the paradigm has centred on large-scale individual connections with high per capita demand, which emanated from the colonial period but was cemented in the expansionist period after independence. The historic process has created path dependency and disincentives for institutional change, and hence aversion for technological change.

Formal institutions also matter. As I have shown in the article on Kenya, not much did change in terms of formal institutions, as well as organisation, for urban water supply. The new water act, which came in 2002, replaced an old legislation that was first conceived around the time of the First World War. So, clearly there has been a certain amount of “historic deadweight” also in the formal institutions.
However, the key argument here is that informal institutions, and the general institutional framework beyond the sector-specific issues of water and sanitation, were more important for the fate of the urban water and sanitation provision systems.
Discussion: applications and future studies

Applications and implications of the findings

First, I will discuss my findings in relation to sector reforms in East Africa. Over time, societies erect ‘institutional scaffolding’ to facilitate collective actions leading (among other things) to service production. However, to change the scaffolding in line with a rapidly changing society is easier said than done. Institutions evolve slowly, especially the informal ones embedded in customs, tradition and beliefs,⁵³ Reforms must therefore be underpinned by a historic perspective. Unless the longer perspective is applied, certain key processes and variables may escape the attention of policy-makers and reformers. A historic approach becomes even more important when large-scale technical systems are the objects of reform.

A key message to reformers in Uganda and Kenya is that public objectives and motives of the actors must be brought out into the open and that a sustainable provision system cannot be achieved unless incentives for technological change also are effectively established. Reform should start from public objectives, not from organisation or technology, and objectives should be identified through democratic processes. The state must then assume a role in order to reduce transaction costs for the provision of safe and adequate water and sufficient sanitation, for the maximum social and environmental benefit. This does not mean there will never be a role for direct service provision by the state, or that the state should only assume a policy-making and regulating role. However, claiming that the state must be the direct service provider and asset holder under a monopolistic structure is starting from the wrong end. Urban water and sanitation systems are assets, or means, to be used for accomplishing public objectives. All too often, the physical assets or the actual service delivery are confused with public objectives. If the stated objective is universally increased quality of life through improved public health, or a healthier environment, these objectives can be achieved in many different ways. That is why reform has to take off from objectives rather than from some pre-determined technological paradigm.

⁵³ North 2005.
In processes of change, there will always be pros and cons, there will be those in favour of change and those against it. Reformers need to ask: qui bono? Who will get something out of change, who stand to lose and what other social stakes are at play in the process? Donors will have an important role to make sure that their support to processes of change is beneficial for the most vulnerable, so that public services may respond also to the rights and demands of the poor.

In Kenya, the current reform process tries to repair the ability of the provision system to sustain itself financially. Financial aspects are extremely important for sustainability, as shown by the history of Uganda and Kenya. However, sustainability is not about finance alone, also environmental and social aspects must be addressed. The lack of institutional incentives for technological change may lead to a trade-off situation between financial and social sustainability. Those with service will get better service because they will start paying more for it, but this will not automatically lead to increased service coverage. Where inequalities in service coverage are cemented also differences in quality of life will remain, or increase. Although financial sustainability becomes more solid, the social fabric risks to be torn apart, unless institutions, organisations and technology all are jointly crafted to create cohesion in society and achieve truly public objectives, not only the objectives of a few.

The conclusions and implication from my study may seem very discouraging and even disheartening. If the large-scale systems are so difficult to change, and if no real incentives for change exist, what hope is there then for the women and men in the towns of East Africa? Are the poor forever doomed to buying services through informal systems, while the rich will continue to defend their entitlement to cheap public services, all because of some ‘inertial’ law of nature? I believe not. In the following I will discuss what opportunities that may arise out of the present situation and the history of East Africa.

While the challenge of change may appear insurmountable seen from the present situation in East Africa and from its modern history, the vantage point of the historian of technology may offer a little hope. Firstly, East African countries are democracies, at least nominally,
which should enable a public debate and allow also poor people to have a legitimate claim on public services. Most European towns did not have such a democratic environment in place when they developed systems for universal water supply. Although corruption is a major problem in East Africa, these societies have a tremendous asset in their democratic constitutions.

