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Reindeer (Rajala 2015)

# Pääkirjoitus

## Tietoa päätöksenteon tueksi

Pitkän lamakauden ja tutkimusrahoituksen rajujen leikkausten jälkeen on erityisen vaikeaa ollut löytää rahoitusta suurten yhteiskunnallisten kysymysten tutkimiseen. Kuitenkin juuri tällaisena aikana tutkimukseen panostaminen olisi olennaisen tärkeää. Vastaavassa tilanteessa 1990-luvun alun laman keskeisenä hoitokeinona pidettiin tutkimukseen panostamista. Nyt valitettavasti on valittu toisin ja dramaattisin seurauksin: tutkijoiden aivovuoto ulkomaille ja jopa täysin toisiin tehtäviin on voimakasta. Aikaisemmat suuret koulutuspanokset menetetään täysin, pahimmissa tapauksissa vieläpä kilpailijoiden hyväksi.

Omalla tontillamme olemme kehittäneet uusia selviytymiskeinoja vaihtelevalla menestyksellä. Yksi niistä on viiden vuoden mittainen Vesihuoltopalvelujen tutkimus-, kehittämis- ja innovaatioklusteri (VEPATUKI) alkaen 1.9.2017 ja päättyen 31.12.2022.

Useissa eri yhteyksissä, tutkimuksissa, vesihuoltoalaa koskevissa selvityksissä ja koulutustilaisuuksissa sekä seminaareissa ja Valtakunnallisilla vesihuoltopäivillä on todettu, että vesihuoltosektorilla ja erityisesti vesihuoltolaitoksilla on tarvetta tutkitulle tiedolle erilaisista vesihuoltopalvelujen organisointiin, strategiseen johtamiseen ja fyysisen omaisuuden hallintaan liittyvistä kysymyksistä.

Myös juuri tekeillä olevassa vesihuollon tulevaisuuden haasteita käsittelevässä tutkimuksessamme samat haasteet nousevat esille. Etenkin ikääntyvän infran mukanaan tuomat kysymykset nousevat jatkuvasti esille, samoin tuottovaatimukset, päätöksenteon avoimuus, koulutus, tutkimus sekä muutama muu aihe. Nämä kysymykset nousevat suoraan kentältä ja niillä on laajempaa mielenkiintoa koko valtakunnan mittakaavassa. Näihin ongelmiin tuodaan hankkeen aikana ratkaisuja tutkimuksen keinoin. Hankkeessa keskitytään yhteen kentältä nousevaan tutkimusaiheeseen vuodeksi kerrallaan ja tuotetaan tutkimukseen perustuvaa tietoa vastuullisen päätöksenteon tueksi.

Esille nousseita keskeisiä teemoja ovat:

(i) saneeraustarve ja toimenpiteet sekä prosessit ja menetelmät saneeraustoiminnan edistämiseksi mukaan lukien vesihuoltolaitosten tuloutusvaatimukset ja niiden kohtuullisuus

(ii) vesihuollon monialayritykset vs. vesihuollon omien organisaatioiden kehittäminen

(iii) vesihuoltolaitosten fyysisen omaisuuden kokonaisvaltainen hallinta

(iv) vesihuoltolaitosten näkyvyys ja asiakaslähtöiset vesihuoltopalvelut

(v) vesihuollon teknologian arviointi ja ennakointi.

Vesihuoltolaitokset panostavat hankkeeseen vuosittain alkaen 1.9.2017 viiden vuoden joitain tuhansia ja isommat laitokset joitain kymmeniä tuhansia. Useiden laitosten yhteispanoksella saadaan aikaan kokonaisrahoitus, joka mahdollistaa näihin laajoihin asiakokonaisuuksiin keskittymisen.

Toiveissamme silti on, että myös julkista tukea saataisiin hankkeeseen, sillä myös koko yhteiskunnan etu olisi, että myös yhteiskunnallisesti merkittäviä tutkimuskohteita tuettaisiin vaikka niistä ei heti olekaan luvassa konkreettisia, käsin kosketeltavia keksintöjä tai laitteita vaan pikemminkin tietoa strategisen päätöksenteon tueksi.

Petri S. Juuti

Editor-In-Chief

Docent/Adjunct Professor

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# Editorial

## Information to support decision-making

It has been especially difficult to find financing for research of big social questions after the violent cuttings of research funding due to the long-lasting depression. However, investing in research would be essentially important in this kind of time. In a similar situation, investing in research was considered as a central cure for the depression of the early 1990's. Now, unfortunately, a different choice has been made, with dramatic consequences: the brain drain of researchers to foreign countries and even to totally different tasks is strong. Earlier considerable education investments will be totally lost, and in the worst cases this will directly benefit the competitors.

On our own sector we have developed new managing methods with varying success. One of them is the Research and Innovation Cluster of Water Services which will last for five years between 1.9.2017 - 31.12.2022.

In several separate connections, studies, reports concerning the water services, and in training meetings, seminars, and in Annual National Water Services Seminar it has been stated that there is a need for research based information: how to best organize water service and strategic management of water services and how to answer questions related to the control of physical property.

Also in our ongoing study considering the challenges of the future of the water sector, the same challenges arise. Especially questions linked to ageing infrastructure keep surfacing continuously, and the same applies to yield requirements, openness of decision-making, education, research and a few other subjects.

These questions arise directly from the field and they have wider interest in the scale of the whole country. During the project, solutions supporting responsible decision-making are suggested to these problems based on research. We will focus on one study subject for a duration of one year.

The central themes are:

(i) rehabilitation gap of water services, measures, processes and methods for promoting rehabilitation including shareholder value and their reasonableness

(ii) diversified enterprises operating in several fields versus developing the water supply and sewerage organizations

(iii) comprehensive control of the physical property of water utilities

(iv) visibility of the water utilities and customer-oriented water services

(y) evaluation and anticipation of the technology in water supply and sewerage

Water utilities will invest in the project every year for five years, few thousand for small utilities and tens of thousands for bigger institutions. The total sum makes it possible to concentrate on these wide thematic entities.

Still, it is our wish that the project would receive public funding, too, as there would be advantages to the whole society. Socially significant research subjects should be supported even when there are no concrete, immediate innovations or technological breakthrougs but rather information to support strategic decision-making.

Petri S. Juuti

Editor-In-Chief

Docent/Adjunct Professor

**Editors:** Petri S. Juuti, Tapio S. Katko, Harri Mäki & Riikka Rajala




# The Waste Management Department of the Metropolitan Assembly of a City in Ghana (1992-2016): an Evidence Based Assessment from a People

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*Managing Solid waste effectively and efficiently is an incessantly burgeoning problem at global, regional and local levels and one of the most obstinate problems for local authorities in urban centers. The research therefore aimed at ensuring unsoiled surroundings in the Kumasi metropolis hence it analyzed the roles of the waste management department of Kumasi metropolitan assembly. Moreover, it ascertained and assessed how effectively they have managed solid waste over the past decades in the metropolis and some challenges confronting the department. The major market centers in the Kumasi metropolis were used as a case study. A total sample size of one hundred (100) respondents was used. They responded to both open and close ended questions. This was randomly done at the market centres. The research identified and in some instance emphasized some of the issues relating to the defects and challenges affecting the Waste Department in the effective management of solid waste in Kumasi, the Ashanti regional capital of Ghana. The respondents also ranked the performance of the Waste Management Department concerning the management of solid waste over the past years. They identified some problems regarding the management of solid waste in the city of Kumasi. A noticeable one is limited and ineffective distribution of bins. Essentially, some possible measures to tackle these problems have also been discussed.*

## Introduction

Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. It may be categorized according to its origin (domestic, industrial, commercial, construction or institutional); according to its contents (organic material, glass, metal, plastic paper etc); or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc).[1] Solid waste management on the other hand refers to the supervised handling of waste material from generation at the source through the recovery processes to disposal.[2] Also in other terms, it is the systematic control of generation, collection, storage, transport, source separation, processing, treatment, recovery, and disposal of solid waste.[3] Ghana around the first half of the twentieth century saw various changes in the improvement of sanitation including an effective management of solid waste. Essentially the quest for a sanitary environment and healthy co-existence necessitated the establishment of Public Health Boards. Noticeable examples were the Kumasi Public Health

1 Solid Waste, accessed, 3rd November 2015, www.cyen.org>innovaeditor> asset.

2 Glossary of Environment Statistics, Studies in Methods, Series F, No.67, United Nations, New York, 1997.

3 Definition of waste; http//www.business dictionary.com assessed on 3rd november, 2015.

Board (KPHB) and the Suame Health Board. These health boards ensured the prevention of plagues and necessitated sanitary reforms for healthy co-existence. This had the tendency or the proclivity to positively impact the socio-economic well-being of the people in Ghana and Asante in particular.[4] Furthermore, these sanitary reforms were initiated by the colonial administrators especially during the governorship of Sir Hugh Clifford between 1910 and 1920. However, by the end of 1900 Kumasi had received sanitation attention. The native and colonial administrators performed creditably to keep the environment clean.[5] Factually the incinerator and dustbin gangs of the KPHB were responsible for the maintenance of incinerators and the collection of refuse to ensure good sanitary conditions in the Kumasi Township. Their work was supplemented and enhanced through the activities of the scavengers or street sweepers.[6] Also the colonial administration was concerned with disposal of refuse hence they noted that refuse dumps should be marked at least one hundred yards from nearest houses. The colonial administration also saw the need for refuse to be burnt and combustible refuse were raked when dried.[7] Over the years, there has been an increasing population density in urban areas throughout the world; the daily consumption pattern is also increasing. With continuous economic development and an increase in living standards, the demand for goods and services is ever increasing, resulting in an increase in per capital generation of solid waste.[8] Rapid population growth, urbanization and industrial growth have led to severe waste management problems in the cities of developing countries like Ghana. Waste problems have great effects on the quality of the environment as well as human life. This can lead to human diseases such as cholera, malaria, and typhoid fever. In recent years, Ghana has been consistently hit with cholera outbreak every year. The situation has become so serious that almost every year, it has become an anticipated ritual that a particular number of people are expected to die from sanitation related diseases. In 2014 alone, over 6000 cases of Cholera were recorded in Accra, and similar numbers were recorded in other major cities across the country with Kumasi being no exception.[9]

General Waste Management in Ghana is the responsibility of the Ministry of Local Government and Rural Development, which exercises direct jurisdiction over the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). The Metropolitan, Municipal and District Assemblies are responsible for the collection and final disposal of solid waste through their Waste Management Departments (WMDs) and their Environmental Health and

4 Adu Gyamfi Samuel, Osei-Wusu Adjei Prince , Owusu-Ansah Daniel ."Preventive Healthcare Strategies and Impact Among the Asante people of the Twentieth Century Gold Coast: A Historical Narrative and Lessons for the Present Sanitation Challenge in Kumase". *Journal of Studies in Social Sciences*.Vol.5 (2013) p218.

5 Ibid.

6 Ibid p. 220.

7 Ibid p. 224.

8 Karak Tanmoy, Bhagat R. M., Bhattacharyya Pradip "Municipal Solid Waste Generation, Composition, and Management: *The World Scenario, Critical Reviews in Environmental Science and Technology*",(2012) 42.

9 Maoulidi Moumie, A water and sanitation needs assessment for Kumasi,Ghana (2010) pp19 http://mci.ei.columbia.edu, George Owusu Social effects of poor sanitation and waste management on poor urban communities: a neighborhood□specific study of Sabon Zongo, Accra, *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, (2010) 3:2, pp. 145-160.

Sanitation Departments.[10] Within the Kumasi Metropolitan Assembly, the Waste Management Department is the sole body responsible for management of waste which includes but not limited to solid waste in the Kumasi Metropolis as provided for in the Local Government Act, 1971.[11] However, the state at which the city of Kumasi is engulfed with filth has given course for concern. The question is, has the waste management division of the KMA been able to effectively and efficiently carry out its mandate?

According to the United Nations Statistics Division (UNSD) Wastes are materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose.[12] They further stated that wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities.[13] However, Urban Development Sector Unit East Asia and Pacific Region define waste as any unwanted material intentionally thrown away for disposal. Nevertheless, they emphasized that certain wastes may eventually become resources valuable to others once they are removed from the waste stream hence they highlight that this definition of waste may differ somewhat from definitions used by other international data sources.[14] Also, Waste according to the Basel convention are substances or objects which are disposed or are intended to be disposed or are required to be disposed of by the provisions of national laws.[15] There are three types of waste, namely the municipal solid waste, hazardous waste and the industrial.[16] Solid waste has been focused on for the purpose of this study.

Again, solid waste can be defined as the useless and unwanted products in the solid state derived from the activities of and discarded by society. It is produced either by - product of production processes or arise from the domestic or commercial sector when objects or materials are discarded after use.[17] It can therefore be regarded as Garbage: the term given principally to food waste, but may include other degradable organic wastes. b) Rubbish: consists of combustible and non-combustible solid waste, excluding food wastes. c) Refuse: the collective term for solid wastes, includes both garbage and rubbish. d) Litter: odds and ends, bits of paper, discarded wrappings, bottles etc left lying around in public places.[18] Moreover Tchobanoglous et al defines Solid waste as any material that arises from human and animal

10 MLGRD. Sanitation Country Profile Ghana (2004). www.un.org/esta/agenda21.../ghana/sanitationGHANA04, assessed on 10th november, 2015.

11 Antonio Anyeley Patricia, The problem of waste management :A case study of Kumasi metropolitan assembly (1996) pp1.

12 Multitudes of approaches and explanations ;www.grid.unep.ch/waste/download/waste 0607assessed on 11th November 2015.

13 Ibid.

14 Urban Development Sector Unit East Asia and Pacific Region; What a Waste: Solid Waste Management in Asia United States of America(1999) pp5. web.mit.edu/urban upgrading/urban environment/resources/references/pdf/what a waste.assessed on 11th November,2015.

15 Multitudes of approaches and explanations ;www.grid.unep.ch/waste/download/waste0607 assessed on 11th November 2015.

16 Solid waste. www.smartranger.net/index.cfm?menuid=3. Assessed on 11th November 2015.

17 Ibid.

18 Ibid.

activities that are normally discarded as useless or unwanted.[19]Again, Hoornweg, and Thomas classified solid waste according to their sources and types .Under residential, there are food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires, and household hazardous wastes.).[20] Industrial consists of Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes. Also commercial comprises of Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes.[21] Construction and demolition includes Wood, steel, concrete, dirt, etc whiles municipal services involves Street sweepings; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas and sludge.[22]

The Centre for Environment and Development has also classified types of solid waste based on origin (food waste, rubbish, ashes and residues, demolition and construction, agriculture waste), based on characteristics (biodegradable and non-biodegradable), based on the risk potential (hazardous waste). The Centre also identified sources of solid waste as residential, waste from shops, commercials establishment, hotels/restaurants/eating stalls, slaughter houses and others.[23]

From the above explanation by the authors, it can be deduced that solid waste is any unwanted or useless solid materials derived from combined residential, industrial and commercial as well as human activities in a given area. Also, based on Hoornweg and the Centre For Environment and Development, it can be said that categories of solid waste consist of food waste, rubbish, ashes and residues, demolition and construction, agriculture waste among others. The sources of solid waste are domestic, industrial, commercial, institutional, and municipal. This definition of terms is essential to the study because it gives understanding of what the subject matter of the topic is, that is solid waste.

Again, Kumah defines solid waste management as "the administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of waste"[24] According to Samuel, Prince and Daniel, prior to 1880, the most insanitary conditions in the Gold Coast were traced or notable by towns along the coast. Thus, they had lagoons which bred swarms of mosquitoes and gave off bad smells.[25] This was as a result of the frequent dumping of human excreta and rubbish including waste into the beaches, alleys and outskirts of towns since they had no public or private latrines. This poor

19 Tchobanoglous, G., Theisen, H. and Vigil, S. *Integrated Solid Waste: Engineering principles and management issues*. McGraw-Hill Publishing Company, USA (1993).

20 Hoornweg, Daniel, Laura Thomas. Working Paper Series,Urban Development Sector Unit. East Asia and Pacific Region.(1999) 5.

21 Ibid.

22 Ibid.

23 Centre for Environment and Development Study of the Attitude and Perception of Community towards Solid Waste Management. A case study of Thiruvananthapuram city-Phase II. Submitted to Kerala Research Programme on Local Level Development. (2003).

24 Kumah, A.M "The Situation of Solid Waste in Ghana". Accra, (2007) 2.

25 Adu-Gyamfi Samuel, Osei-Wusu Adjei Prince, Owusu-Ansah Daniel. "Preventive Healthcare Strategies and Impact among the Asante people of the Twentieth Century Gold Coast: A Historical Narrative and Lessons for the Present Sanitation Challenge in Kumase". *Journal of Studies in Social Sciences*.Vol.5 (2013) 215.

sanitation eventually led to tropical infections such as malaria, worm infestation, yellow fever, sleeping sickness and yaws.[26] Nonetheless Adu-Gyamfi et al argued that it was in 1893 that Governor Griffith began to take first steps towards the adoption of a system for the disposal of sewage as well as strengthening of the staff at the Public Works Department.[27]

However, according to Oteng-Ababio, systematic solid waste management started in 1898 with the establishment of the Accra City Council. In 1925, public dustbins which were emptied by means of two pushcarts were introduced. These were later replaced with large carts drawn by mules and later with special sanitary vehicles. Incinerators were also introduced in 1929.[28] Around the latter part of the twentieth century, that is, late 1950s, the existing arrangement had become frazzled due to the increase in population cumulating to the total breakdown or crash of the only incinerator by 1970.Martin further pointed out that, the consequence of this was the pile up of refuse especially in the low income areas.[29]

According to Salifu, in an attempt to halt the decline, they resorted to masonry brick-furnaces for burning refuse (in our local parlance referred to as "boiling" from which came the derivate "bola" from "boiler") could no longer work.[30] The first major push to re-sanitize cities started with the implementation of the Accra Wastes Management Project from 1985 to 1994 with support from the German Technical Cooperation, GTZ (now GiZ). The project saw the injection of refuse loading trucks with the introduction of compaction trucks to replace the ubiquitous side-loading trucks (side-loader) that was in use in many towns and managed then by the environmental health units.[31] He further argued that just about this same time micro and small-scale enterprises participated in filling the gap, especially in difficult to reach areas relying mainly on non-motorized refuse collection systems (mainly donkeys and push-trucks).[32] The first Waste Management Department (WMD), Accra Metropolitan Authority's – WMD, was established in 1985 with the conversion of the then Mechanical Engineers Department which was solely responsible for managing the workshop for vehicle/equipment repair and maintenance to include solid waste collection and disposal services.[33] The Kumasi Metropolitan Authority's WMD (KMA-WMD) followed in 1992 with the assistance of the UNDP-Kumasi Sanitation Project. The Overseas Development Association, ODA (now DFID) of the UK also provided vehicles, machinery and equipment under the Kumasi Solid Waste Disposal project (1992 – 1995).[34]

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26 Ibid.

27 Ibid 216.

28 Oteng-Ababio Martin,"Private Sector Involvement In Solid Waste Management In The Greater Accra Metropolitan Area in Ghana. *Waste. Management & Research*(2009) 323.

29 Ibid.

30 Salifu Y Lukman "Access to Improved Waste Services: Clearer and Collective Responsibility, Innovation and Value Addition" National Workshop on Solid Waste Management (2011), British Council, Accra. p. 3.

31 Ibid.

32 Ibid.

33 Ibid.

34 Salifu Y Lukman"Access to Improved Waste Services: Clearer and Collective Responsibility, Innovation and Value Addition" National Workshop on Solid Waste Management (2011), British Council, Accra.p3.

