Routes to Water and Sanitation Equity in Dar es Salaam: An Analysis of Health Justice

A dissertation submitted in partial fulfilment of the requirements for the MSc

Health in Urban Development

Word Count: 10180

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14 September 2021

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Abstract

Poor water and sanitation brings health inequalities in Dar es Salaam, which sets great challenges to achieve health justice. Finding routes to water and sanitation equity is an important development agenda in Dar es Salaam. To answer the research question about how the current water and sanitation governance of Dar es Salaam affects health justice, the dissertation adopts literature review and case study to have an analysis. Through literature review, vulnerabilities in the relationship between poor water and sanitation and health inequalities in Dar es Salaam are founded. Through three cases, Kombo (Ilala Municipality), Keko Machungwa (Temeke Municipality) and Tandale Slum, interactions among all kinds of determinants and stakeholders in Dar es Salaam' water and sanitation governance are analysed and discussed. Drawing the analytical framework of health justice, all cases are analysed from environmental justice, social justice and planning justice, these three aspects that help to achieve health justice. In the end, the dissertation identifies future challenges to water and sanitation equity in Dar es Salaam and proposes recommendations to the local and global water and sanitation governance.

Keywords: water and sanitation equity, health justice, Dar es Salaam

Acknowledgements

I would like to thank my supervisor, Professor Haim Yacobi. With his support, the process of writing the dissertation is efficient. And I would like to express the appreciation to all staff at the Development Planning Unit for all the efforts they made in this tough year. Their extraordinary contributions made my study journey valuable. I would also like to express my gratitude to my classmates and friends for their support in the past year. They inspired me a lot and gave me a lovely time in my life.

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1. Introduction

Water and sanitation inequalities have exacerbated health injustice in Dar es Salaam for decades. Access to safe and equitable water and sanitation services is a human right to benefit public health and achieve health justice (United Nations UN, 2012). 844 million people around the world lack access to safe water and sanitation and half of them are in Sub-Saharan Africa (Adams et al., 2018). With population growth and city sprawl, the demand for water and sanitation in Dar es Salaam rapidly climbs and the water and sanitation system has overstretched, affecting people's health and wellbeing. An analysis (Totin et al., 2021) indicated two main adverse health outcomes contributed by water and sanitation services in Africa. One is that poor water and sanitation bring the prevalence of waterborne diseases and infections particularly targeting vulnerable groups. The other is that the uneven distribution of water and sanitation services has been expanding health disparities, especially in informal settlements (Totin et al., 2021). As one of the fastest developing African cities and the largest and commercial capital in Tanzania, Dar es Salaam faces amplification effects of these above health outcomes. On the one hand, Omotayo et al. (2021) mentioned that diarrhoea morbidity and mortality among children under five resulting from poor water and sanitation in Dar es Salaam, two significant impact indicators of annual water and sanitation program evaluation, were higher than other cities in Tanzania. On the other hand, Dar es Salaam's unplanned and informal settlements grow at twice the rate of the whole city. The population in these settlements has a double increase every 20 years, contributing to the inadequacy of water and sanitation infrastructures (McGranahan et al., 2016). Akbar et al. (2007) indicated limited access to improved water and sanitation is associated with urban poverty, in which over 50% of the population in Dar es Salaam are low-income dwellers living in informal settlements. Studies about informal settlements in Dar es Salaam showed that increased health risks resulting from disadvantaged social determinants challenged the water and sanitation equity most and brought social injustice, environmental injustice and planning injustice aggravating health injustice (Penrose et al., 2010; Kombe et al., 2015; Christopher and Beal, 2021; Panman, 2021). Nowadays the biggest challenge to decrease water and sanitation inequalities and achieve health justice in Dar es Salaam is how to manage a best-practice model serving the urban poor for water and sanitation governance and planning to reduce urban vulnerabilities (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2019; Smiley, 2019; Bhanjee and Zhang, 2021; Christopher and Beal, 2021).

Improving water and sanitation to health justice has been an important agenda in the city development of Dar es Salaam for decades. Millennium Development Goals (MDGs) for

water and sanitation try to halve poverty rates and the population having no access to improved water and sanitation by 2015, decreasing risks of communicable disease transmission and improving public health (Satterthwaite, 2016). Tanzania failed to achieve these targets of MDGs in 2015 although policies and interventions designed for improved water and sanitation had been conducted for many years (Christopher and Beal, 2021). Studies drawing Dar es Salaam as a case for the failure analysis found injustice and limitations in the governance process such as deficient financial mechanism, fragmented stakeholder participation and insufficient policy-driven practices (Kyessi, 2005; WaterAid, 2008; Hofmann, 2021). And in the United Nations 2030 Sustainable Development Agenda, we can tell that global water and sanitation governance is still a crucial issue in the next decade. According to Sustainable Development Goal 6 (SDG6) related to water, sanitation and hygiene (WASH) in the Agenda, it highlights water and sanitation availability and tries to make more countries have sustainably managed water resources by 2030 (UN, 2020). Hofmann (2021) points out the SDG6 towards 2030 is more ambitious than MDGs to water and sanitation equity and it tries to establish an integrated water and sanitation system with service availability, accessibility and affordability monitoring, which shows a significant shift of improved water and sanitation evaluation criteria from simply control demographic quantitative data to build a holistic related-indicator system with the quantitative and qualitative combination. Therefore, Dar es Salaam will face more challenges to achieve water and sanitation equity in the next step, including water and sanitation infrastructure investment, public-community partnership building, technology innovation, household satisfaction improvement and resilience improvement at environmental risks (Sweya et al., 2019; Smiley, 2019; Christopher and Beal, 2021; Hofmann, 2021).