Secondly, the large-scale technical systems that were inherited from the colonial period are important assets. Although they may be unsustainable in the long run, in the short to medium term they will continue to be important. These systems can be used as a backbone for expanded service provision to marginalised groups, if new and complementary provision systems are developed in the periphery of the large-scale networks. These complementary systems may be small-scale and managed by public or private actors. There are a number of parallels in history. The large-scale electricity grid in Sweden was not extended with distribution lines to more remote areas in the first decades of 20th century for economic reasons. However, local communities then formed user groups that would build and operate local distribution networks for electricity, buying its electricity supply from the large-scale supplier.\footnote{Thue 1995.} This model of provision could be called a ‘nested socio-technical system’, in analogy with what Elinor Ostrom has called ‘nested enterprises’, where multiple layers of technical systems and institutions together make up a larger system for provision.\footnote{Ostrom 1990, p 90.} The nested system for supply and distribution of electricity was successful in Sweden and the large-scale electricity supplier promoted such co-operative solutions as it expanded their market. Similar models have been tried in recent years for urban water supply in Mwanza, Tanzania.\footnote{I visited a community in peri-urban areas of Mwanza in 2001 who had built and operated a local water distribution network as a collective undertaking, with assistance from UNDP, buying water in bulk from the public water company.} The positive experience of condominial sewerage in Latin America in recent years also builds on the same nested systems approach. A community-based user group then takes responsibility for a small communal sewerage pipe, laid down at shallow depth within their own neighbourhood area, and is allowed to connect it to the main public sewer.\footnote{Mara 1998; World Bank 1998.} The institutional framework must be well adapted to allow such a nested system. In the Nairobi Third Water Supply project, which started 1989, one of the objectives was to improve water supply
in the slum area of Kibera, through liaison with private small-scale providers in the area. However, the initiative failed, partly because the public water provider – the Council – did not succeed in establishing a supportive institutional framework for the small-scale provision and for how the two systems (the public large-scale and the private small-scale) should inter-relate. Nevertheless, there are obviously opportunities for technical change if the right institutional framework can be established.

Here, I will return to the discussion of how the LTS and the NIE can mutually support each other when studying water and sanitation. I think that a combination of the LTS and NIE approaches when studying options for technological and institutional change of water and sanitation systems in East Africa is motivated. The LTS could be used to assess opportunities for change of the large-scale technical systems and inter-relations with other technical systems. Some LTS are referred to as being ‘tightly coupled’ and may be more difficult to change due to significant interplay with other socio-technical systems. However, as mentioned, expansion at the periphery does not have to be according to a ‘more-of-the-same’ principle, and these peripheral sub-systems may well be successfully established. The LTS may be useful for assessing options for and understanding the dynamics of technical change, either in the form of peripheral expansion or through more profound paradigmatic changes, and what institutional and organisational changes that need to accompany the technical change. The NIE may pick up from there, and look at institutional change and their relation to public objectives. Such a process would have to be iterative, as institutions and technology are related to each other in both directions. Looking at successful examples from other parts of the world would also provide important lessons. Why were nested systems of service provision successful in Sweden and Latin America but not in Kenya? Anyway, addressing institutional change or technical issues isolated from each other will not produce the desired outcome: improved quality of life for all urban citizens.

Can the findings from Uganda and Kenya be of any use in other contexts? I believe they can, although I am definitely not promoting anything that should be regarded as a blanket solution. My modest theoretical contributions - the application of Public Goods theory to

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59 Kaijser 1994, p 51-54.
water and sanitation and the potential in combining LTS with NIE - I believe could be useful elsewhere. I would also strongly recommend the application of history studies to many development challenges in other countries, in particular in reforms for large-scale technical systems such as networked urban water and sanitation systems. The specific issues pointed out about Uganda’s and Kenya’s water reforms above may also be valid for other low-income countries especially with a similar colonial past. Especially for Tanzania, which I only dealt with very superfluously in my first article, I am convinced that many of the findings from Uganda and Kenya will hold true. Dar es Salaam, for example, share much of the developments in the past, as well as present structural and institutional challenges, with her “sister cities" in East Africa.\textsuperscript{60}

Further research

As previously said, the history of water and sanitation in East Africa is still largely unexplored. Unfortunately, Africa receives relatively little attention from scholars globally, and the number of African historians involved in studies of history of technology or related areas is infinitely small. Hopefully, more African scholars and researchers from the rest of the world will gradually turn attention to the African past, which is so important for her future. Below, I will give some ideas for my own future research on the history of urban water and sanitation in East Africa.

On the theoretical side, I would like to see a deeper exploration of the connections between New Institutional Economics (including Public Goods theory) and the Large Technical Systems approach. A combination could be enlightening for understanding what processes are at play when societies develop certain infrastructures and certain technologies. Especially the inertia associated with large-scale systems, and why these systems are so persistent, needs further exploration especially in the context of African water systems. I also think this will border on the ‘regime theory’ and particularly the thinking about ‘technological regimes'; how a certain prescriptive or normative thinking can arise in tandem with a certain technology, and what the dynamics of such regimes look like.\textsuperscript{61} More focus also should be directed towards the relationships of power within the

\textsuperscript{60} The recent history and present situation of Dar es Salaam has been extensively covered in: Kjellén 2006.

\textsuperscript{61} Inspiration for this has been found in Ertsen 2005.
social setting of such systems: for whom are systems designed? The political nature of technical regimes therefore is of great importance, as pointed out by Gabrielle Hecht.62

In terms of continued empirical studies, there are two main themes. One would be to look more in detail at the sectors of Kenya and Uganda in the post-WW2 period to find out more about the mechanisms for the evolving technological paradigm, or technological regime. That would entail looking at national, city-level and consumer level data to try to map how norms have emerged and what the mechanisms for consumers to express preferences have looked like. This would also allow a more in-depth analysis of the relation of the public institutions to disadvantaged groups in society, e.g. the urban poor or women. Such an empirical study should align well with the theoretical research theme above. The other theme would be an international comparison over time, both with other developing countries or former colonies, and with the history of water and sanitation services in Europe and USA. One constraint in comparing with other developing countries, is the relatively small body of literature on this topic. However, more research is slowly but constantly coming up, and such a comparative study could be well worth looking into within the next few years.63

Finally, I would like to encourage scholars, policy-makers, donors and all other interested to embark on history studies for facing today’s and tomorrow’s challenges. History studies are not only fascinating and full of suspense, you also learn a great deal about our own time, and about how to relate to it. It is a truly humbling experience, but also, and above all, incredibly fun.