Oteng-Aabio continued by arguing that afterwards refuse were been collected either house-house collection (HH) or communal container collection (CCC) in high and low areas respectively. Commercial rates were charged for HH services, whiles cross-subsidization was adopted for CCC.[35] During this period, about 660 tons of refuse were generated daily in Managing these waste led to a huge financial burden on Accra Metropolitan Assembly as users of CCC, constituting about 70% of the entire population enjoyed free services.[36] He added that to improve revenue mobilization, a privatization policy was conceived which was also seen as a means to extend coverage. However the sole responsibility of the waste management department was the treatment and disposal of waste.[37]

Salifu further pointed out that, the Government of Ghana (GoG) with support from external-support agencies (ESAs, now collectively referred to as Development partners to including NGOs and CSOs), particularly the World Bank, implemented a number of projects to remedy the situation which was alarming in many large cities and secondary towns; these efforts culminated in the implementation of the Urban Development Projects series, including Urban II, III, IV and V which were carried out between (1992 – 2001); the second phase of the Urban Environmental Sanitation Project (UESP II)which is ongoing till date.[38] Additionally, the Environmental Sanitation Policy (1999 and the Revised version of 2010) provided the space for private sector involvement at all stages of the service chain from collection to disposal.[39] It is therefore important to note that, Samuel, Prince and Daniel pointed out how indigenes in gold coast managed waste and also their sanitary conditions at that point in time. Martin in his research also traces historical information about how systematic solid waste management began and Lukman did an extensive historical research on how the government managed solid waste over the years.

According to Achankeng, municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of African cities. This is because even though these cities are using 20-50 percent of their budget in solid waste management, only 20-80 percent of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation.[40] He further stated that in many other cities including Accra, Ghana where only 11 percent of the 1.4 million people benefit from home collection of their solid waste. Hence, the uncollected waste is illegally dumped in open spaces, water bodies, and storm-drainage channels, buried, burnt or deposited along the streets or roadsides. Blocked drainage channels cause flooding in the cities.[41] These he says attribute to the prevalence of parasites, tetanus, malaria, hookworm, cholera, and diarrhea so common in many African cities to unsanitary conditions caused by waste being simply strewn

35 Oteng-Ababio Martin, Private Sector Involvement In Solid Waste Management In The Greater Accra Metropolitan Area in Ghana. *Waste. Management & Research* (2009) 323.

36 Ibid.

37 Ibid.

38 Salifu Y. Lukman. "Access to Improved Wast timee Services: Clearer and Collective Responsibility, Innovation and Value Addition" National Workshop on Solid Waste Management (2011), British Council, Accra.p4.

39 Ibid p. 8.

40 Achankeng Eric , "Globalization, Urbanization and Municipal Solid Waste Management in Africa" in African Studies Association of Australasia and the Pacific Conference Proceedings - African on a Global Stage.( 2003) p. 7.

41 Ibid p. 15.

around.[42] Benoit also added that, poor management of solid waste has a major impact on the people's health and livelihood. For instance, in the Greater Accra Metropolitan Area, the ten most common problems reported at outpatient facilities clearly demonstrate the importance of environmental conditions. Of these, malaria is the most prominent, followed by upper respiratory tract infections, diarrhea, skin diseases, and intestinal worms.[43] Thus, in Accra, Ghana, the major health problems are diseases attributed to poor environmental sanitation. Also, it has been noted that malaria is Ghana's major health problem, the country's number one source of death, currently killing 25 percent of children aged five and under, and accounting for over 40 percent of all outpatients in health centers in Accra and Kumasi.[44] He emphasized that not only does poor sanitation affect the health and socio-economic status of the people; it is also a disincentive to potential investors.[45]

Owusu-Sekyere et al also argue that the uncollected waste clogs drains leads to flooding and impacting negatively on public health. Data from the Ghana Health Service indicate that six (6) out of the top ten (10) diseases in Ghana are related to poor environmental sanitation, with malaria, diarrhea and typhoid fever jointly constituting 70%- 85% of out-patient cases at health facilities.[46] Owusu-Sekyere et al further argues that Malaria remains the number one killer in Ghana, accounting for 17,000 deaths, including 2,000 pregnant women and 15,000 children below the age of five", a quarter of all child mortality cases and 36% of all hospital admissions over the past 10 years". The Ghana Medical Association also stipulates that about five million children die annually from illnesses caused by the environment in which they live.[47] In Kumasi, a Ghana Health Service (2010) report states that, "out of the cholera cases reported to health facilities, 50% came from Aboabo and its environs (Subin Sub-Metro) where solid waste management is perceived to be the worst". Poor waste management practice also places a heavy burden on the economy of the country.[48]

Again, poor waste management damage ecosystems**.** When solid waste is dumped into rivers or streams it can alter aquatic habitats and harm native plants and animals. The high nutrient content in organic wastes can deplete dissolved oxygen in water bodies, denying oxygen to fish and other aquatic life form.[49] Solids can cause sedimentation and change stream flow and bottom habitat. Sitting dumps or landfills in sensitive ecosystems may destroy or significantly damage these valuable natural resources and the services they provide.[50] However, Owusu argues and emphasis on the social implication of poor management of solid waste. He

42 Ibid.

43 Demanya Klenam Benoit, 'The Role of Local Knowledge in planning and managing urban solid waste: the tale of two (2) West African Cities, Accra and Kumasi, Ghana'A thesis presented to the University of Waterloo in fulfillment of the thesis requirement for the degree of Doctor of Philosophy in Planning Waterloo, Ontario, Canada, (2006) p. 10.

44 Ibid.

45 Ibid p.11.

46 Owusu-Sekyere Ebenezer, Emmanuel Harris, Ebenezer Bonyah, Forecasting and Planning for Solid Waste Generation in the Kumasi Metropolitan Area of Ghana: An ARIMA Time Series Approach, *International Journal of Sciences*(2013) p. 70.

47 Ibid.

48 Ibid.

49 Solid waste: generation, handling, treatment and disposal, "Environmental Guidelines for Small-Scale Activities in Africa (EGSSAA)"(2009) p 4 www.encapafrica.org.assessed on 11th November 2015.

50 Ibid.

argues from his study i.e. on the sabon zongo community that the abundance of uncollected garbage and its use as a weapon raises questions about community social cohesion. Poor urban communities are noted for their strong social cohesion. This is achieved through social networks; a process which tends to assist the poor to weather the storms and challenges associated with urban life.[51] Owusu further argues that related to community social cohesion which is the role of adults as promoters of good social values and the moral upbringing of young community members. Under the fear of possible retribution of being bombarded with garbage, adults watch as some youths openly smoke marijuana and engage in other social vices in the community. In this context, adults' role as guardians of the future generation of the community is greatly impeded.[52] Also, he states that another social consequence of poor sanitation and waste management is its effects on children. He continues to point out that poor living environments have particularly far reaching consequences for children and adolescents as they are more vulnerable than adults to a range of environmental concerns and more likely to be affected in ways that have longer-term repercussions. It is therefore widely acknowledged that clean and well kept neighborhoods are not only good for the health of children but also affords them opportunities for companionship, recreation and social learning.[53] In addition, the environment serves as the arena for cultural rules and norms that guide the activities and behaviors which are reinforced and reproduced through the repetition of those daily activities in which people participate.[54] Main effect of this observation is that children's world view will be to a certain extent determined by what they observed in their community. This may partly account for some of the youths' undisciplined behavior towards littering and their lack of appreciation of good sanitary practices.[55] George further supports his argument that, growing up within an environment of garbage all around and poor sanitary practices, the youths and young children of Sabon zongo are unlikely to behave any differently from their older community members who litter the community. Reinforced by inadequate waste management by AMA, this situation is likely to perpetuate a vicious cycle of poor sanitation. [56] Finally he argues that the poor state of sanitation and the physical living environment have implications for community characterization and stigmatization by "others". The negative characterization of poor urban communities as a result of their poor infrastructure and physical environment is associated with stigmatization of the population and individuals living in such communities.[57] By far, we know and understand some implications or effects of solid waste if not managed or handled properly. It is therefore important to point out that Eric and Benoit identified some health and negative environmental impact of poor solid waste management whereas George highlighted some social consequences relating to poor management of solid waste. It helps to know various and different implications altogether pertaining to poor solid waste management.

51 Owusu George. Social effects of poor sanitation and waste management on poor urban communities: a neighborhood-specific study of Sabon Zongo, Accra, *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, (2010) 3:2, p. 156.

52 Ibid.

53 Ibid, p.157.

54 Ibid.

55 Owusu George. Social effects of poor sanitation and waste management on poor urban communities: a neighborhood-specific study of Sabon Zongo, Accra, *Journal of Urbanism: International Research on Place making and Urban Sustainability*, (2010) 3:2, p. 157.

56 Ibid.

57 Ibid.

Salifu stated in his paper that, waste management services were largely provided by the public (i.e. MMDAs) and therefore had its antecedents in how local governance of our towns and cities evolved.[58] He further argued that the Municipal Ordinance of 1859 established municipalities in the coastal towns of the Gold Coast. In 1943, a new Ordinance established elected town councils for Accra, Kumasi, Sekondi-Takoradi and Cape Coast. In 1953, the Municipal Councils Ordinance was passed. Many of our municipalities started as Public Health Boards with the establishment of the first one in Cape Coast, followed by Accra and then Kumasi.[59] The mandates of the Public Health Boards were primarily to ensure hygienic living surroundings within settlements. The main operational tool was enforcement management with diligent premises inspections and sanctions. The public health boards provided all the services and paid for these from taxes and central government transfers.[60]

However, Salifu pointed out that after independence, the Local Government Act 54 of 1961 followed. The local government bodies were required to provide municipal services and amenities in their localities without regard to whether or not they had the resources to deliver.[61] He emphasize that this state of affairs continued into the 1960s and early 1970s with the creation of City Councils and up to the establishment of the District Assemblies by Local Government Law, 1988 (PNDCL 207).[62] He added that the first Waste Management Department (WMD), Accra Metropolitan Authority's – WMD, was inaugurated in 1985 with the conversion of the then Mechanical Engineers Department which was solely responsible for managing the workshop for vehicle/equipment repair and maintenance to include solid waste collection and disposal services.[63] The Kumasi Metropolitan Authority's WMD (KMA-WMD) followed in 1992, with the assistance of the UNDP-Kumasi Sanitation Project. The Overseas Development Association, ODA (now DFID) of the UK also provided vehicles, machinery and equipment under the Kumasi Solid Waste Disposal project (1992 – 1995).[64]

Moreover, According to the Ministry of Local Government and Rural Development (MLGRD), general waste management in Ghana is the responsibility of the MLGRD, which supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). [65] However, the ministry specified that, regulatory authority was vested in the Environmental Protection Agency (EPA) under the auspices of the Ministry of Environment and Science. The Metropolitan, Municipal and District Assemblies are responsible for the collection and final disposal of solid waste through their Waste Management Departments (WMDs) and their

58 Salifu Y Lukman "Access to Improved Waste Services: Clearer and Collective Responsibility, Innovation and Value Addition" National Workshop on Solid Waste Management (2011), British Council, Accra.p. 2.

59 Ibid.

60 Ibid.

61 Salifu Y Lukman "Access to Improved Waste Services: Clearer and Collective Responsibility, Innovation and Value Addition" National Workshop on Solid Waste Management (2011), British Council, Accra. p. 3.

62 Ibid.

63 Ibid.

64 Salifu Y Lukman "Access to Improved Waste Services: Clearer and Collective Responsibility, Innovation and Value Addition" National Workshop on Solid Waste Management (2011), British Council, Accra. p3.

65 MLGRD.SanitationCountryProfileGhana(2004).(www.un.org/esta/agenda21.../ghana/sanitation GHANA04. Assessed on 10th november, 2015 p. 2.

Environmental Health and Sanitation Departments (EHSD).[66] The policy framework guiding the management of hazardous, solid and radioactive waste includes the Local Government Act (1994), Act 462, the Environmental Protection Agency Act (1994), Act 490, the Pesticides Control and Management Act (1996), Act 528, the Environmental Assessment Regulations 1999, (LI 1652), the Environmental Sanitation Policy of Ghana (1999), the Guidelines for the Development and Management of Landfills in Ghana, and the Guidelines for Bio-medical Waste (2000). All these Acts and Regulations emanate from the National Environmental Action Plan.[67]

Again, Appiah et al proceeded by arguing that the Local Government and Rural Development (MLGRD) published Ghana's National Environmental Sanitation Policy (NESP) document which highlighted the requisite role an enabling institutional framework plays in the attainment of an efficient environmental sanitation service delivery as it linked to the poor status of environmental sanitation in the country at the time its inception in 1999 to factors directly or indirectly related to the institutional framework.[68] According to the Policy, some of the factors that were responsible for the poor state of environmental sanitation in the country at that time were; weak and/or outdated and poorly enforced environmental sanitation legislation; Inadequate allocation of resources for environmental sanitation services, both nationally and at district level and lack of adequate professional manpower including engineers, planners and administrators, for planning, management, policy formulation and research.[69]

Furthermore, the ministry i.e. the MLGRD developed Out of the National Sanitation Policy, a technical guideline document titled 'The Expanded Sanitary Inspection and Compliance Enforcement (ESICOME) Programme guidelines.[70] The programme guidelines which were implemented by the MMDA's, consistently looked at four broad areas specifically; effective environmental health inspections (Sanitary Inspections), dissemination of sanitary information (Hygiene Education), pests/vector control and law enforcement. All MMDAs have developed waste management and environmental health plans to help solve the numerous sanitation problems.[71] The National Environmental Sanitation Policy Co-ordination Council (NESPoCC) was generally responsible for coordinating the policy and ensuring effective communication and cooperation between the many different agencies involved in environmental management in their respective Districts.[72] It can be deduced from the above that lukman historically looked at how the local government administration and decentralization influenced the enactment of the legislations that sought to specify the roles of agencies and entities responsible for planning and delivery of services including solid waste. Conversely Peter, Emmanuel, Anthony and the sanitation country profile helped in analyzing various sanitations regulations and policies that had been kept in place by the MLGRD to deal with the solid waste menace in the country, rather, it has proved futile in achieving its goals and improving in the area of solid waste management.

66 Ibid.

67 Ibid.

68 Appiah Peter, Obeng Emmanuel A. Donkor Anthony Mensah, ,"Assessment of institutional structuresfor solid waste management in Kumasi", Management of Environmental Quality: An International Journal (2009), Vol. 20 Iss 2 pp. 107.

69 Ibid.

70 MLGRD.SanitationCountryProfileGhana(2004).(www.un.org/esta/agenda21…/ghana/sanitationGHANA04. Assessed on 10th november, 2015 p. 2.

71 Ibid

72 Ibid

According to Amoah et al (2014), when the entire functional elements of solid waste management are been practiced, it ensures good sanitation. This still remains a reverie for most developing economies across the globe.[73] They further identifies inefficiencies in dealing with the management of solid waste in Ghana is attributed to the myriad of factors such as lack of well thought management plan for solid waste collection and disposal in most developing countries hindering the effective management of solid waste in most countries, lack of awareness of proper disposal habits on the part of residents in poor urban suburbs, in some cases whereby residents burn or dump refuse in streams and stagnant gutters, all of which creates breeding grounds for disease spreading insects and vermin as well as the inefficient monitoring mechanisms from the quarters of city authorities.[74] Also, low technological know-how to manage the waste which is engulfing the cities and towns, government's inability to mobilize the needed funds to finance solid waste management, poor urban planning that militate against waste collection and the lack of policies and regulations that sanctions officials and residents who are found couple of environmentally unfriendly practices.[75]

Guerrero et al not stating contrary to what is shared by Amoah et al, postulate that the challenges affecting the management of solid waste includes technical, environmental, financial, socio-cultural, institutional and legal issues.[76] They further indicated that under the technical factors were; lack of technical skills among personnel within municipalities and government authorities, deficient infrastructure, poor roads and vehicles, insufficient technologies and reliable data.[77] Also factors affecting the environmental aspect of solid waste management in developing countries are the lack of environmental control systems and evaluation of the real impacts. Financial and socio-cultural challenges were said to be the huge expenditure needed to provide the service, the absence of financial support, limited resources, the unwillingness of the users to pay for the service, lack of proper use of economic instruments, people not participating in decision making, community awareness and societal apathy for contributing in solutions have hampered the delivery of proper waste management services.[78] Institutional and legal challenges argued were; lack of organizational capacities (leadership) and professional knowledge, the absence of satisfactory policies and weak regulations been injurious to the management of solid waste.[79]

Additionally, these researchers stated apparently the various factors that impinge on the effective management of solid waste in developing countries and Ghana in particular. They failed to delve and give account of conditions or situations that caused these challenges. This research therefore seeks to give facts which will help to unravel the sources or causes of the

73 Amoah Twumasi Samuel, Enoch Akwasi Kosoe, "Solid Waste Management in Urban Areas of Ghana: Issues and Experiences from Wa." *Journal of Environment Pollution and Human Health*, (2014) vol. 2, no. 5 pp. 110-111.

74 Ibid.

75 Ibid, pp. 111,116.

76 Guerrero lilliana Abarca, Ger Maas, William, Hogland "Solid waste management challenges for cities in developing countries" *Journal of Waste Management.* (2013) www.elsevier.com/ locate/wasman pp221.

77 Ibid, p. 222.

78 Ibid.

79 Guerrero lilliana Abarca, Ger Maas, William, Hogland "Solid waste management challenges for cities in developing countries" *Journal of Waste Management.* (2013) www.elsevier.com/ locate/wasman p.222.

challenges that confronts managers of solid waste in the Kumasi metropolis. Day in day out, tons of wastes is generated in the city of Kumasi**.** In 1995, the rate of domestic waste generation in Kumasi was estimated at 600 tons per day. By 2005, 1000 tons of solid waste was generated each day in the city; three years later, the WMD was collecting 1,200 tons a day and 2010 WMD document shows that 1,500 metric tons of waste was generated in Kumasi each day.[80] Most of the waste is generated in the Subin sub-metro area, largely because there are two markets there. A 1999 study estimated that two-thirds of residential waste was dumped in open lots or on the banks of natural streams. The uncollected waste posed a serious health hazard and contaminated surface water sources. Also, relatively high incidence of sanitation related diseases such as malaria; cholera, typhoid fever, and dysentery are attributable to improper management of solid waste.[81] In Kumasi, a Ghana Health Service (2010) Report states that, "out of the cholera cases reported to health facilities, 50% came from Aboabo and its environs (Subin Sub-Metro) where solid waste management is perceived to be the worst".[82] Filth and foul smell emanating from the heaps of rotten refuse are another cause of worry. Outstanding among the problems stated include people constantly littering the streets, pavements and lawns without any hesitation as a result of inadequate public education and sensitization programmes. According to the Metro District Health Management Team Annual Report (2007), the relatively high incidence of water borne diseases like typhoid fever, cholera, dysentery and other gastro-intestinal infections prevalent in some nearby communities are attributable to the pollution of the streams, because of poor management of this solid waste.[83]Also, solid waste disposal had been recognized as one of the major problems in peri- urban and urban communities like Kumasi.[84]With the persistent levels of sanitation related diseases in Ghana especially in Kumasi, it has become imperative for a research to be conducted in order to examine how effective the Waste Management Department of the Kumasi Metropolitan Assembly has performed its task over the years. The research will specifically examine the roles they play in the management of solid waste and various factors that have hindered the effective operation of the waste

## The Topography and Approach

The study focused on the Waste Management Department of the Kumasi Metropolitan Assembly of the Ashanti Region of Ghana and examined how effective the department has played its role in the management of solid waste in the metropolis. Geographically, Kumasi is located in the transitional forest zone and is about 270km north of the national capital, Accra. It is between latitude 6.35° – 6.40° and longitude 1.30° – 1.35°, an elevation which ranges between 250 – 300 meters above sea level with an area of about 254 square kilometers.[85]The

80 Post J, 'The Problems and Potentials of Privatizing Solid Waste Management in Kumasi, Ghana'. *Habitat International,* Vol. 23,(1996) No. 2, pp. 201-216.