Related studies about water and sanitation equity highlight its relationship with health and raise the significance of urban governance, which inspires researchers to explore interactions among different social and environmental determinants affecting health to most possibly control the efficiency of related interventions in the process of the equity. Focusing on Dar es Salaam, the dissertation will give the answer to the following research question: How does the current water and sanitation governance of Dar es Salaam affect health justice? To answer this research question comprehensively and critically, several research objectives are set as follow:

- To figure out the vulnerabilities in the relationship between poor water and sanitation and health inequalities in Dar es Salaam.
- To understand the interactions between current water and sanitation interventions and health justice in Dar es Salaam and identify their impacts.

- To evaluate the applicability of current interventions to potential health challenges and suggest possible actions to water and sanitation equity in Dar es Salaam.

To achieve these objectives, the dissertation will adopt literature review and case study as research methods. The first objective will rely on literature review and the rest will base on case analysis. Three representative cases are selected for discussion, located in different areas in Dar es Salaam respectively Kombo (Ilala Municipality), Keko Machungwa (Temeke Municipality) and Tandale Slum. According to different characteristics, three cases focus on different issues of water and sanitation governance. The case of Kombo will analyse the significant shift from policy-driven to needs-driven for water and sanitation service provision. Community-based water and sanitation service management will be discussed in the case of Keko Machungwa, an informal settlement. Associated with severe urban poverty, the case of Tandale Slum will focus on health impact assessment in water and sanitation governance serving children, adolescents and women, the specific vulnerable groups. Based on the findings from the research objectives' achievement, the dissertation expects to give some valuable opinions working for policymakers to find the routes to water and sanitation equity and achieve health justice in Dar es Salaam as soon as possible.

2. Literature Review

2.1 Poor water and sanitation and poor health outcomes in Dar es Salaam

Urban sprawl causes the insufficiency of city resource provision, which affects residents' living conditions directly. According to the recent demographic health profile of Dar es Salaam, over 65% of poor health outcomes are contributed by poor water and sanitation services, showing a strong relationship between the living environment and health impacts (Leyna et al., 2017). Disaggregated by age, gender and income, children, women and the low-income are three major vulnerable groups suffering those poor health outcomes in Dar es Salaam's city development.

Children's morbidity and mortality are crucial indicators that can assess the status of public health (Leyna et al., 2017). In Dar es Salaam, the prevalence of waterborne diseases and the low nutrition status are main contributors to high morbidity and mortality to children under five (Leyna et al., 2017; Rees et al., 2020). Diarrhoea is the most common type of waterborne disease and the number of its hospital admission of children in Dar es Salaam constantly grows by 2.3% every year from 2015 to 2020 (Nalitolela et al., 2021). Moyo et al. (2011) points out poor water quality during Dar es Salaam's dry season brings acute watery

diarrhoea that is one of the diarrhoea types commonly causing all kinds of infective complications to children under five and poor sanitation conditions speed up the spread of virus, which based on above two reasons, the risk of the children mortality will increase. The deaths of cholera outbreaks in Sub-Saharan Africa are children most (Zerbo et al., 2020). Cholera is identified as a waterborne disease with a rapid transmission rate and high mortality, contributed by unsafe drinking water contaminated with poor sanitation conditions and developing countries' urbanization characterised by high population density, overcrowded informal settlements and limited access to improve water and sanitation has great impact on risk accumulation to the epidemiology of cholera (Zerbo et al., 2020). Dar es Salaam's urbanization makes the health system face much pressure and have limited capacity responding to cholera outbreaks, especially those children living in informal settlements (Zerbo et al., 2020). In terms of the status of children's nutrition, studies show that Tanzania has a higher prevalence of under-five children's undernutrition than other Sub-Saharan African countries, the reason for which poor water with harmful chemical elements blocks children's immunity improvement and is bad for dietary digestion and adsorption (Khamis et al., 2019; Saronga et al., 2020). Low-nutrition status is also a chain health outcome of diarrhoea, increasing the risk of under-five children's stunting in Dar es Salaam (Gosselin et al., 2016).