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63 The modern history of water and sanitation in Ghana and its relation to international policy trends is being studied in Bohman 2006 (forthcoming).
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Sammanfattning

Problemställningen för denna licentiatsavhandling är att klargöra vilken inverkan historien har på beslutsutrymmet för offentliga system för vattenförsörjning och sanitet i städer i Östafrika, här begränsat till Uganda och Kenya. Storskaliga system för vattenförsörjning och avlopp (VA) etablerades i Östafrika under de första decennierna av 1900-talet av koloniala administratörer. Samhällena i Östafrika har undergått snabb social och ekonomisk förändring sedan de storskaliga VA-systemen etablerades, men dessa system har inte kunnat expandera på ett hållbart sätt. Situationen har försämrats över tiden, och idag saknar stora delar av den urbana befolkningen i Östafrika en rimlig tillgång till vatten och sanitet. Mina studier syftar till att rekonstruera och analysera historien för de urbana vatten- och sanitetssystemen i Östafrika för att öka förståelsen kring dessa processer och bidra med ny kunskap som skall kunna användas i pågående reformprocesser.


Avhandlingen består av tre delstudier, samt en ramberättelse. I den första studien testade jag Public Goods-teorin på vatten- och sanitetstjänster för att se om den är ett användbart teoretiskt verktyg. I den andra studien studerade jag framväxten av vatten- och
avloppssystemen i Kampala, Uganda, under perioden ca 1920-1950. Den tredje studien, som är samförfattad med Dr E.N. Nyangeri vid University of Nairobi i Kenya, beskriver och analyserar den nationella politiken för urban vattenförsörjning i Kenya över 1900-1990. Mina resultat kan sammanfattas som följer:

Karakteren på vatten och sanitetstjänster är sådan att det ofta är motiverat att staten tar ett ansvar för att dessa tjänster tillhandahålls, även om staten inte måste producera själva tjänsten. Detta får heller inte tolkas som att vatten- och sanitetstjänster måste produceras genom en monopolistisk produktionsstruktur i offentlig ägo. En fokusering på offentligt monopol kan stå i motsatsförhållande till att tillhandahålla tjänster för de fattigaste. De tekniska system som etablerades under den koloniala perioden var främst avsedda att förse de mer välbeställda i städerna med vatten och avloppstjänster och systemen var därför relativt kostsamma. En expansion av dessa tjänster till bredare samhällsgrupper blev eftersträvandesvård då det koloniala systemet i Östafrika ersattes av självständiga representativa regeringar på 1960-talet. De ekonomiska förutsättningarna saknades dock och de traditionella storskaliga systemen blev ekonomiskt ohållbara. Försämrad ekonomisk utveckling, befolkningstillväxt i städerna samt förändringar i samhällets institutionella ramverk, såväl det formella som informella, ledde till att kostnadstäckning övergavs i praktiken på 1970-talet, i motsats till vad som angavs i den officiella politiken. Ett tekniskt paradigm uppstod där storskalig och kostsam teknik gavs företräd framför enklare teknik, trots en medvetenhet om paradigms finansiella ohållbarhet. Trögheten hos stora tekniska system gör sig här tydligt påmind, och utvecklingen uppvisas 'spårbundenhet'. Dessa tendenser har troligen förstärkts av en hög grad av politisk klientelism, det vill säga gynnande av vissa inflytelserika grupper inom ramen för det offentliga systemet.

Min slutsats är att dagens offentliga beslutsutrymme för urban vatten- och sanitetsförsörjning i hög grad påverkas av historien. Dels genom ett fysiskt arv; de storskaliga systemen finns och kommer att finnas kvar länge än. Dels genom ett institutionellt arv, där tankemönster kring statens roll och kring standards och tekniska lösningar är minst lika viktigt som de formella institutionerna. För att uppnå långsiktigt hållbara system måste beslutsfattare bereda bättre plats för historien i analyser och beslutsunderlag. Dessutom måste drivkrafter för teknisk förändring gynnas i de pågående reformerna så att mer hållbara system kan växa fram.
Appendix

**Article 1:**

**Article 2:**
“A heritage of un-sustainability? Reviewing the origin of the Large-Scale Water and Sanitation system in Kampala, Uganda”, Environment & Urbanization 18:2, October 2006 pp 369-385

**Article 3:**
“Pipes and Politics. A century of change and continuity in Kenyan urban water supply” submitted to the Journal of Modern African Studies, October 2006. Co-author Dr E. N. Nyangeri, University of Nairobi