81 Ibid.

82 Ebenezer Owusu-Sekyere, Emmanuel Harris, Ebenezer Bonyah,Forecasting and Planning for Solid Waste Generation in the Kumasi Metropolitan Area of Ghana: An ARIMA Time Series Approach, *International Journal of Sciences*(2013) p. 70.

83 Ibid.

84 Edem Cudjoe Bensah,Edward Antwi and Julius Cudjoe Ahiekpor:'Improving Sanitation in Ghana-Role of Sanitary Biogas Plants', *Journal of engineering and applied sciences* p.126.

85 Owusu-Sekyere Ebenezer , Emmanuel Harris, Ebenezer Bonyah,Forecasting and Planning for Solid Waste Generation in the Kumasi Metropolitan Area of Ghana: An ARIMA Time Series Approach, *International Journal of Sciences*(2013) p. 70.

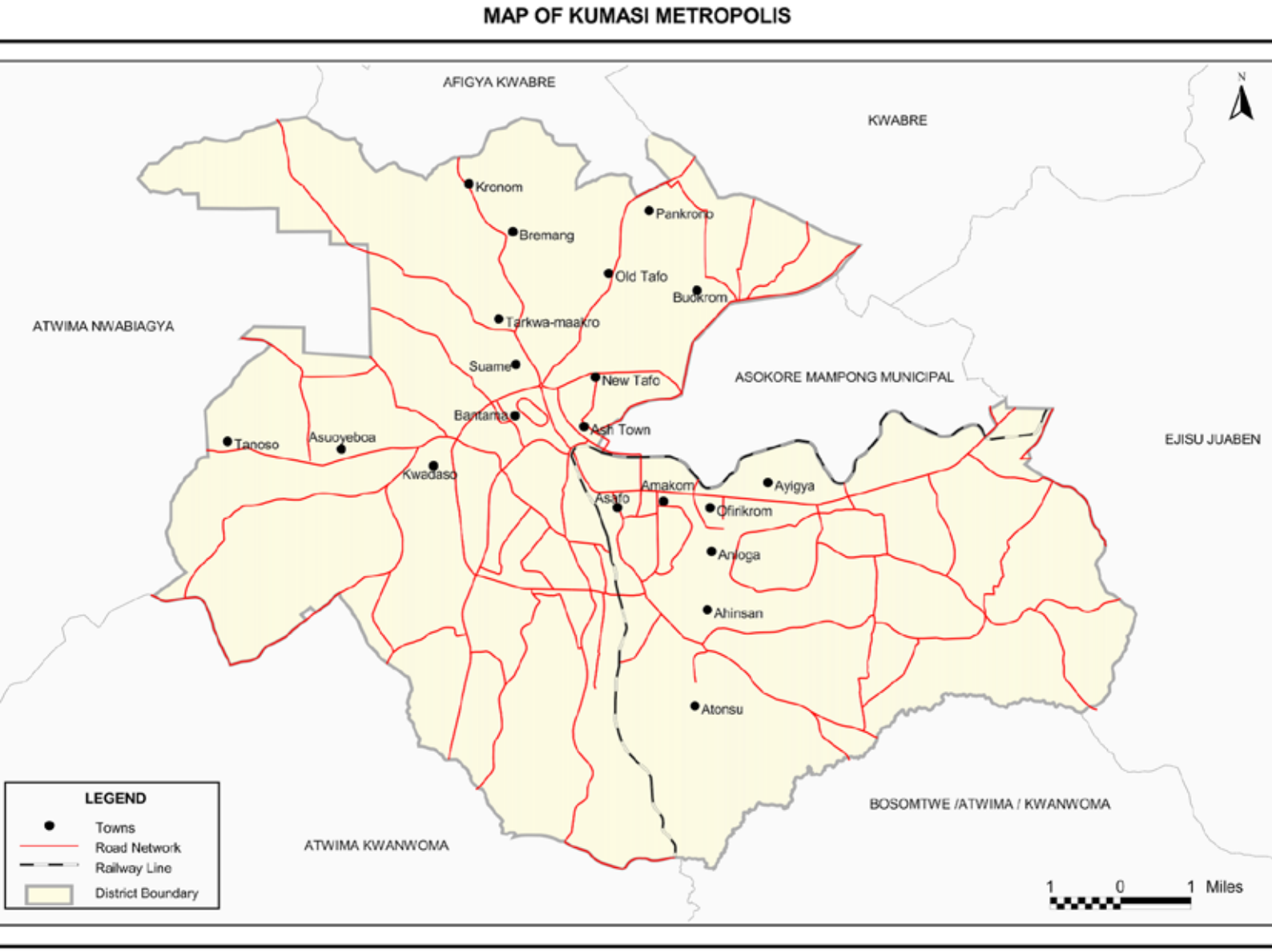



**Figure 1.7** Source: Ghana Statistical Service, GIS.

Kumasi metropolitan assembly constitutes the highest authority in the metropolis. It is divided into ten administrative sub metro council areas. These are located at Bantama, Subin, Manhyia, Oforikrom, Tafo-Pankrono,Nhyiaeso, Kwadaso, Suame, Asokwa and Asawase. The basic occupation of the people in Kumasi is trading.[86] The waste management department in Kumasi started operation in 1992 which coincided with the Fourth Republic. In order to do holistic examination and assessment of the operations of the waste management department of Kumasi metropolitan assembly, this research work covers the period of the establishment of the Waste Management Department.

Again, urbanization had also increased leading to growth in population as a result of expansion of industries and large commercial activities in and around Kumasi, eventually contributing to the amount of solid wastes produced in the city. The study basically focused on

86 Kumasi Metropolitan Assembly; www.kma.ghanadistricts.gov.gh assessed on 11november 2015.

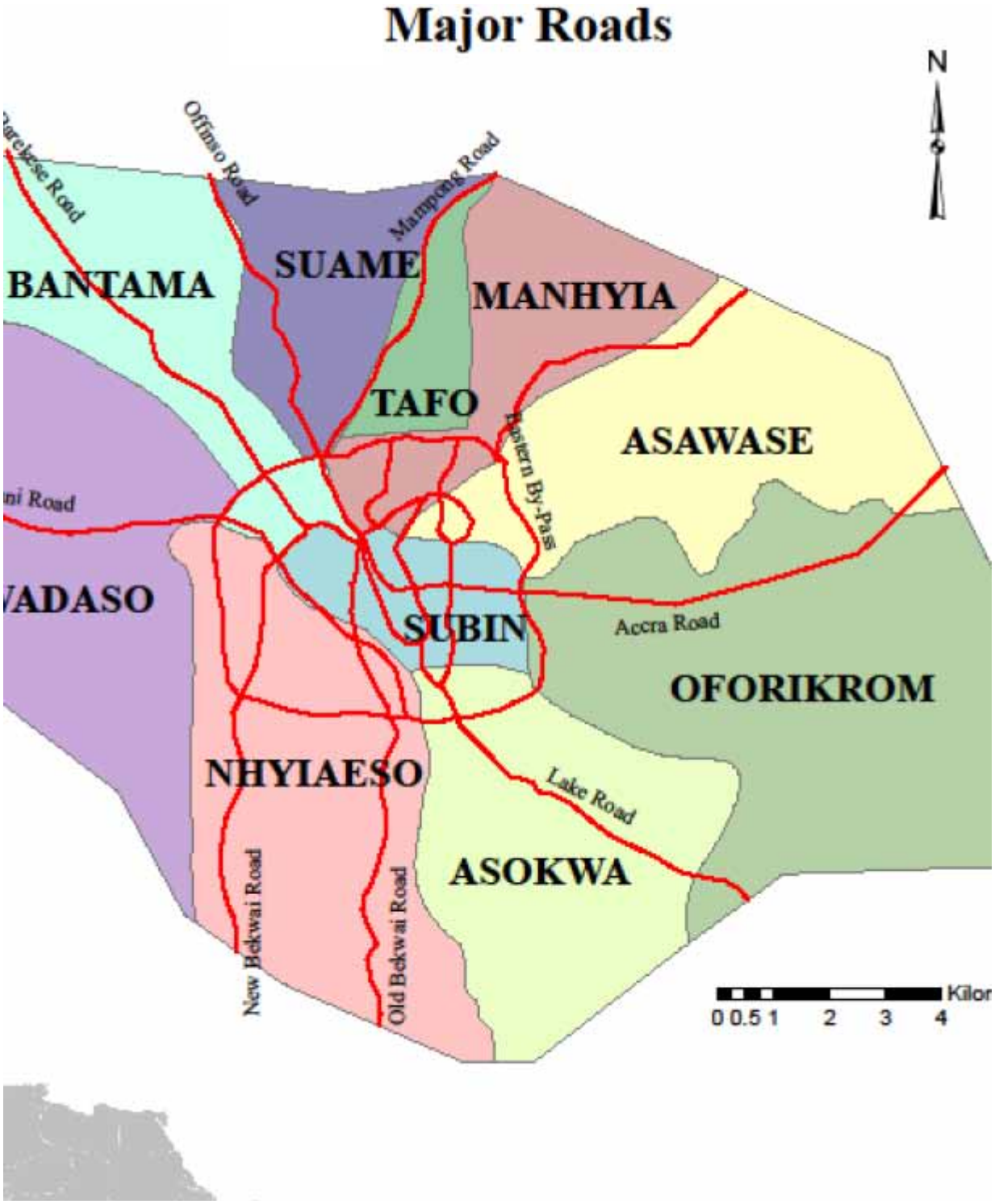



**Figure 1.7,2** Map of Kumasi Showing Sub-Metropolitan Areas and Major Roads.

domestic waste because most of these wastes are generated within the metropolis. The Kumasi metropolitan area had been estimated to have a daytime population of about 2 million. It was projected to have population of 1,610,867 in 2006 and 1,889,934 by 2009 based on the growth rate of 5.47% per annum.[87]

This study employed the qualitative method of data collection and analysis. This therefore involved primary data like personal interviews with key personnel within the waste management department, waste management experts and other executives from the private waste management departments. Archival data i.e. records on how the waste management department of the KMA has operated over the years in relation to the management of solid waste. Also a combination of tools was used to collect information which includes a questionnaire survey. The questionnaire was administered to market people within Kumasi metropolis. These questionnaires were randomly given to the traders and businessmen and women within the market. Again, though some were educated most of the questionnaires were translated into Twi to enable respondents to understand. The questionnaire survey was used mainly to collect numerical data about the opinions of the management of waste and their assessment of the operations of the waste management department in Kumasi. The type of questionnaires used in this research was both closed and open-ended questionnaires. By using this type of questionnaire the people were able to answer the questions in their own words as well as chose from possible options about happening in the area especially the issue of solid waste. A sample of hundred people was used in this research. Also the quantitative data gathered from the closed questionnaire was analyzed by coding the data into the computer for analysis with the help of Statistical Package for the Social Sciences (SPSS). This helped to give a comprehensive knowledge about the knowledge about the effectiveness of the waste management department in the management of solid waste in the Kumasi metropolis of Ghana. Secondary sources such as books, published articles and journals were also used in the course of the research.

## Discussion

The waste management department in Kumasi was established in 1992.[88] Lukman has argued that it was built or formed with the assistance of the United Nations Development Program -Kumasi Sanitation Project. The Overseas Development Association, ODA (now DFID) of the UK also provided vehicles, machinery and equipment under the Kumasi Solid Waste Disposal project (1992 – 1995).[89] It started as a cleaning department of the assembly and then developed to waste management department.[90] The main role of the department since its inception is to ensure that waste generated within the metropolis is transported and disposed of appropriately to keep the city clean and provide a clean environment safe and healthy for socio-economic

87 Asase Mizpah,Ernest K Yankul,Moses Mensah,Jay Stanford,Samuel Amponsah,Comparison Of Municipal Solid Waste Management Systems In Canada And Ghana:A Case Study Of The Cities Of London ,Ontario,Kumasi,Ghana,*Waste Management* (2009) p. 2781.

88 Interview with Mr. John Yaw Donkor, The Deputy Director of The Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st march, 2016.

89 Salifu, Lukman Y "Access to Improved Waste Services: Clearer and Collective Responsibility, Innovation and Value Addition" National Workshop on Solid Waste Management (2011), British Council, Accra. p.3.

90 Interview with Mr. John Yaw Donkor, The Deputy Director of The Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st March, 2016.

development.[91] As Oteng-Ababio, confirmed in his research that the sole responsibility of the Waste Management Department was the treatment and disposal of waste.[92] The waste generated within the metropolis around the 90's were 800tons per day, so virtually 292,000tons of waste were generated yearly within the metropolis. From 1992-2000's, 1,200 tons were generated per day amounting to 438,000 tons of waste generated within the metropolis.

Also from 2008-2014, 1,500 tons of waste were generated within the metropolis therefore 547,500 were produced yearly.[93] He stated that the increasing rate in the volume of waste generated over the years within the metropolis is as a result of population i.e. as population increases, the volume of waste generated also increases.[94] Another contributory factor he added was that urbanization and the lifestyle of the people keeps changing, they have been switching from the use of organic to inorganic. People migrate from rural areas to urban centres at times not specifically to permanently stay but to engage in commercial activities and go back. In that sense, urban population keeps increasing. When these migrants come into the cities or towns like Kumasi they definitely generate waste contributing to the waste generation capacity within the metropolis.[95] The waste management department started partnering with one private contractor in 1998 on a pilot basis under the Urban 4 Environmental Sanitation Project 1. The company was Waste Group Ghana limited, and then in 2000, it partnered with others. The department continues collaborating with 6 private contractors in the management of waste. They are Zoomlion ,KMWL, Sakem, Anthoco, Vermark and Asadu. The main roles of these private contractors are collection and transporting wastes to landfill sites, other agencies manage it from the disposed area. The final disposal site of solid waste in the Metropolis is the landfill site at Dompoase.[96] The role of the waste management department is now monitoring, supervision, evaluation and community education and sensitization. They have an officer at the sub metro and unit committee member who see to the coordination between the waste management department and the other private contractors and gives feedback on contractors concerning the collecting and transportation of wastes as well as their efficiency.[97]

## Demographic Characteristics Of Respondents

### Sex of Respondents

The respondents for this questionnaire were both males and females at some markets in Kumasi; they are hundred (100) in number. The females constituted 57.0% whiles the males represented 43.0%.This was because trading in Ghana is dominated by females who are mostly found in the market than men. Also in our traditional settings, females are mostly noted to be in charge of sweeping and gathering different forms of domestic solid waste and disposing them off.

91 Ibid

92 Oteng-Ababio, Martin "Private Sector Involvement In Solid Waste Management In The Greater Accra Metropolitan AreainGhana.*Waste.Management&Research*(2009) p323.

93 Interview with Mr. John Yaw Donkor, the deputy director of the Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st march, 2016.

94 Ibid.

95 Ibid.

96 Interview with Mr. John Yaw Donkor, The Deputy Director of The Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st march, 2016.

97 Ibid

The respondents were from three markets. The largest respondents were from The Central Market in Kumasi, representing 40%, followed by both Asafo and Kejetia markets, representing 30%. This means that individual respondent were dominated by the people at Central market .This is because is the main central market in Kumasi metropolis and they amount to a highest number of population.

### Age Group of Respondents

The ages of the respondents were categorized into four parts. 24.0% of the respondents were between the ages of 18-29, 50.0% of them were in the age range of 30-49, 25.0% of the respondents were in the age range of 50-69 and it was also revealed that 1.0% was between 70 years and above .The largest age range in terms of percentage are those between the ages of 30-49 and they are mostly found engaging in various kinds of businesses at the market centres.

### Educational Level of Respondents

Concerning the educational level, 9.0% of the respondents had no formal education, 23.0% of them had primary education, 39.0% of the respondents had middle school or junior high level education, and 17.0% also had senior high school, technical or vocational level education whereas 12% of the respondents had attained their tertiary education. The majority of the respondents are junior high or middle school levers. It means that, at least the people have attained some level of education hence there is some level of literacy within the area under study.

## Disposal Of Waste Within The Kumasi Metropolis

### Common Forms of Solid Waste Generated

The Waste Management Department of KMA noted that there are two types or categories of wastes generated within the metropolis. They are organic and inorganic wastes. The organic are those that decompose easily whereas the inorganic do not. The organic consists of food wastes such as banana peels, kenkey peels, orange peels and others.[98] The inorganic comprises of plastics, cardboards papers, glass/bottles, metals, and textiles. The composition of organic wastes generated in the Kumasi metropolis is 40.19%.under the inorganic wastes constituents; plastics form 19.86%, glass/bottle make up 1.20%, paper represent 7.04%,metal compose of 2.23%.textiles constitute to 6.94% and "INET" which stands for sand, ash ,fire and demolishing of waste material add up to 20.84.[99]

From the table the study indicated that, 62.0% of rubbish are been generated by the respondents in the market, Again, 35.0%constitute food wastes produced by them, 2.0% represent wood generated by the respondent and 1.0% of others such as ashes are as well been generated by the respondents. Hence rubbish can be said as the common forms of waste generated within the market centers.

98 Interview with Mr. John Yaw Donkor, The Deputy Director of The Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st march, 2016.

99 Ibid.

**Table 2.0** Source: Researcher's Field Work (2016).

| **Solid Waste** | **Frequency** | **Percentage (%)** |
|---|---|---|
| Rubbish | 62 | 62.0 |
| Food Wastes | 35 | 35.0 |
| Wood | 2 | 2.0 |
| Others | 1 | 1.0 |
| **TOTAL** | **100** | **100%** |

### Where Wastes Are Been Dumped Off

With regards to where they normally dump their wastes, 17.0% of the respondents dump their wastes by the road side, 16.0% represent those who dump theirs at the dumpsite, 3.0% of the respondents dump their waste in nearby gutters, 35.0% are those who dump their wastes in bins then lastly the others which constitute 29.0% of the respondents dump their waste in front of their stores, sacks, polythene bags or either boxes. So majority of the respondents dump their waste in bins which are illustrated below.

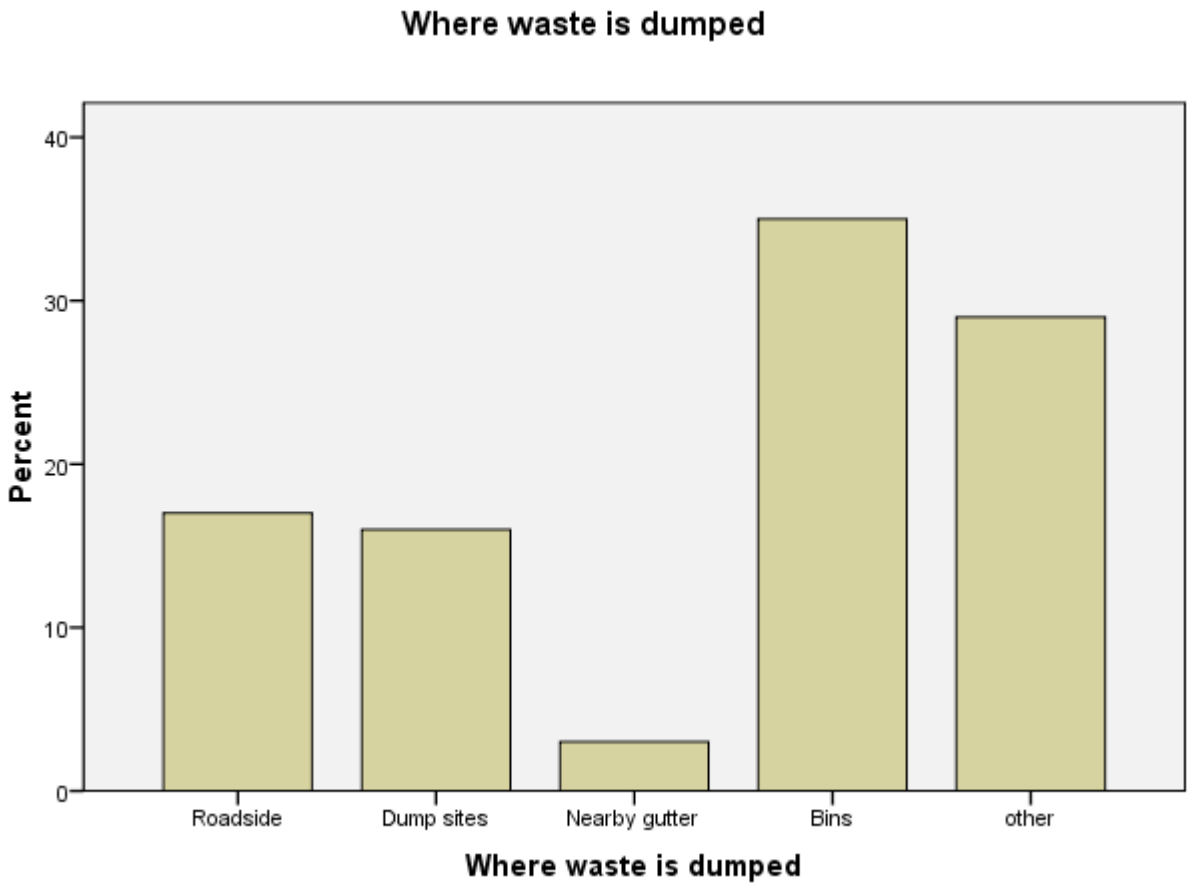



**Table 2.1** Source; Researchers Field Work (2016).

## Collection Of Waste By The Waste Management Institutions

Out of the 100 respondents, 22.0% of the them responded that the waste management division of KMA collects their waste for disposal, 40.0% of the respondents responded that Zoomlion (A Private Refuse Collection Company in Ghana) collects their waste for disposal. 27.0% of the respondents had no idea about the institutions that collect waste within the market and 11.0% indicated that no waste management institution collect their waste so they hire people or potters to collect their refuse. They are charged according to the volume of waste generated.

### Regularity of Waste Collection

According to the waste management department, there is no need determining the frequency of waste collection. The ideal situation for the house to house (door-to-door) collection is for them to collect the wastes twice within a week but they are unable to do so frequently. With the communal system, the containers become full before they go for it.[100] Collection of waste frequently is a momentous exercise in the management of solid waste. From the survey, 54.0% of the respondents indicated that wastes are collected everyday within the markets. They added that waste management institutions do collect the refuse but sometimes their efforts are supplemented by people they pay out of pocket to help them collect their refuse regularly.12.0% of the respondents also answered that wastes are collected every three days.34.0% represented those who pointed out that wastes are collected weekly, 4.0% of the respondents responded that collection takes place every two weeks, again 4.0% of them responded that wastes are collected monthly and finally 2.0% represents those who confirmed that their wastes are not collected so they either leave them and hope to washed by the rains.

The table below shows what happens if the wastes are not collected in time.

**Table 2.2** Source; Researcher's Fieldwork (2016).

| Where Wastes Are Dumped | Frequency | Percentage (%) |
|---|---|---|
| Gutters | 16 | 16.0 |
| Available Space | 23 | 23.0 |
| Burn Them | 13 | 13.0 |
| Burry Them | 1 | 1.0 |
| Others | 47 | 47.0 |
| **TOTAL** | **100** | **100%** |

100 Interview with Mr. John Yaw Donkor, the deputy director of the Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st march, 2016.

From the table above, 16.0% of the respondents dump their waste in gutters if not collected in time. 23.0% represented those who dump their wastes in available space near them, also 13.0% of the respondents burn their waste if not collected in time, 1.0% represents respondents who burry their wastes and 47.0% of the respondents indicated that they either leave their wastes until it is collected by the waste management institutions or they pay people to collect them.

**Mode of Solid Waste Collection**

According to the waste management department, they have two collection systems; the communal collection and the house to house (door-to-door) collection systems.


Table 2.3 above focuses on the mode of collection within the markets. 47.0% of the respondents indicated that waste is collected on communal basis. 50.0% represents those who responded that the mode of collection is door –to-door.3.0% represents respondents who had no idea about the mode of collection of wastes within the markets. Conclusively, the majority of wastes are collected on door-to-door basis.

## Management Of Waste Within The Kumasi Metropolis

### Assessment of How Effective The Waste Management Department Of Kumasi Metropolitan Assembly Had Been In The Management Of Solid Waste Over The Years

| Assessment | Frequency | Percentage (%) |
|---|---|---|
| Effective | 34 | 34.0 |
| Very Effective | 4 | 4.0 |
| Very Poor | 49 | 49.0 |
| Extremely Poor | 13 | 13.0 |
| **TOTAL** | **100** | **100%** |

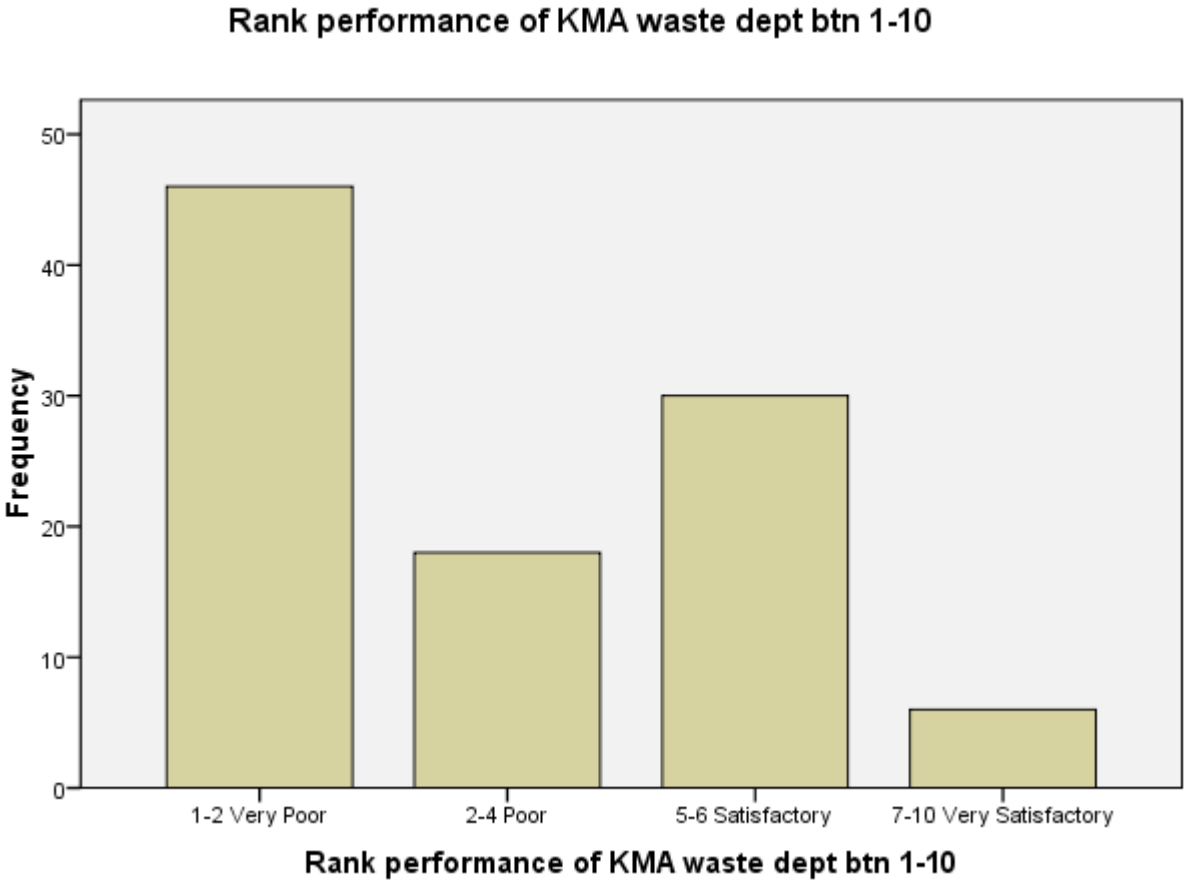
From table 2.3, the study revealed that 34.0% of the respondents agreed that the waste management department had effectively managed solid waste in the metropolis over the past decades.4.0% represents respondents who indicated that the waste management department have been very effective in the managing of waste within the metropolis. Contrarily, 49.0% of the respondents stated that the waste management department of the Kumasi metropolitan assembly had poorly managed waste over the years and lastly 13.0% of the respondents strongly responded that the waste managed had failed in the management of waste within the metropolis. Essentially, a greater part of respondents concluded that the waste management department had unconvincingly seen to the management of solid waste within the metropolis over the past decades.

With regards to the ranking of the performance of the waste management department of the Kumasi metropolitan assembly on a scale of 1-10, the deputy director of the waste management department pointed out that the department would be ranked between 7-8 the Kumasi metropolis have not been experiencing epidemic thus diseases affecting so many people at a particular place at a particular time so the absence of epidemic or considerably low scale epidemics happening in the metropolis is a clear indication that waste is being managed effectively to some extent.[101]The senior environment health officer also hinted that on a scale of 1-10, he will accord the rate with 6 because they have satisfactorily performed their duties as the department that manages solid waste within the Kumasi metropolis.[102]

101 Interview with Mr. John Yaw Donkor, The Deputy Director Of The Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st march, 2016.

102 An interview with Eric Gyasi, Senior Environment Health Officer of the Environmental Protection Standard Enforcement Unit of the Kumasi Metropolitan Assembly .Kumasi 21st march, 2016.

Here are the respondents' responses as illustrated below:




From table 2.3above, from the scales of 1-2, 46.0% of the respondents suggest that the performance of the waste management division of KMA is very poor, on the scales of 2-4, 18.0% of the respondents concluded that the waste management had performed poorly, also on the scale of 5-6,30.0% of the respondents confirm that the waste management department had performed satisfactory and on the scale of 7-10, 6.0% of the respondents represent those who indicated that the waste management department had performed very satisfactorily in mandatory roles within the metropolis. Significantly, the majority of the respondents were those who indicated that the waste management department had performed inadequately as a department responsible for the management of solid waste within Kumasi and its environs.

**What Accounts for the Poor Waste Management Within the Metropolis?**

Out of the 100 respondents, those who work at the market area (Asafo) suggested that there are various factors accounting for poor waste management within the metropolis. 24.0% of the respondents stated it is due to lack of funds or capital which results to the poor management of waste within the area. 28.0% of them hinted that lack of equipment for the collection of solid waste eventually leads to the ineffective management of it. They added that unavailability of equipments such as bins and containers in the markets lead to the indiscriminate littering of gutters and available spaces. These causes rubbish to pile within the markets. A respondent hinted: *"since there are no bins in the markets or on the streets, after eating my oranges I decide to hold the peels and discard it if I find a bin, I walked several miles and upon not finding any I dropped it because I was tired"*.

The above suggest why the streets keep becoming dirty and smelly.14.0% of the respondents conjectured that it was inadequate skilled personnel that lead to poor waste management or insanitary conditions within the Kumasi metropolis. They added that some of these personnel are not committed to their work, they are irregular in the performance of their duties; this is worsened by the fact that they are not paid well by the authorities. A respondent pointed out that political affiliations also lead to poor attitude towards work. Lastly 34.0% of the respondents noted that the activities of the people within the metropolis led to poor waste management. They pointed out that some people do not even keep themselves clean how much more their environment. They concluded that people are indiscipline and therefore deliberately litter the streets or are lazy to collect their waste neatly into bins. Lack of proper disposal of refuse consequently leads to choked gutters and filthy surroundings. Respondents have also listed ignorance as a key issue worsening the sanitation situation within the Kumasi area. In all, a majority of the respondents suggested that it's the poor attitude of the people that leads to poor waste management within the markets and Kumasi metropolis at large as can been seen in the figure below.

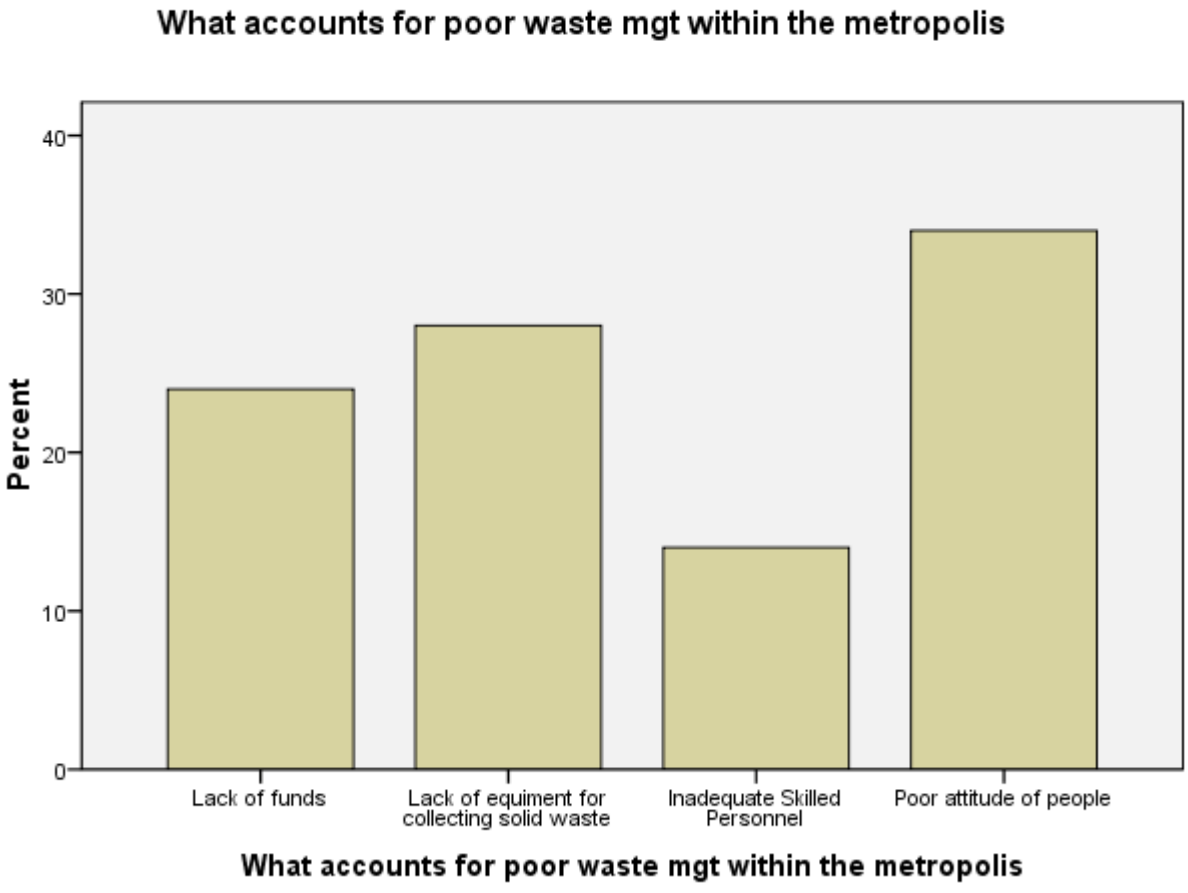



**Table 2.4,3** Source: Researchers Field Work (2016).

**Littering Around Asafo and Its Environs**

**Figure 2.5.3** Source; Researcher's Fieldwork (2016).

**Some Challenges of the Waste Management Department of Kumasi Metropolitan Assembly**

The waste management department of KMA pointed out some challenges confronting the department in the performance of their duties. The department's first challenge is finance, which is inadequate capital. Although they introduced the full cost recovery, which required that users or beneficiaries of their services paid for services, the amount they paid was insignificant, that which they also referred to as "non-economic rate". Beneficiaries of the services of the KMA rather paid "social rate". This made the waste department unable to get enough funds to formally pay private contractors and also to enable the contractors to buy adequate equipments to aid them to deliver as expected.[103] In addition, the deputy director stated that the inability of the department to buy equipments since they are expensive and the fast deterioration of existing ones due to bad roads in the Kumasi area coupled with the fact that the wastes decay very fast, become very acidic and corrode the vehicles, the department needs a cutting edge technology and effective and efficient financing.[104] Additionally, in Yoada et al, they stated that generally while existing waste disposal facilities are inadequate to deal with the quality and quantity of waste generated, more sophisticated systems are expensive and their maintenance

103 Interview with Mr. John Yaw Donkor, The Deputy Director of the Waste Management Department of Kumasi Metropolitan Assembly, Kumasi 21st March, 2016.

104 Ibid.

requirements are high.[105]Sometimes the department provides all the logistics, that is, the containers and the household bins but people prefer dumping the waste into nearby drains especially when it is cloudy. They speculate that the drains will just be washed by a heavy down pour of. Significantly, there is the need for an attitudinal change; this would lessen the plight of the waste management division.[106] The officers of the waste management department emphasized that monetary and socio cultural constraints retard and sometimes derail their efforts. Similarly, concerning the management of solid waste, Guerrero et al postulate that some financial and socio cultural challenges are huge expenditures needed to provide the service i.e. the absence of financial support, limited resources, the unwillingness of the users to pay for the service, societal apathy for contributing in solutions have hampered the delivery of proper waste management services.[107]

Moreover the Deputy Director of the Waste Management Department suggested that there are measures that can be put in place to improve the operation of the waste management department. He said that since the serious challenge is financing; if they are able to mobilize enough funds they would be able to repair their faulty vehicles. The availability of road worthy vehicles would enable them to offer better services and deliver as specified in their working document which states that wastes should be collected twice a week. Their ability to deliver on that score would be a significant improvement of the collection and management of waste within the Kumasi metropolis.[108]

**Measures That Can Be Put In Place to Curb or Curtail the Insanitary Conditions within the Kumasi Metropolis**

The respondents suggested different measures that can be put in place to curb the poor environmental conditions within the Kumasi metropolis. Some of their views or opinions are as follows:

(1) Provision of financial aid to the waste management department, that is, the Government of Ghana as well as concerned agencies should provide financial assistance to abet the management of solid waste.

(2) Provision of logistics: This should include the availability of bins and the acquisition of new waste carrying vehicles to collect waste frequently.

(3) Law enforcement: strict policies and laws should be put in place and existing ones should be enforced to punish people who dump indiscriminately on the streets and markets.

(4) Measures to ensure proper supervision and monitoring by agencies contracted to manage waste within the Kumasi Metropolis should be forthcoming.

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105 Yoada Ramatta Massa , Dennis Chirawurah and Philip Baba Adongo "Domestic waste disposal practice and perceptions of private sector waste management in urban Accra" Yoada et al. BMC Public Health (2014) p.2. http://www.biomedcentral.com/1471-2458/14/697.

106 Interview with Mr. John Yaw Donkor, The Deputy Director of the Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st March, 2016.

107 Guerrero Lilliana, Abarca Ger Maas, William, Hogland "Solid waste management challenges for cities in developing countries" *Journal of Waste Management.* (2013) www.elsevier.com/ locate/wasman p.222.

108 Interview with Mr. John Yaw Donkor, the deputy director of the Waste Management Department Of Kumasi Metropolitan Assembly, Kumasi 21st March, 2016.

(5) Public education that is, educating the people within Kumasi on sanitation and its effects. Respondents argued that it should start at the primary level and also the need for people to volunteer to educate the populace on sanitation and public health issues.

(6) Banish the use of plastic or it should be recycled. Wastes should also be separated and recycled.

(7) Employment of city or sanitary guards to see to it that people don't litter.

(8) Wastes should be disposed immediately and frequently when containers are full.

(9) Employing more skilled and committed personnel into the sector and employees should be paid well to effectively perform their task.

(10) Attitudinal change by the local people: The people in Kumasi are encouraged to desist from littering.

(11) Radio and Television campaigns on sanitation and how to keep our cities clean.

(12) By installing CCTV cameras on the streets to film people who dump or litter indiscriminately; this would also have some security benefits.

(13) More dumpsites and designated places should be created for the disposal of waste

(14) A respondent keenly stated that over the years there use to be some waste management agency called "FRECO' who diligently swept daily all places at Kejetia, the central business area in Kumasi, her requests so is for the waste management department of Kumasi metropolitan assembly to continue and even do more toward this end.

(15)Hawkers and pedestrians should be sacked from roadsides because they are a contributory factor to the littering of the streets.

(16) Finally there is the need for Ghanaians to be patriotic and work toward the cleanliness of their country.

With respect to recycling of waste within the Kumasi metropolis, the waste management department do not do source separation. The domestic waste or municipal wastes that are generated concerning recycling, recyclables are removed from the waste and they are processed for other purposes. The recyclables, especially metals are used for different purposes and plastics are cleaned and reused. This however, is not done on a large scale but on a small scale basis. Efforts have been made to use organic waste for composting. This goes through different levels of processing; it is also done on small and medium scale basis which is yet to be moved to the large scale processing.[109] Concerning what the waste generated in the markets could be used for, the market women in particular suggested that the wastes generated within the Kumasi metropolis can be recycled.87.0% of the respondents suggested that the waste generated can be recycled into other products or even processed into biogas.6.0% of the respondents argued that the waste cannot be recycled into anything and 7.0% of the respondents noted that they had no idea or knowledge about the recycling of wastes into other products.

109 Interview with Mr. John Yaw Donkor, The Deputy Director of The Waste Management Department of Kumasi Metropolitan Assembly, Kumasi, 21st March, 2016.

**Some Diseases that Occur due to Poor Waste Management**

The respondent shared some views on some diseases they have learnt or know that attack the people within the Kumasi area due to poor waste management. 43.0% of the respondents stated that malaria is one of the diseases that infect the people due to poor waste management. Another 43.0% of the respondents also noted that cholera is known to be one of the diseases that attack the people due to poor waste management. The others, representing 14.0% of the respondents suggested that diseases Such as typhoid, diarrhea and dysentery are an effect or consequence of insanitary or poor management of waste within the Kumasi metropolis.

An interview with the Senior Environment Health Officer of the Environmental Protection Standard Enforcement Unit of the Kumasi Metropolitan Assembly revealed that poor waste management promote cholera because if wastes are not managed well it promote the breeding of houseflies and these houseflies serve as one of the transmitting agents of cholera organisms.[110] Also wastes dumped in gutters and in water bodies serve as breeding places for mosquitoes which leads to malaria. There are other diseases such as typhoid, dysentery and other external diseases; worms infections can also be linked to poor sanitation.

**Recorded Cases of Cholera and Other Sanitation Related Diseases in the Kumasi Sub-Metro over the Decades**

**Table 2.6.2** Source: Ghana Health Service.

| YEARS | CHOLERA | MALARIA | TYHOID | DIARRHOEA |
|---|---|---|---|---|
| 2001 | 15 | 141290 | 627 | 16065 |
| 2002 | 0 | 220025 | 1226 | 18519 |
| 2003 | 0 | 183769 | 1894 | 15047 |
| 2004 | 0 | 191302 | 132 | 2166 |
| 2005 | 1621 | 219319 | 321 | 2339 |
| 2006 | 20 | 177991 | 340 | 1867 |
| 2007 | 0 | 347108 | 4027 | 21524 |
| 2008 | 0 | 328442 | 5963 | 10768 |
| 2009 | 0 | 422867 | 5234 | 28402 |
| 2010 | 0 | 442647 | 7941 | 24639 |
| 2011 | 0 | 349775 | 8285 | 30137 |
| 2012 | 0 | 336522 | 9994 | 26233 |
| 2013 | 0 | 318218 | 13105 | 37753 |
| 2014 | 19 | 231590 | 11768 | 34664 |
| 2015 | 6 | 177693 | 8731 | 27164 |

The study was undertaken to assess the operations or roles of the waste management department from 1992-2014 and to ascertain whether the waste department is a sanitary icon or a failure as well as some challenges that have hindered their effectiveness in managing solid waste within the Kumasi metropolis of the Ashanti region of Ghana. To attain the desired aims and objectives, Hundred (100) respondents answered the questionnaires and their views or

110 Interview with Eric Gyasi, Senior Environment Health Officer of the Environmental Protection Standard Enforcement Unit of the Kumasi Metropolitan Assembly .Kumasi 21st March, 2016.

opinions were solicited. Frequency distribution tables and diagrams were used for the analysis and interpretation of the data.

The commonest form of solid waste produced in the metropolis is rubbish and though majority of the respondents stated that they dump their wastes in bins, they indicated that they buy the bins themselves. Others hinted that they keep their wastes in polythene bags, boxes, and sacks, in front of their stores. In view of the fact that there are no bins in the market centers and on the streets some respondents resort to dumping waste in nearby gutters, roadsides, opened spaces and other unapproved areas. The study also revealed that there was irregular or lack of routine collection of waste by waste management institutions. Waste collection was mostly carried out everyday but respondents stated they pay people or potters and not institutions to collect their waste. Others indicated that waste collection companies collect them weekly. However, some of the respondents argued that sometimes no collection is done for a very long time. A majority of the respondents hinted that the waste management department has failed or performed poorly in their management of solid waste in the metropolis over the past decades. They pointed out that filth is still engulfing the city; hence they suggested there can be more room for improvement in the management of solid waste within the metropolis. They argued among other things that if the authorities in charge of management of solid waste perform their roles effectively and provide adequate bins on the streets and see to it that strict policies and laws are put in place to punish those caught littering or indiscriminately dumping solid waste on the streets of Kumasi, both offenders and potential offenders would be deterred. From the study, the waste management department also indicated that they had performed adequately in terms of management of waste within Kumasi over the decades since 100% efficiency cannot be attained. They stressed that there is no epidemics in the Kumasi area and this in itself should suggest to the people that they have creditably. However, they admit that there are some difficulties they are encountering in their field of work such as inadequate finance to pay contractors and also lack of funds to secure some equipment. Waste managers have also argued that the attitude of the local population towards waste is a contributing factor. In terms of recycling, the study indicated there are some measures being put in place by the waste management department to produce other products out of the wastes generated within the metropolis. Again, the study has confirmed that people within the Kumasi metropolis are infected with diseases such as malaria, cholera, diarrhea, typhoid among others due to poor management of solid waste.

## Suggestions

Based on the findings of the study, the following measures are recommended for efficient and effective management of solid waste in Kumasi metropolis. These are discussed below.

**Adequate Resourcing of Waste Management Department**- The Waste Management Department should be sufficiently resourced by the Metropolitan Assembly to ensure efficient and effective waste management in the area. They government must also fund the assembly as sanitation and solid waste management are very key sectors within the country to be looked at since they are interlinked with health. Hygienic environment enhance good living and low mortality rate. The Metropolitan Assembly should also liaise with other corporate bodies like the United Nations Development Program to pull financial resources to support the institutions in charge of managing waste. With the support, adequate dustbin, skips and core waste management equipments such as, roll on/roll off trucks, skip loaders compaction trucks would be procured to ensure effectual waste collection and disposal.

**Provision of Adequate Logistics or Equipments Such As Skips And Dustbins**- Adequate dustbins skips and containers should be provided by Waste Management Department and Metropolitan Assembly for residents especially the market centres because most of these wastes are generated there. These dustbins and skips should be supplied in order to avoid dumping of waste in open spaces, gutters, and roadsides. These dustbins and skips are supposed to be placed at vantage points in and around the markets.

**Regular Collection of Waste**- wastes generated within the Kumasi metropolis should be promptly and frequently collected by the waste management institutions to evade stacking of waste on streets and gutters as well as over flowing of containers with solid waste. At least, waste should be collected daily in the market centers because most of our food crops are bought and brought from there. There should also be regular monitoring of waste collection by the waste management department of the Metropolitan Assembly. This in the long around which help keep the place constantly clean and avert any doable outbreak of transmissible diseases such as cholera and typhoid.

**Public Education on Sanitation and the Need to Keep Our Surroundings Clean**- the public must be educated on sanitation since some of the people are ignorant about the effect of indiscriminate littering or dumping of waste in gutters. Educating the people would enlighten them and would help reduce the rate at which streets are littered and gutters choked. Again, this programme should start from the basic schools. The reason is that when ideas concerning sanitation are inculcated within the youth or young people within the country, they would discontinue the bad habits of the adult population. This has the tendency or the proclivity to shape the thought pattern of the next generation and also secure the environment to ensure good health and prosperity. Moreover, waste management is a collective issue and has influence on the society so other bodies such as churches should also advocate and teach their members about keeping their surroundings clean. Is it not truism that cleanliness is next to godliness? Essentially, if all these measures are put into practice it would help keep our cities clean.

**Enforcement of Statutes and Bye-Laws of Waste Management**- laws regarding waste management should be enforced and the authorities must see to it that people who are found littering around the streets should be dealt with or punished. Since the indigenous people are not conforming to the sanitation laws, there is the need to re-look at the laws and adopt appropriate strategies that would help enforcement agencies to strictly enforce the laws and if this is done continuously people would desist from dumping waste indiscriminately.

## Conclusion

The result of the research provides information concerning the role of the Waste Management Department of the Kumasi Metropolitan Assembly, and also assessed whether it has been a sanitary icon or a failure since its inception in the Kumasi metropolis. The study was designed to achieve the following objectives. The first objective was to critically examine the operations of the Waste Management Department of the KMA and ascertain whether it has been able to fully manage solid waste within the Kumasi metropolis. The second objective was to examine some of the health hazards due to the poor waste management within the Kumasi metropolis. The third objective was to suggest measures to curb the menace of poor solid waste management within the Kumasi metropolis. The study identified the causes of ineffective solid waste management which include inadequate capital, inadequate equipments and also the poor attitude of the people within the metropolis as well as the health implications/ hazards

or diseases that occur as a result of poor waste management. Some solutions have been highlighted by respondents who argued among other things that the the problem of waste management within the Kumasi area can be managed if dustbins are provided including the enhancement of sanitary laws and policies, consistently educating the public on the need to keep their surroundings clean especially the avoidance of littering among others. The study also revealed that the waste management department had ineffectively managed solid waste since their inception hence they have failed as a department in the performance of their duties as waste managers. This notwithstanding, if much attention is given to the recommendations provided in this research it shall inure to the benefit of both the Waste Management Division of the KMA, the people of Kumasi and its environs and Ghana in general.

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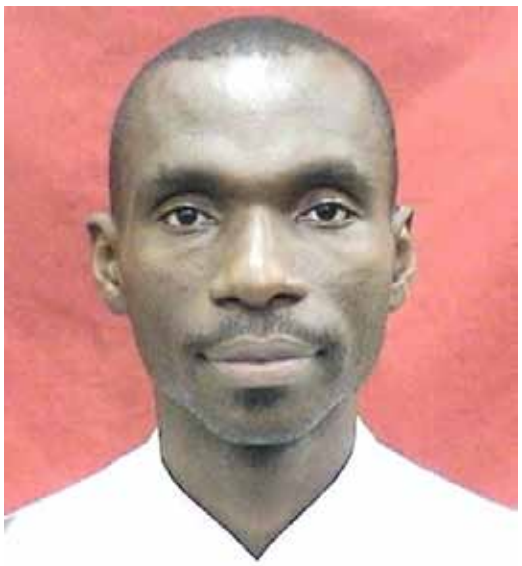

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# Local narratives in the long term water conflicts: Case of Turku Region in Finland

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## Introduction

Finland is known as a land of thousands of lakes. Yet, there are regions in Finland where lakes are very few and the lack of fresh water is an ordinary problem. Finland is quite unique in Fennoscandia as to its water resources. The country has some 56 000 lakes with a minimum area of one hectare and all together circa 200.000 lakes. Ground water occurs in alluvial eskers formed during ice ages, the last of which ended some 10 000 years ago. Nowadays some 60 per cent of the people use natural or artificially recharged ground water. However, areas lower than 50–60 metres above sea level have problems with water quality due to geological reasons. In such areas bigger cities use surface water for their water supply or acquire their raw water from sources further away.

The south-western coast where the Turku region is also situated is one of the regions with insufficient raw water resources (figure 1). Turku was the capital of Finland until the year 1812, and it is one of the growing population centers in the country. The population is around 180.500 and the population of the Turku sub-region is around 300.000.

The General Plan for water acquisition in south-western Finland was published in 1969 by the National Board of Roads and Waterways. It stated that due to continuous regional population growth and an increase in specific water consumption, water demand will rise during next decades and due to local water scarcity, there will be absolute necessity for long distance water acquisition (Tie- ja vesirakennushallitus 1969).

The problem of water supply in Turku region has been tried to solve during more than four decades. The defining factor for this highly prolonged inter municipal water acquisition project is the formation of the environmental conflict between the project planners and the local people of the region from where the raw water was planned to acquire. The struggle forms around the conflicting views about the use and acquisition of water.

Altogether, the process can be divided in two phases: the water acquisition project from Lake Pyhäjärvi (1969-1993) and the managed aquifer recharge project (1999-2011). First phase started in 1969, when the National Board of Roads and Waterways introduced the possibility of water acquisition from Lake Pyhäjärvi to be the most favourable option (Tie- ja vesirakennushallitus 1969). The lake is situated in the municipality of Säkylä, some 70 kilometers to north-east from Turku (see Figure 1) and it is the only big lake in the Turku region. However, local people raised a strong opposition toward water extraction and it led to several appeals in different court instances. Finally, the project fell down in 1993.

Thereafter, the municipalities of Turku region started to look for new solutions for fresh water supply. In 1996 the new survey for the water acquisition options for Turku region was


**Figure 1:** Location of case city Turku.

established (Suunnittelukeskus 1996). One option was to build managed aquifer recharge (MAR) system to the esker Virttaankangas and take raw water from the River Kokemäenjoki. The water quality in the river Kokemäenjoki had improved during three decades and it was considered the best option after the water acquisition from Lake Pyhäjärvi was denied. However, the investigations about the MAR system as a water treatment option were made already in 1990 and MAR was mentioned as a water treatment method already in the General plan for water acquisition in south-western Finland in 1969.

The MAR project for Turku region started officially in 1999 when the General plan for water acquisition for Turku region recommended it as an option to be executed. Also this project faced strong opposition among the local people. Nevertheless, the production of artificial groundwater started in 2011.

Previous studies show that the Turku region water acquisition project has had remarkable societal impact in the region and even nationally. According to Kaakkurivaara (1988) the local resistance around Lake Pyhäjärvi was significant. The problem circulated between the state and citizens, colored by other spheres of interest and the media. This circulation continued in the second phase of the project. Common to both phases is that the project is opposed because of the supposed negative environmental, economy and livelihood impacts of the project (Kaakkurivaara 1988, Virtanen 2002).

This paper analyzes the evolution of inter-municipal water acquisition for Turku region and the environmental struggles around it, during the years 1970-2010. The aim is to look at the problem from the perspectives of different stakeholders in the context of changing community planning ideologies and paradigms.

Almost 6000 newspaper articles were scanned through and quantitative analysis is presented in this paper. More profound qualitative analysis was made from selected articles concerning the second phase of the project by Kurki et al. (2015). However, the environmental struggles are of course lot more than the picture that media draws. Important strategies, internal consensus and hierarchy are searched from the other sources like from the official documents, earlier researches and interviews.

In this article, we first examine the history of community planning and the changes around the environmental discourse in Finland. Second, we describe the two phases of the water acquisition project. Finally, the influence of the macro level operating environment to the project will be discussed.

## From the rational to the participative planning

In Finland in the 1960s and 1970s the rationalistic planning ideology was developed along with the rapid economic growth. It is based on the synoptic ideal: all the information can be comprehensively collected from the target and logical conclusions can be made. Hierarchical top-town planning processes do not see the uncertainty but believe in the omnipotence of the planning and technology. (Kaakkurivaara 1988)

The flip side of the rationalistic planning is its' narrow-mindedness and alienation from the everyday life. Individuals are excluded from the process and for the ordinary citizen the only way to have an influence is indirectly through the representatives or appeal procedure (Koskiaho 1974, 249). In addition, the rationalistic planning mainly supports the needs of the

big population centers (Uusitalo 1974, 63-69). Especially the water resources from the periphery are used for producing economic growth to the urban centers (Järvikoski 1979).

The rationalistic planning ideology is based on the industrial paradigm, which emphasizes materialistic values and economic growth. The nature is seen as a resource and manageable object which can be exploited in the name of well-being. Cotgrove (1982) presents the environmental paradigm as a counter paradigm to the industrial one. Environmental paradigm emphasizes the absolute value of the nature and the limited resources of the earth. In addition the social relations and the democratic decision making are valued. (Cotgrove 1982, 28-34.)

In Finland, the environmental paradigm became one of the basic frameworks at the turn of the 1980s and it had also institutional consequences. At that time, organized environmental movement was born through numerous local environmental struggles. Political parties started to pay attention to environmental issues and the Ministry of Environment was established in 1983. (Konttinen 1996, Sairinen 2000.)

Reasons for the rise of environmental awareness can be searched from the environmental problems like environmental load of wood processing industry. However, Konttinen (1996) for example emphasizes that it was part of wider turning point of society (New Social Movement in Europe), and the spirit of the age (Zeitgeist by Karl Werner Brand) was favorable for environmental awareness to rise. Strong belief in modernization changed into criticism toward it. The environment was raised to be a social and political question. Environmental discourses were strengthened at the expense of the hegemony of industry and technology.

Alongside with rationalistic planning ideology emerged a new humanistic planning ideology, which demanded anthropocentrism and conservation of natural resources. It emphasized the public participation and interactive planning (Kaakkurivaara 1988). In Finland the participative planning started to intrigue in 1980s but it became more common only during the next decade. In ideal case with communication between different stakeholders – the planners, authority and public – should dispel the supposed uncertainties and risks related to the project. (Kaakkurivaara 1988)

## The water acquisition project from the lake Pyhäjärvi

After the exceptionally long dry seasons in 1951, the water acquisition became the most important issue of the water supply service of Turku. The water acquisition from Lake Pyhäjärvi was mentioned already in the 1950s. However, the proposed decisions of the water issue were left in abeyance until the 1963 when the Turku city council again raised the question of Lake Pyhäjärvi. Increase in the water consumption was presented as justification for the proposition. The issue was considered as urgent and the Council of State gave the task to the National Board of Roads and Waterways (Stenroos 1998, 126).

The general plan for water acquisition in south-western Finland was published in 1969 including three options for raw water sources: the lake Pyhäjärvi, two rivers Loimijoki and Kokemäenjoki and dammed fresh water basins from the gulf of Mynämäenlahti or Paimionlahti. Options were evaluated with total costs, water economic, technical, and judicial conditions. Emphasizing the techno-economic conditions the general plan stated that the first option was the most favourable one because of its' beneficial location and good water quality. The timetable for the implementation of the plan was rather optimistic. It was estimated that the whole project would be finished by the 1975. (Tie- ja vesirakennushallitus 1969.)

The municipalities around Turku were facing the problems of water scarcity as well. The necessity for inter municipal cooperation in the water acquisition project was mentioned already in the general plan for water acquisition in south-western Finland (Tie- ja vesirakennushallitus 1969, 79). The Turku Region Water Ltd (TRW) was founded in 1974 (Stenroos 1998, 142). The company owned by five municipalities – Turku, Kaarina, Lieto, Piikkiö and Raisio-Naantali - aimed for long distance water acquisition from the lake Pyhäjärvi according to general plan (Stenroos 1998).

Urgency of the proposed project in the general plan was justified with the lack of fresh water in the short run. Future water demand was based on the optimistic population forecast and the estimation for specific water consumption per capita, which was in the city of Turku 450 – 550 litres per day in 1990. (Tie- ja vesirakennushallitus 1969). However, the peak in water consumption was reached in 1973 when the specific water consumption per capita was 360 litres per day and the decrease continued until mid-1990s (Stenroos 1998). According to Katko (1996) the reasons for the decrease in water consumption was the energy crisis in 1972 and the sewage surcharge act when the water invoices almost doubled. The number of inhabitants of the region was estimated to be 310 000 in 1990 (Tie- ja vesirakennushallitus 1969). The actual number was 231 567 (Suomen kuntaliitto 2012). However, the expectations for the increase in water consumption were still alive in 1978 (Stenroos 1998, 134). The plans for long distance water acquisition for Turku region were not questioned. Instead, the necessity was justified also by the bad quality of the River Aurajoki which was the main raw water resource of the region. (Stenroos 1998, 142.)

The main defenders of the project were the National Board of Waters, TRW, and the municipalities of the Turku region. Instead, the opposing group formed little by little from the inhabitants of the Pyhäjärvi Region and spread to the nationwide level. This process will be described in the following chapter.

**Arise of the opposition of the project**

Lake Pyhäjärvi is 20 kilometres long and five kilometres wide representing the only big lake at the region. In the 1980s the lake employed some 40 professional fishermen and it was known as a most fishy lake of the temperate zone. The lake has its relevance also as a fresh water source to the local industry and as a recreation area. Thus, the local people and industrial plants had already made fierce protective measures on their own account. (Soikkeli et al. 1983, 20-25.)

The public opposition of the project started already in the 1970s. Pyhäjärvi movement was founded in 1974 to prevent the water acquisition from Lake Pyhäjärvi. It was lightly organized with a committee as representative organ (Kaakkurivaara 1988), which was typical for water movements in Finland in 1980s (Lätti 1988). Pyhäjärvi movement can be classified as local intervener group. According to Douglas and Wildavsky (1982) the participants of this kind of unorganized groups are part of middle age and middle class. Concern about the decrease in value of the estate or comfort of environment nearby is a main motive. Therefore, the goal is to stop the project or at least prevent the implementation in the neighborhood. Group does not question the functioning of society as such. The problem is rather on democracy and mismanagement of public participatory process: first contact to local people has been made when decision about the project is already made. All the definitions are accurate with the Pyhäjärvi movement (Kaakkurivaara 1988).

The opponents made use of the media to support their cause. They organized demonstrations, signed petition, visited the parliament and made appeals to the ministers. The project gained large publicity in local newspapers but also in the regional ones. In 1980 a peak in the newspaper writings can be observed. At this stage the opposition of the project started to spread: political parties of the region, provincial federation and environmental NGO group took stand on the project (Kaakkurivaara 1988). The water acquisition project became a political question. The municipal elections of 1980 were most likely one of the activators of the conversation as well. According to Kaakkurivaara (1988) the opposition of the Pyhäjärvi project was connected to the wider societal change which included the rise of environmental awareness, which took place at the turn of the 1980s in Finland. Environmental arguments became the most used ones in the public discussion (Figure 2).

According to Järvikoski (1979) the success of the environmental movement is highly dependent on the expert knowledge which they can use in the rational argumentation and negotiations. Especially when the movement is trying to oppose a single project, it is up against strong institutions like state authorities, municipalities and public utilities. Between 1980 and 1986 several studies were made about Lake Pyhäjärvi. Different organisations like National Board of Waters, Turku Water District and University of Turku made three researches concerning the water flows, biological- and fish production, and the general condition of the lake. In the media these studies were interpreted from different perspectives: the defenders of the project claimed that according to the researches made the water acquisition project does not cause any ecological risk. However, the representatives of the University of Turku warned about wrong and premature conclusions. (Kaakkurivaara 1988)

Later the struggle about Lake Pyhäjärvi became a nationwide and it gained support from the Members of Parliament and ministers. Even a special enactment was suggested to protect the lake. Despite of several attempts this did not realize.

## Legislation and decision making process

According to Water Act (1961/264) both surface and groundwater are considered as commodity for the public good, which can be utilized by anybody, even though the owner has the right of priority. After the Water Act came into force in 1962 the Water Rights Court was established to handle the water issues. Before the reformation, in conflict cases only the owners of the share in water right were listened. For example the environmental movements had no right to take part into the legal proceedings. After the Water Act reform in 1987 (1987/467) the freedom of speech was given to other stakeholders as well but the right of appeal still concerned only the shareholders.

Even though the Water Act can be seen as consequence about the general recognition of water conservation, later it drew lots of criticism. Participants of water movements repeatedly stated the Water Act to be out of date (Lätti 1988). Also different organizations and even some authority have put forward criticism. Undoubtedly, this has had an effect on the Water Act reform (Konttinen 1994).

In the case of water acquisition project for the Turku region, there can be seen two interpretation of the Water Act. The proponents emphasized that the project serves the common need and the benefits are bigger than the disadvantages. The Water Act (1961/264) states that the water construction projects cannot be authorized if the construction causes significant and wide damaging changes in the environment or considerably worsen the population- and

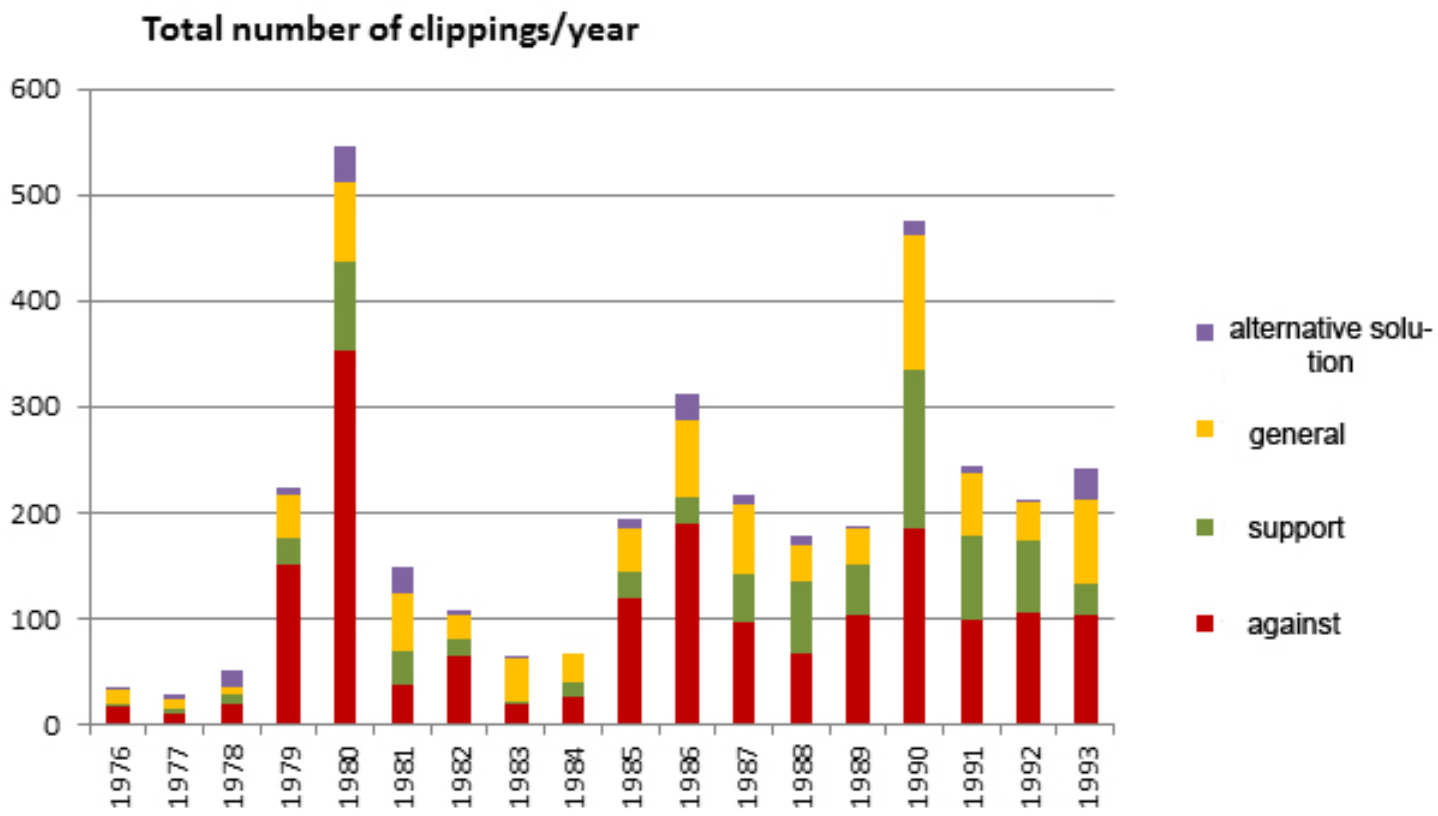


**Figure 2:** Newspaper clippings per year, red colour: against, green: yes, yellow: general comment, purple: alternative solution.

livelihood conditions. According to the General Plan (Tie- ja vesirakennushallitus 1969, 18-19) the implementation of the project would not cause the changes. However, the opponents emphasized that the project would particularly cause damaging changes to the lake's ecosystem and would make harm to the population- and livelihood conditions (Kaakkurivaara 1988).

However, after fifteen years struggle in the 1985 the Water Rights Court of Western Finland authorized Turku region for water acquisition from Lake Pyhäjärvi. Earlier at the same year the provincial federation with the regional planning authority organized a negotiation for the members of the parliament of the region. The purpose of this negotiation was to bring out the supporting and opposing views (Stenroos 1998, 142). The opponents appealed against the decision and collected over 44,000 names to the petition, which they submitted to the ministry. This was typical example of the direct action model of the water movements of 1980s (Konttinen 1994).

In 1987 the Supreme Administrative Court rejected all appeals. However, it set orders for continuous monitoring and liability to compensate for losses. When the authority was clearly against the opponents, they started to affect to the decision makers: they believed they could bring down the project by negotiating with the decision makers of Turku (Stenroos 1998, 143).

Already in the 1970s opponents had suggested a compromise for the project: the water should be extracted from the north side of the lake where the water discharges into the River

Eurajoki. It was argued by the ecological balance of the lake. This option was first left aside and then turned town in 1980 because of the higher implementation costs. However, in 1990 the city of Turku made a decision in principle that the project will be implemented following the compromise solution if the state will give a sufficient financial support. In 1993 the city council of Turku voted down the whole project. The opinions inside the two biggest political parties differed. Over two decades long first phase of the long distance water acquisition project game into its end (Kurki 2016).

## Second phase: the managed aquifer recharge project

Already in the end of the 1980s the first investigations about the managed aquifer recharge (MAR) option started. In 1988 the TRW bought over 160 hectares land from the municipality of Alastaro to this purpose. At the same time opposition of the project spread in to the region around the esker where the experiments for infiltration were conducted. At this stage the purpose was to use raw water from Lake Pyhäjärvi (Kurki 2016).

In 1990 the TRW appealed to the County Administrative Court about the building plan of the village of Virttaa. Appeal concerned the center of motorsport, which was situated in the same region were MAR plant was planned to be built. Court approved the appeal and did not ratify the plan concerning the area which the company possessed. At the same time the Supreme Administrative Court rejected the rights for 1.1 million cubic metres gravel extraction from the same region.

Since the water acquisition project from Lake Pyhäjärvi had fell down, during 1993-1998 TRW investigated new possibilities. The water quality in the River Kokemäenjoki had improved since 1970s. The possibility to use it as a raw water resource was studied and it was discovered to be suitable. In 1993 TRW made a licence application for the groundwater recharge on the esker Virttaankangas (Kurki 2016).

Dry summer in 1999 speed up the water acquisition plans for Turku region. The general plan for water acquisition for Turku region recommended MAR as an option to be executed. In 2001 partners of the TRW wrote a contract about the execution of the MAR project. After the environmental impact assessment (EIA) the environmental licence agency of Western Finland commanded it to be handled as an inspection. The documents of inspection caused several comments from the side of local people. The project was authorized in 2005 and this caused lot of appeals (Kurki 2016).

The project went through all the court instances and the final permit was given in 2008. The Supreme Administrative Court rejected all appeals and claims but at the same time it tightened the permit conditions (Kurki 2016).

Test infiltrations started in 2010 and the plant started the operation in 2011. See more on this from Kurki 2016.

## Discussion and Conclusions

The industrial paradigm and rationalistic planning ideology was in use in 1960s and 1970s when the water acquisition plans for Turku region were made. According to Kaakkurivaara (1988) this can be easily recognized for example from the aims of the General Plan and overestimated water consumption forecast. They were based on the strong believe on growth thinking and exploitation of nature. In the most visible environmental conflicts the question is often about the collision of industrial- and environmental paradigm.

However, the opponents did not implicitly represent the environmental paradigm (Kaakkurivaara 1988). The opponents were heterogenous group even though they had a common goal. The project was opposed with economic, environmental, social and political arguments. This applies also to the opposition of the MAR project during 1999-2010, even though the environmental arguments were clearly the most used ones. Interestingly enough, at the second phase of the project, also the defenders started to use the environmental argumentation.

Kaakkurivaara (1988) argues that environmental interests are more and more visible in water projects and perhaps these are the most strong reasons also for opposition of the projects. The quantitative analyse of the newspaper writings from 1975 to 2010 show that the amount of environmental argumentation augment during those years. However, Kurki et al. (2015) argue that in the case of MAR project the most important issue behind the opposition is the regional policy. Though, both opponents and defenders use the language of the hegemonic environmental discourse.

What makes the Pyhäjärvi movement special? First of all, it was established earlier than other water movements which were mostly situated at the turn of the 1980s when environmental movement arose in Finland. In general, water movements represent public interest and oppose private interests (Lätti 1988). Case of Pyhäjärvi is not as simple as that. Participants struggle for the interest of the Pyhäjärvi region, both public and private. Instead, the water acquisition project is about water services which can be considered as public good. Indeed, word 'public' in their case mean the people of Turku region.

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Water Act (1961/264)

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# Negotiating groundwater governance: lessons from contentious aquifer recharge projects

*Vuokko Kurki*

Lectio praecursoria 17.6.2016

*Honourable Custos, Honourable Opponents, Ladies and Gentlemen.*

My research is related to conflicts as well as collaboration. My question is: What can we learn from contentious groundwater projects in order to establish better collaboration projects for the future?

The strategy of Tampere University of Technology is entitled: "Technology for the benefit of people and the environment". To my view this statement implies the need for highly inter-disciplinary research where technological artefacts should be analysed from various perspectives. My research combined engineering as well as social sciences in order to grasp the essence of water technologies, which are embedded in our natural and social environments. From this perspective a groundwater project can be seen not only as a technological but also as a social construction. In my study, I have analyzed two contentious groundwater projects: case Turku region which took over 40 years to be implemented and case Tampere Region which has been going on for more than 20 years and the final result is still open.

Since my research concentrates on water and especially on groundwater, I will first illustrate you the importance of groundwater from the global perspective. As we all know, water is vital to every human being and living creature. Most of the water, approximately 97 %, is located into the oceans. The three percent left, the fresh water, is mostly locked in polar ice gaps. Thus, the water available to us is a very small fraction of all water. From this amount of available fresh water, approximately 95 % is hidden underground. Indeed, groundwater is almost everywhere, even though we cannot see it. In terms of water services, groundwater has many benefits if compared to surface water: it is generally of better quality, it has rather stabile temperature and it is better protected from contaminations. In addition, while technologies have developed, abstraction of groundwater has become easier and economically more feasible. Consequently, the use of groundwater has globally more than tripled over the past 50 years. The hidden resource is a valuable source for economies all over the world, in agriculture, industries and everyday living.

The dark side of this story is that groundwater is often overexploited, especially in arid and semi-arid regions. This causes serious problems such as land subsidence or contamination of groundwater by seawater intrusion, not to mention, political conflicts around this precious and limited resource.

One solution to overcome many challenges related to groundwater is to infiltrate surface water to the aquifers in order to raise groundwater level. This system is called managed aquifer recharge. It has been practiced since the 19$^{th}$ century for example in England, France, Germany, and the USA. Currently, it is used worldwide. In Finland, the share of groundwater as a source of community water supply is 66% out of which 16% is artificially recharged.

Due to geological reasons, potential areas for groundwater recharge in Finland are in eskers and in ice marginal delta formations which are sparsely situated. Conversely, the most densely


populated areas in Finland are situated in coastal regions, which lack adequate groundwater resources and have rather poor quality of surface water, in the Finnish context. Consequently, to gain adequate fresh water resources, inter-municipal cooperation started to develop on coastal areas. For example, two largest coastal city centers, the Helsinki metropolitan area and the Turku Region, currently receive their drinking water from inland water sources.

It is not, however, always that straightforward to acquire water from neighbouring municipalities. When jurisdictional boundaries are crossed, projects become more complex

and the probability for contradictions increases. In Finland, we have several examples of contentious inter-municipal groundwater projects. Here are the two cases of my research (figure 1).

The Finnish context is quite interesting for water conflicts: we are, after all, living in a land of thousands of lakes. This indicates that water conflicts are not always about water scarcity. In fact, this has been noted globally for example by OECD, which states: "the current water crisis in not about water scarcity it is about a crisis of governance".

In both cases, the local people started to oppose the projects and gradually the opposition emerged. Opposition was not unanimous, but it was strong and persistent, as we can interpret from the timelines of these two projects.

I am quite sure that when the Turku Water Company was established in 1974, the project managers and decision makers did not assume that their first project, which aimed at water acquisition from lake Pyhäjärvi, would be voted down in Turku City Council in 1993 and it would still take almost twenty years to accomplish the long distance water project for Turku region. Neither did the founders of project Tavase in the 1990s imagine that the licencing authority would deny the licence for the project in summer 2015 and the litigation process would still continue.

These two case studies are very complex in nature. An aquifer recharge plant is certainly a complicated technical system. But what is it that makes these projects really complex ones? As I stated in the beginning, they are not only technological in nature, but they involve interactions between natural, built and social environments. They involve various agents in various levels, and the interactions of those agents make these projects unknowable, uncontrollable and unpredictable.

In the beginning of my research I had three questions: what happened? Why did this happen? And, what could have been done otherwise? I still do not have complete answers to these questions. However, I have found some signposts from where these answers can be searched for.

Conflicts can be seen as anomalies in the present society. They are landmarks or signs that something is wrong here. The current methods and policies are questioned. Expert knowledge is no longer only legitimate source of knowledge and engineering skills are no longer enough in the complex environment of project planning and implementation. Something has to change.

Imagine the situation in the beginning of 20th century: the projects went on like a train, which could not be stopped. Decisions were made and announced, then they were implemented. While the world has become more and more complex in the late 20th and in the beginning of the 21st century the top-down implementation is no longer self-evident. Currently, we can find more and more examples where decisions are contested. The decision-makers and project planners start to defend the project with its goals that have already been settled. This was more or less the life cycle of the two case studies as well.

As an answer to these kinds of deadlocks, participative actions have emerged in the fields of urban planning as well as natural resources management. The change is slow, but while new ideas emerge and die, the overall direction seems to head towards more collaborative platforms. In these platforms benefits are created for each stakeholder, the knowledge base is gathered collaboratively and mutual trust is one of the baselines for every project. However,

(Juuti)

there are still several question marks around the collaborative action: what if one party does not want to enter into the negotiation table? What if decision-makers assume that they have to give up their power or experts assume that they have to compromise the best technical solutions as well as their own authority?

However, as we are addressing complex management problems, the project planning and implementation is about negotiation and searching for balance. As water professionals we need to negotiate with several representatives of several stakeholder groups. In addition to technological capacity, we need to develop skills for fluent interaction and negotiation. In the end, it is not indifferent, how these negotiations are developed further. Therefore, I return to the question presented in the beginning of this lecture: What we can learn from these groundwater conflicts? How can we improve project planning and implementation in water sector in order to enhance collaboration?

This dissertation tells a story about a certain tradition in water sector – that can no longer respond to complex management problems. Thus, the profession of water engineering is evidently changing along with the changing world. While there is nothing permanent except change, we can either try to swim against the tide or go with the flow.

I ask you, honoured Professor Persson and Doctor Peltonen as the opponents appointed by the Faculty of Business and Built Environment, to present the observations and comments on my dissertation that you consider appropriate.

The dissertation can be found from here: http://urn.fi/URN:ISBN:978-952-15-3762-2

# Vesi, ongelma ennen ja nyt?

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*Vesihuollon teknisten järjestelmien perusperiaatteet ovat pysyneet samanlaisina. Kehitys on lähtenyt tarpeesta, joka ei ole juurikaan muuttunut kaupunkien historiaa ajatellen. Teknisten järjestelmien ohella on täytynyt olla hallintojärjestelmä, joka pystyy hoitamaan järjestelmiä, pitämään ne kunnossa ja hankkimaan niille tarvittavat varat tavalla tai toisella. Jo roomalaiset hallitsivat tällaisen vesilaitostoiminnan periaatteet. Toisaalta taas nykyisinkin löytyy kaupunkeja, joissa vesihuolto ei ole kunnossa. Onko vesi tällöin ongelma vai onko pikemminkin kysymys kyvyttömyydestä hallita vettä eri tilanteissa? Tarkoituksena on luoda katsaus eri aikojen samankaltaisiin ongelmiin ja ratkaisuihin. Usein historiasta oppia hakemalla virheiltä olisi voitu vältyttyä.*

## Vedestä laskutus mittauksen mukaan

Tampereen kaupungin valtuusmiehet päättivät, Helsingin kaupungin vesilaitosinsinööri C. Hausenin ehdotuksen mukaisesti, 21. päivänä lokakuuta vuonna 1897 vesijohtokomitean esityksestä, että aikaisemmasta käytännöstä poiketen vedestä laskutetaan mittauksen mukaan. Aikaisemminhan vuonna 1882 valmistuneessa gravitaatiojärjestelmässä laskutus tapahtui tonttikohtaisen laskutuksen mukaan, nyt, uudessa 1898 valmistuneessa korkeapaineisessa vesilaitoksessa, alettiin laskuttaa mitatun kulutuksen mukaan. Tähän oli päädytty nimenomaan ”haaskauksen estämiseksi”. Kyseessä oli merkittävämpi asia kuin ehkä heti tulee ajatelleeksi. Seuraavassa Hausenin perustelut:

”Yksinkertainen keino tämän (veden hukkaamisen) estämiseen on veden jakaminen mitan mukaan, mikä kuitenkaan ei ole tarpeellista heti vesijohdon toiminnan ensi aikoina, vaan vasta myöhempään kun tarve näyttää pyrkivän olemaan suurempi kuin yllä mainittu kohtuullinen. Kun perustamiskustannukset riippuvat joka päivä tarvittavasta vesimäärästä suurenevat edelliset suuressa määrin ja tarpeettomasti, jos laskun perusteeksi pannaan se vedentarve, joka voi tulla kysymykseen jos käyttäjät saavat pidellä vettä mielensä mukaisesti niin kuin asian laita on vettä jaettaessa ”a discretion” (mielivaltaisesti), jolloin määrättyä vuosimaksua vastaan huoneelta tahi muuten vettä saa käyttää kuinka suuressa määrässä tahansa. Minun tietääkseni ei tämä myöskään ole tuottanut mitään todistettavaa hyötyä mitan mukaisen jakamisen rinnalla, mutta kyllä usein paikoin vaikuttanut että sekä syylliset että syyttömät ovat saaneet kärsiä vedenpuutetta.”

Valtuusmiehet päättivät kustantaa talojohdot katujohdosta tonttiviivaan saakka sekä tonttien sisäpuolella vesimittarit ja sen laitteet. Valtuusto päätti veden kuluttajahinnaksi 20 penniä kuutiometriltä kulutuksen ollessa 0-100 $m^3$ neljännesvuodessa, 100 $m^3$ yli menevästä kulutuksesta maksu oli 15 penniä. Valtuuston päättämä vesimaksu oli huomattavasti halvempi kuin Hausenin esittämä 30 penniä, joka sekin olisi ollut halvempi kuin Helsingissä.[1]

Mitattuun kulutukseen sitominen oli kaukonäköinen päätös: esimerkkejä ongelmista muunlaisista järjestelyistä löytyy liikaakin. Esimerkiksi Englannissa mitattuun kulutukseen siirtymistä

1 Hausen 1891; Juuti 2001.Suomen ensimmäiset vesimittarit löytyvät jo hieman aikaisemmin Helsingistä.

Tampere 2002 (Juuti P.)

pohditaan vuonna 2000, siellä vedestä maksetaan veroa yksityisomaisuuden määrän mukaan.[2] Vedelle pitäisi yleensäkin määrätä todellinen hinta, jolloin vettä ei käytettäisi tuhlaillen. Vaikka veden alihinnoittelu tai myyminen mitattuun kulutukseen perustumattomilla tavoilla onkin suuri ongelma, veden suurimittaisinta hukkakäyttöä ja alihinnoittelua esiintyy kasteluveden jakelussa. Kyse ei ole pienestä asiasta sillä, maatalouden tarvitsema kasteluvesi on noin 70 prosenttia makean veden kulutuksesta. Kuitenkin jopa kaksi kolmasosaa kasteluvedestä joutuu hukkaan, koska viljelijät maksavat esimerkiksi Yhdysvalloissa ja monissa kehitysmaissa vain murto-osan hinnasta, joka kuvastaisi veden saatavuutta ja tuotanto- ja jakelukustannuksia alueella. Valtion subventio on suurimmillaan jopa 90 prosenttia. Alihinnoittelun laskutusperusteena on usein pinta-ala, jolloin suuremman tilakoon myötä veden kuutiokustannukset laskevat. Tällaisten laskutusjärjestelmien seurauksena on veden tuhlaus, liiallisen kastelun aiheuttama maaperän vettyminen ja veden kuivuessa suolojen saostuminen, mikä voi viime kädessä tehdä maan viljelyskelvottomaksi, kasteluveden epäoikeudenmukainen jakautuminen kastelukanavien eri vaiheissa sijaitsevien tilojen välillä sekä erilaiset muut ympäristöhaitat. Esimerkiksi vuonna 1990 Kaliforniassa riisiviljelmät kuluttivat kolme kertaa enemmän vettä kuin Los Angelesin kaupunki, jossa vesipula hidasti jo teollisuuden kasvua. Silti ylituotettujen lajikkeiden kasteluvedentukea ei esityksestä huolimatta lopetettu kongressissa. Vesihuollon suurten ratkaisujen, mukaan lukien laskutusperiaatteet, onkin oltava linjassa myös valtakunnan tason lainsäädännön kanssa, vesilaitoksen ja paikallisviranomaisten toimenpiteet eivät riitä, jos valtakunnallisella tasolla ratkaisut raahaavat jäljessä tai ovat ristiriidassa vesilaitoksen ratkaisujen kanssa.[3]

2 Katko 2000, s.9.

3 Cairncross, s.90-94.

## Perusratkaisut tehty jo tuhansia vuosia sitten

Jo hyvin varhain osattiin rakentaa toimivia vedenjakelujärjestelmiä. Varsinaisesta vedenhankinnasta ja viemäröinnistä onkin säilynyt tietoja samoilta ajoilta kuin varhaisesta kaupunkikulttuuristakin, Egyptistä on havaintoja kaivoista ja Mesopotamiasta kivisistä sadevesikouruista jo 3 000 vuotta ennen ajanlaskumme alkua (eaa.). Mesopotamian yhdestä ensimmäisistä ja tunnetuimmista kaupungissa, Urissa, arvellaan vuoden 2000 eaa. asuneen noin 360 000 ihmistä. Kaupungissa oli sadeveden poistojärjestelmä ja jopa vesivessa löytyy yleisesti yksityiskodeista. Mesopotamiasta tunnetaan myös ensimmäiset laajamittaisen keinokasteluun perustuvan maanviljelyksen aiheuttamat ongelmat: viljelysmaat muuttuivat hedelmättömiksi suolamaiksi. Indus-joen laaksossa noin 2 000 vuotta eaa. kukoistaneen Harappa-kulttuurin jäännöksistä on löytynyt tiilillä peitettyjä kanavia, jotka johtivat vettä kylpylöihin. Nykyisessä Pakistanissa Indus-joen alajuoksulla sijaitsevan Mohenjo-Daron pronssikautisessa kaupungissa on nähtävissä jopa satoja muinaisia kaivoja ja vesijohtoja. Vesijohtoputket olivat poltettua savea ja niitä tehtiin vakiokokoisina.[4]

Egyptissä oli käytössä patoja ja kanaaleita, jotka vaativat paitsi insinööritaitoja myös säännöllistä kunnossapitoa. Egyptistä tunnetaan tiettävästi varhaisin vedenpuhdistusjärjestelmä, jossa vettä tai viiniä puhdistettiin laskeuttamalla sakat pohjalle. Muinaisista kaivoista saa hyvän käsityksen Kairossa sijaitsevasta n.300 jalkaa syvästä Josephin kaivosta, josta vesi nostettiin ämpäriketjuilla ylös. Aristoteleen aikana 384-322 eaa. tunnettiin vedensuodatus huokoisen saven läpi jo laajalti. Intiassa jo 2 000 vuotta eaa. osattiin puhdistaa vettä keittämällä, pitämällä sitä pitkään auringonvalossa tai suodattamalla sitä hiekan läpi.[5]

Vanhan Testamentin Mooseksen kirjoissa on useita kuvauksia vesijohdoista sekä kaivoista, niiden rakentamisesta, käyttöoikeudesta, omistuksesta ja suojauksesta. Assyrian pääkaupunkia Niiniveä kahdeksannella vuosisadalla eaa., ympäröi muuri, jonka sisäpuolelle tuotiin vettä johdolla.[6] Antiikin ajoilta tunnetaan parhaiten roomalaisten rakentamat gravitaatiovesijohdot eli akveduktit. Vanhimmat niistä on löydetty Kaldean Uurista.[7] Vesi johdettiin akvedukteja pitkin kaupunkeihin, joissa se jaettiin lyijyputkista tehdyllä verkostolla. Verkostoihin oli liitetty myös varastosäiliöitä. Yksityiset vedenkäyttäjät maksoivat veroa putkiensa läpimitan mukaan.[8]

Jo roomalaisten edeltäjillä, etruskeilla, oli ilmeisesti varsin kehittynyt vesihuolto kaupungeissaan. Onkin todennäköistä, että roomalaiset hyödynsivät etruskeilta peräisin olevaa tietämystä omissa järjestelmissään. Roomalaiset olivatkin taitavia sulauttamaan muualla tulleita keksintöjä ja käyttämään niitä hyödykseen laajassa mittakaavassa. Rooman valtakunnan alkaessa murentua akvedukteja oli kaikkiaan 19 kappaletta ja niiden yhteispituus oli yli 600 km.[9] Rooman akveduktien yhteispituus vastaa esim. Tampereen kaupungin vesijohtoverkon pituut-

4 Hendricks; s.7-11;Jansen 1994; Coffey & Reid 1976, s. 128; Erävuori 1976, s. 9; Toivonen ym. 1981, s. 38-39; Hukkinen 1985; Katko 1996, s.23; Louekari, s.9.

5 Cosgrove 1909, s.4; Coffey & Reid 1976, s. 128; Aho 1995. s. 9; Linde-Jensen ym. 1976, s. 8; Katko 1996, s.23.

6 Spier 1989, s. 34.

7 Orrje & CO 1975, s. 277.

8 Toivonen ym. 1981, s. 39; Antila 1986.

9 Hendricks, s.26; Erävuori 1976, s 9; Katko 1996, s.24. Onpa esitetty epäilyksiä, että juuri lyijyjohtojen käyttö olisi ollut yksi keskeinen syy koko valtakunnan rappeutumiseen. Nämä on kuitenkin kumottu , kts. esim. Vuorinen 1994, s.9-22 tai Bruun 1991, s.127-130.

ta 1980-luvun loppupuolella! Kulutus Roomassa oli tietysti huomattavasti suurempi. Vuoden 100 tienoilla Rooman akveduktit toivat vettä 0,7 miljoonaa kuutiometriä vuorokaudessa eli vuodessa vettä tuli kaupunkiin noin 250 miljoonaa kuutiometriä.[10] Karkeasti voidaan sanoa, että Tampereen vedenkulutuksen ollessa suurimmillaan juuri ennen energiakriisiä vuonna 1972, Tampere kulutti vettä vuodessa saman verran kuin Rooma kuukaudessa.

Bruun arvioi, että vuoden 100 vaiheilla Rooman asukkaat saivat keskimäärin 67 litraa vettä päivässä. Tampereella vertailuvuonna 1972 kulutus oli 314 litraa vuorokaudessa asukasta kohti. 1800-luvun Euroopassa 25-50 litraa päivässä pidettiin tarvittavana minimimääränä.[11] Energiakriisi vuonna 1973 ja jätevesimaksut käänsivät kulutuksen laskuun.

Yksi Rooman vesikomissaarin Frontinuksen[12] huolista noin vuonna 100 ajanlaskun alun jälkeen (aaj.) oli, että vettä otettiin laittomasti maanviljelyksen tarpeisiin Rooman ulkopuolella, mikä aiheutti ajoittain tilanteen, jossa Rooman kaupungissa ei ollut tarpeeksi vettä katujen puhdistamiseen. Vastaavia ongelmia siis kuin 1990-luvun Yhdysvalloissa! Jopa ilman veden varastamista turvallisen ja luotettavan vesivarannon ja jakelun järjestäminen vaati ratkaisuja moniin vielä nykyäänkin olemassa oleviin ongelmiin. Paineen säilyttäminen, ilmanvaihto, paineiskun estäminen ja vuotojen eliminoiminen ovat ongelmallisia edelleen.[13] Myös vastaavista maanviljelyksen aiheuttamista ongelmista löytyy esimerkkejä muualtakin 1990-luvun lopulta.[14]

Antiikin kreikkalaiset tekivät jo 220-luvulla eaa. pronssisia paineputkia, joissa vedenpaine oli korkeimmillaan 200 metriä. Putket ympäröitiin kivistä poratuilla kauluskappaleilla. Tällaista sukellusjohtoa, jossa oli kolme halkaisijaltaan 100 mm rinnakkaista putkea, käytettiin muun muassa Pergamonissa. Kreikkalaisten arvellaan jo havainneen, että lyijyputkien käyttö on terveydelle vaarallista.[15]

Roomalaisten muinaiseen vedentoimitus ja -jakelu järjestelmään kuului myös säiliöitä ja selkeytysaltaita. Insinööri Vitruvius[16] kirjoitti jo noin 25 eaa. vedenvarastointitekniikasta. Hän suunnitteli holvatut katteet avoimille kanaville veden suojaamiseksi suoralta auringonvalolta ja leväkasvun estämiseksi. Akveduktit kulkivat tarvittaessa myös tunneleissa. Myös ilmanvaihdosta oli huolehdittu. Vesi virtasi ilman pumppuja tai muuta mekaanista järjestelmää ja tämä aiheutti rajoituksia korkeuskulmille ja etäisyyksille, joihin vettä voitiin siirtää. Ilman kloorausta veden puhtaana pysymisen kannalta oli erittäin tärkeää pitää vesi liikkeessä. Asettamalla säiliöitä muutaman mailin välein putken varrelle roomalaiset välttivät koko järjestelmän tyhjentämisen korjausten aikana. Heillä oli myös vakiomallit putken kulma- ja liitoskappaleista.[17]

10 Juuti 1993, s.21, 37-38.

11 Bruun 1991, s.103-104; TKVL VK 1972; Hietala 1987, s.418

12 Bruun1991, s.10. Sex. Iulius Frontinus, curator aquarum, kirjoitti De aquae ductu urbis Romae –teoksen n. vuonna 100. Rooman vesihuollosta kts. Bruun 1991.

13 Foil & co; Gray.

14 Esim. Mannila, Johanna, HeSa 6.12.1996.

15 Orrje & CO 1975, s. 278-279.

16 Bruun 1991, s15-16. Vitruvius eli ensimmäisellä vuosisadalla e.a.a., Frontinuksen De aquaeductu urbis Romae on n. vuodelta 100 a.a.j.. Vitruviuksella oli myös käytännön tietoa asioista joista hän kirjoitti, mutta arkkitehdit ja rakentajat eivät seuranneet kaikkia hänen luomiaan periaatteita.

17 Gray; Foil&co.

Tampereella 2012. (Juuti L.)

Roomalaisten järjestelmien laadusta kertoo paljon se, että vielä vuonna 2000 Espanjan Segoviassa on käytössä osa roomalaisten noin vuonna 100 eaa. rakentamasta akveduktista.[18] Antiikin ajoilta on peräisin myös varhainen palonsuojelu, esimerkiksi paloruisku keksittiin 250 eaa. Aleksandriassa Egyptissä.[19]

Nykynäkökulmasta katsottuna roomalaisten järjestelmien ongelmana oli se, että vaikka hyvän veden ja huonon veden välinen ero sekä viemäröinnin tarve tajuttiin, niin silti huomiota kiinnitettiin lähinnä vesijohtoihin, ei niinkään viemäreihin ja käymälöihin sekä hygieniaan. Puutteellisen hygienian ja saastuneen veden välityksellä levinneiden tautien takia lapsikuolleisuus olikin korkea. Yleinen terveydentila ei ilmeisesti voinut olla kovin hyvä. Huomattava on, että köyhien ja rikkaiden välinen kuilu oli suuri. Köyhät olivat yleisten käymälöiden ja vesipostien varassa ja he asuivat laaksoissa, joissa viemäröinnin ongelmat kasautuivat. Rikkaat taas saivat hyvälaatuista vettä, kävivät omissa käymälöissään ja asuivat kukkuloilla.[20]

18 Hörberg, s.16;Wijmer, s.20.

19 Juuti 1993, s.37-38.

20 Vuorinen 1995, s.41-49; Vuorinen 1997, s.81-87.

Rooman valtakunnan luhistuttua järjestetty vesihuolto taantui vaikka monissa paikoissa olikin toimivat järjestelmät. Keskiaikaisissa kaupungeissa vedenhankinta perustui kaivoihin, jotka sijaitsivat kaupunkien ulkopuolella ja osin myös kaupunkialueella. Ainakin jo tuolta ajalta tunnetaan myös yksityinen vedenmyynti, jossa vedenmyyjä vei aasikärryillä vettä asiakkaiden oville saakka. Pariisin vesihuollosta vastasi 1700-luvulla arviolta 20 000 vedenmyyjää[21] ja Kairossa heitä arvioitiin keskiajalla olleen jopa 100 000.[22] Samanlaista tekniikkaa käytetään vielä 2000-luvun alussa hyvin paljon kehitysmaiden kaupunkien slummeissa.

## Vesihuolto ongelmaksi kaupunkien nopeassa kasvuvaiheessa

Kaupunkien kasvuvaiheista on löydettävissä taitekohtia, joiden jälkeen vesihuollon on toimittava tai kasvu käy vaikeaksi ellei mahdottomaksi. Yksi tällainen vaihe on puukaupungin muuttuminen kivikaupungiksi. Juha Kuisma vertaa puukaupunkien toimintaa maalaistaloon 500-kertaisessa mittakaavassa. Luonnehdinta sopii myös Tampereeseen. Kun kaupungin koko kasvaa ja maaseutumainen – tai maalaistalomainen – asuminen alkaa hävitä kaupunkimaisen asumisen tieltä, irrottautuu kaupunki Kuisman mukaan aineenvaihdunnallisesti ympäristöstään. Ravinteet eivät enää palaudu kiertoon esimerkiksi sikojen syötäväksi tai maanparannusaineiksi, vaan ne poistetaan jätteinä tunkioille, kaatopaikoille ja myöhemmässä vaiheessa viemäriverkostoa pitkin vesistöön.[23] Tampereella oltiin 1830-40-luvuilla tämän nopeasti kiihtyvän muutoksen alussa. Teollisuuden kasvun myötä kaupunki kasvoi nopeasti; muutoksen rajuutta kuvaa hyvin esimerkiksi väkiluku, joka kasvoi 1830-1920 yli 25-kertaiseksi: alun noin 1600 hengestä yli 40 000 henkeen. Tampereen nopea kasvuvaihe alkoi Viljo Rasilan mukaan vuonna 1838.[24]

Laajemmassa mittakaavassa vastaava nopean kasvun kausi Rooman valtakunnan luhistumisen jälkeen löytyy Englannista, jossa 1700-luvun loppupuolella alkoi kaupungistuminen kiihtyä. Näihin aikoihin ajatus siitä, että vesiasioista huolehtiminen kuuluisi valtiolle tai että niiden hoitaminen koituisi yleiseksi hyväksi, ei ollut yleisesti edes esillä. Poikkeuskin kuitenkin löytyy: Ruotsissa vuonna 1630 kirjoitti soturi ja valtiomies Jaakko de la Gardie Kustaa II Adolfille: ”En vattenledning i en stad är publicum bonum”. Valtio yleensä kuitenkin pysyi Ruotsissakin erossa vedenhankinnasta ja viemäröinnistä aina 1800-luvulle asti.[25]

Englannissa vesistöjen saastuminen ja terveystilanne kävi kuitenkin niin huonoksi, että jotain oli tehtävä. Vuonna 1820 joitakin puuvesijohtoja korvattiin valurautaputkilla ja ensimmäinen yhdyskuntaa palveleva vesilaitos rakennettiin vuonna 1830. Englannissa 1842 Poor Law Commissioneerit neuvoivat, ettei jätevesiä tyhjennettäisi suoraan jokiin, joista otettiin juomavesi. Paria vuotta myöhemmin kaupunkien terveyskomission raportti vuonna 1844 ”The Sanitary Condition of the Labouring Population of Great Britain” paljasti niin ällistyttävän määrän maatuvaa jätettä ja orgaanista materiaalia kaikkialla Englannin kaupungeissa, että se nostatti voimakkaan liikkeen olojen parantamiseksi. Sen johtohahmo oli kyseisen raportin kirjoittaja

21 Ponting 1991, s. 349.

22 Coffey & Reid 1976, s. 133.

23 Kuisma, s.162-163.

24 Rasila 1984, s.131.

25 Bjur, s.15-17. Johan Pontusson de la Gardie eli Jaakko (1583-1652) kuten suomalaiset hänet tunsivat oli monipuolinen sotilas ja valtiomies, joka harjoitti myös liiketoimintaa, hoiti lukuisia virkoja, hän oli mm. holhoojahallituksen jäsen ja sotakolleegion presidentti. Suomalaiset sotilaat kutsuivat johtajaansa Laiska-Jaakoksi koska tämä ei lähtenyt pois Venäjältä: ”Lähtee suvi, lähtee talvi, vaan ei lähde Laiska Jaakko”.

**Taulukko 1.** Vesihuollon eri aikakaudet ja järjestelmät

| Ajoitus | Kulttuuri | Menetelmiä | Kiinnostuksen kohde | Järjestelmät |
|---|---|---|---|---|
| Aika ennen kaupunkeja | Keräilykulttuuri | Sadevesi, lähdevesi, ämpäri | Eloonjääminen | Ämpärijärjestelmä |
| Varhaiset vaiheet | Babylonia, yms<br><br>Rooma | Vesijohdot, viemärit, wc<br><br>Akveduktit, viemärit, palokunta<br><br>Köyhät ja rikkaat eri asemassa, ”epädemokratisuus” | Siisteys, mukavuus<br><br>Nautinnot, Sotilaalliset arvot<br><br>Kylpylät | Modernijärjestelmä (juomavesi) & protojärjestelmä (jätevesi) |
| Vesihuollon pysähtyneisyyden aika | Kirkolliskulttuuri<br><br>Kaupungit lakastuvat | Vanhat modernit järjestelmät hajoavat. Potta, tunkio, ämpäri<br><br>Palovartiointi, sammutusjoukot | Hengellinen elämä<br><br>Symboliset arvot | Ämpärihjärjestelmä |
| Hitaan kehityksen aika | N.1850-l alkaen Englannista<br><br>Suomessa karkeasti n.1880-1910 | Putkesta sisään, toisesta ulos, ”rännijärjestelmä”. Kuivatus ensin, sitten ensimmäiset vesilaitokset, hidassuodatus<br><br>Wc, hygienian ja bakteriologian läpimurto<br><br>Pakkopalokunta ja VPK | Hygienia, työkyky<br><br>Terveys, turvallisuus, työkyky<br><br>Tuotannolliset arvot | Protojärjestelmä |
| Kehittyneen kaupunki-infrastruktuurin aika ns.moderni aika | Eri vaiheissa eri puolilla maailmaa<br><br>Esim. Suomi 1800-1900 vaihe | Vedenkäsittely, pikasuodatus, jätevesien puhdistus<br><br>Mitattu kulutus, paineistettu vesijohto | Ympäristö, terveys, hygienia<br><br>Köyhät ja rikkaat lähes samassa asemassa<br><br>Tuotannolliset arvot | Moderni järjestelmä |

asianajaja Edwin Chadwick (1800-1867). Tämän reformin aikaansaannoksia seurattiin tarkkaan myös ulkomailla ja vesilaitoksia alettiin vähitellen perustaa muuallekin.[26] Samoihin aikoihin 1800-luvun puolessavälissä Louis Pasteur todisti, että bakteerit aiheuttavat taudit. Viemäröinnin merkitys nousi uuteen arvoon. Kaupungit aloittivat asteittain laajoja viemäröintiprojekteja. Talojen liittäminen viemäreihin tehtiin pakolliseksi Hampurissa 1843 ja Lontoossa 1847. Vielä tämän jälkeenkin Lontoossa jätteet siirrettiin taloista Thames-jokeen. Mitään ei tehty ennen vuoden 1855 kolera-epidemiaa, jolloin joen saastuttaminen kiellettiin. Mutta kolerasta huolimatta vielä jonkin aikaa kiinnitettiin enemmän huomiota teollisuuden ja maanviljelyn tarvitseman veden saastumiseen kuin uhkaan terveydelle.[27]

Kehitys oli kuitenkin hidasta ja Lontoo kärsi vielä kahdesta kolera-epidemiasta 1866 ja 1872. Samanlaiset olot vallitsivat kaikkialla Euroopassa ja Amerikassa. Sir John Harrington keksi

26 Gray;Foil & co; Ekman 1947, s. 16; Asola, s.40; Katko 1996, s.39. Esim. Hollannista kts. Wijmer, s.61,66-69.

27 Foil & co; Gray.

vuonna 1596 huuhteluvessan. Sitä alettiin käyttää yleisesti vasta 300 vuotta myöhemmin, kun Thomas Crapper kehitti huuhtelua ”läpättömällä vesijätteen estäjällä”.[28]

## Vesihuollon järjestelmien karkea luokitus

Eri järjestelmien kuvaamisen helpottamiseksi olen lähinnä omaan käyttööni luonut kolmijakoisen luokituksen:

1. Ämpärijärjestelmät
2. Protojärjestelmät (tai rännijärjestelmät)
3. Modernit järjestelmät

Taulukossa 1 on poimittu eri aikakausille ja järjestelmille tyypillisiä piirteitä.

Ämpäriin perustuva vedenhankinta, palotoimi ja jätehuolto toimivat niin kauan kuin kaupungissa asuttiin maaseutumaisen väljästi. Nopean kasvun kausi toi asukastiheyden ja sen vaatimat rakennustekniset ratkaisut –kuten tiheään rakennetut puutalokorttelit ja myöhemmin ensimmäiset kerrostalot – siihen pisteeseen, että jotain oli tehtävä. Samanaikaisesti niin vedenhankinta, palotoimi kuin jätehuoltokin vaativat uusia ratkaisuja tai muutoin koko kaupungin olemassaolo olisi vaarantunut.

Kasvavien ympäristöongelmien, kaupungeissa riehuvien suurten tulipalojen ja jätekasojen keskeltä ongelmien ratkaisuksi syntyivät protojärjestelmät, jotka ohjasivat ongelmat pois silmistä. Tähänkin ratkaisuun vaadittiin käsitys siitä, että ongelmia oli ja että päättäjillä oli tahto muutokseen. Päättäjillä oli myös oltava käsitys siitä, että yhteisön oli huolehdittava näistä asioista. Tyypillistä oli esimerkiksi veden otto kaupunkialueen välittömästä läheisyydestä, mutta ei enää kaupunkialueelta esim. kaivoista, veden johdattaminen putkistoa pitkin käsittelemättömänä kuluttajille, likaviemäreiden rakentaminen siten että lika- ja sadevedet johdettiin samaan järjestelmään ja puhdistamatta lähivesistöihin sekä jätteiden kuljettaminen kaupunkialueen välittömään läheisyyteen tai upottaminen lähivesistöihin. Protojärjestelmää voitaisiin kuvata myös sen toimintaperiaatteella: putkesta sisään, putkesta ulos. Kuten aina prototyypeissä, vikoja ja virheitä esiintyi. Modernit järjestelmät pyrkivät perusteellisempiin ratkaisuihin, kuten raakaveden käsittelemiseen ennen johtamista kuluttajille, kaupunkialueen kattaviin palopostijärjestelmiin, erillisviemäröintiin ja jätevesien puhdistukseen sekä jätteiden käsittelyyn luontoa säästävillä tavoilla.

## Onko vesi ongelma?

Edellä esitettyjen esimerkkien avulla olen yrittänyt kuvata, että vesi ei ole ongelma. Jo muinaiset roomalaiset osasivat johtaa riittävästi vettä miljoonakaupungin tarpeisiin sekä huolehtia viemäröinnistä. Valitettavasti tämä taito unohtui hyvin pitkäksi ajaksi. Myös ajatus siitä, että kaupunkien asukkaiden hyvinvoinnista huolehtiminen kuuluisi yhteisiin asioihin, valtion tai kaupungin hoidettavaksi, unohtui. Vasta 1800-luvun puolivälissä ajatus virisi uudelleen samaan aikaan tapahtuneen bakteriologisen vallankumouksen kanssa. Tällöin ryhdyttiin kehittelemään ratkaisuja vesihuollon järjestämiseksi kaupungin mittakaavassa, mutta valitettavasti antiikin perimää ei osattu käyttää hyväksi ja vasta lukuisten virheiden ja ihmishenkien mene-

28 Gray;Foil & co. Tarkemmin wc:n vaiheista esim. Wijmer, s.60

tysten kautta päästiin toimiviin, moderneihin järjestelmiin. Yhä edelleen kuitenkin eri puolilla maailmaa unohdetaan kaikki tämä tieto ja rakennetaan järjestelmiä, jotka eivät perustu koetellusti toimiviin periaatteisiin. Vesi ei ole ongelma, mutta usein siitä vastaavien päättäjien sekä veden kuluttajien asenteista löytyy vääriin käsityksiin ja puutteelliseen tietoon perustuvia toimintamalleja, jotka aiheuttavat ongelmia. Näkyvimpänä ongelmana tästä kasteluveden subventoiti alueilla, joilla toisaalta podetaan vesipulaa.

Kunnollisen veden puute on useissa eri yhteyksissä katsottu maailman suurimmaksi ongelmaksi, jonka ratkaisijalle pitäisi antaa sekä rauhan- että lääketieteen Nobel-palkinto (J.F. Kennedy). Vuonna 2017 puutteellinen sanitaation ja turvallisen juomaveden puute aiheuttaa eri arvioiden mukaan noin 10.000 - 50.000 kuolemaa päivässä eli 3,65 – 18,25 miljoonaa vuodessa. Suurempi arvio merkitsee kolme kertaa enemmän kuolleita kuin koko Suomessa on asukkaita. Yhteensä maailmassa on noin miljardilta ihmiseltä puuttuu turvallista vettä ja noin 2,5 miljardilta perussanitaatio ja peräti 80 prosenttia maailman jätevesistä jää puhdistamatta.

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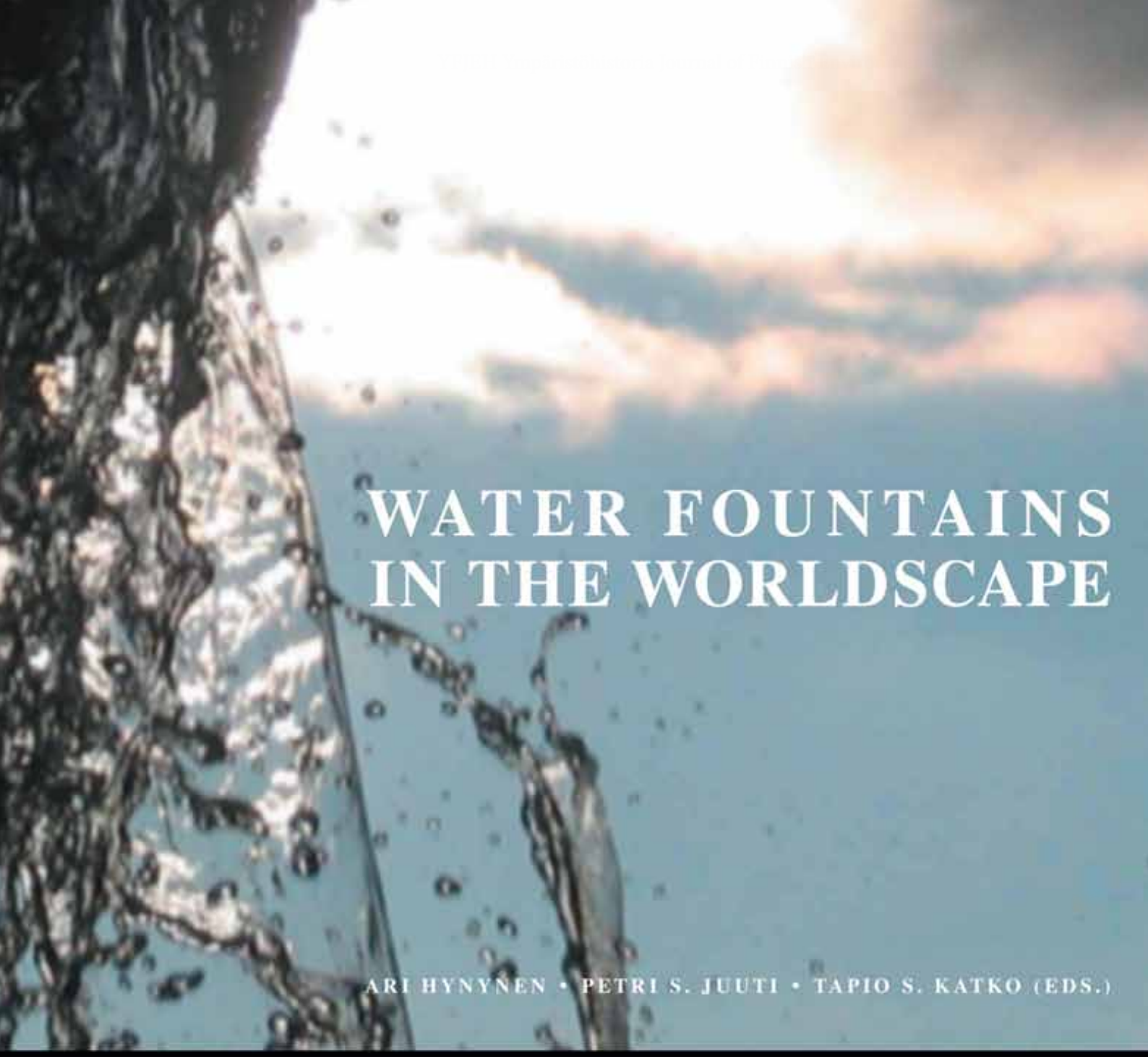


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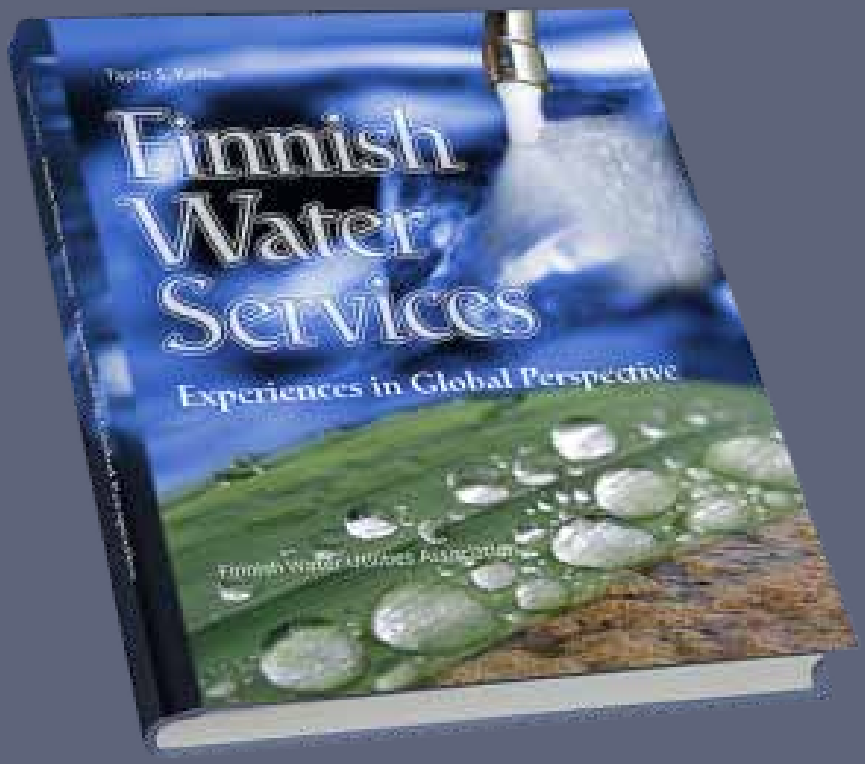


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