For women, poor water and sanitation affects not only their physical health but also mental health. Over 75% of women in Dar es Salaam participate in domestic water fetching and they need to travel with water containers suffering the heat for an average 1.4 hours in a one-way trip, commonly getting heat stroke, anemia and physical injuries (Ngasala et al., 2019). Over 80% of the households in Dar es Salaam use traditional pit latrines and over 45% of women lack access to clean sanitation facilities (Jenkins et al., 2014; Doglas et al., 2021). Public and contaminated pit latrines with poor fecal sludge disposal increase the risk of communicable diseases and unsafe issues to women, which the data shows areas with improved toilets in Dar es Salaam has a 12% decrease of the morbidity for women and over 85% of women in Dar es Salaam indicate they experience dangerous situations like pilferage, violence and sexual harassment when they access to sanitation facilities and as a result they have much pressure to basic sanitation services in daily life (Jenkins et al., 2014; Seleman et al., 2020). Without sufficient improved and private sanitation facilities such as flush toilets in households, it's very difficult to keep a hygiene and safe environment for women's health and their dignity protection in Dar es Salaam.

Limited by the affordable capacity, the low-income lack access to improved water and sanitation services. In Dar es Salaam, there is a strong relationship between income

disparity and water and sanitation inequality (Ekers and Loftus, 2008). The majority of low-income residents live in informal and unplanned settlements and their health outcomes contributed by relational factors in their living environments, and their ways to improved water and sanitation are highly related to the power dynamics that can minimize social inequalities in the community (Hofmann, 2017; Seleman et al., 2020). Only a small area of Dar es Salaam's informal settlements is covered by public piped water provision systems and ageing and decaying water infrastructures in the settlements result in the intermittent domestic water supply and poor water quality (Monstadt and Schramm, 2017; Smiley, 2019). Characterised by high population density, these low-income informal settlements have a high health risk and children and women here will be more vulnerable (Monstadt and Schramm, 2017).

2.2 Water and Sanitation Services Availability, Accessibility and Affordability in Dar es Salaam

To achieve SDGs for water, sanitation and hygiene (WASH), availability, accessibility and affordability are three key challenges for water and sanitation improvement in the service delivery process in Dar es Salaam. Smiley (2019) also points out these three aspects will be significant indicators for water and sanitation service measurements to monitor the SDGs process. In urban Dar es Salaam, the availability of water and sanitation is the vital first step for all. Provided by the Dar es Salaam Water and Sewerage Corporation (DAWASCO), the piped water supply system is the most convenient way for residents to access domestic water but it just covers the urban high-income areas and a small area in informal settlements, which blocks equitable access to water in the urbanization (Pastore, 2015; Smiley, 2019). And the worst thing of this system is limited time of water provision and unpredictable and provisional water intermittency, decreasing the basic value of the water use, that is water is available when needed (Graham et al., 2016; Smiley, 2019). Although there is a service schedule for water provision timing, it is not followed in most cases and residents have to look for another access as a backup way to address emergency situations (Smiley, 2019). As a result, only 1% of Dar es Salaam households can access available water at any time (Smiley, 2019). In terms of the availability of sanitation facilities, the number of sanitation facilities doubled from last decade but only 35% of them are available (Seleman et al., 2020). Most public sanitation facilities are always full of faeces and sludge and without hygienic desludging, which results in poor sanitation and hygiene over time and less use, even no use in the end (Jenkins et al., 2014; Seleman et al., 2020). The availability of these sanitation facilities for some vulnerable groups such as the disable and women is worse due to their unreasonable design and arrangements (Seleman et al., 2020).

Water accessibility in Dar es Salaam is highly related to the distance and time of fetching domestic water. Without well-developed water supply systems, there is no more access to water on premises, making water be fetched in daily life (Graham et al., 2016). Surrounding the residential housing and informal settlements, sources of safe water are limited and far away. Despite nearby polluted surface water contributed by unhygienic desludging and industry contaminants upstream, groundwater and commercial water are the main sources of water fetching, which their water collection points, such as wells and water kiosks, are possibly across different towns (Smiley, 2013; Seleman et al., 2020). For the collection time, it includes round-trip walking, waiting in the queue and fetching water into containers (Smiley, 2019). Although the study (Smiley, 2019) shows the average water collection time in Dar es Salaam has shortened in the past decade because of the expanded coverage of on-premises water supply, over 45% of households still have to spend time fetching water. A study (Cassivi et al., 2019) highlights the relationship between water accessibility and quantity. According to responses of those Dar's residents, the quantity of water collected depends on the number of household members and daily water consumption, which a greater quantity brings more difficulties in the collection process especially in the back way trip (Cassivi et al., 2019; Smiley, 2019). The way of water transportation like carrying, cycling and carting is a great determinant of the assessment between water accessibility and quantity, which is neglected in most previous studies (Martínez, 2017; Cassivi et al., 2019). In terms of sanitation accessibility, in Dar es Salaam, improved sanitation facilities are much less than poor sanitation facilities like traditional pit latrines and most of them are decentralised located in the fringe of residential areas, which is not convenient to access (Kombe et al., 2015).

Water and sanitation affordability can affect their accessibility. If residents can afford the water service of vendor delivery, they will save the collection time and have water at home, which improves water accessibility and creates an ideal living environment (Smiley, 2019). According to Dar's residents' preferences, they would rather pay more to have easy access to safe water, avoiding fetching water by themself (Smiley, 2019). Once the price of water and services becomes reasonable, most residents will choose to purchase for them to improve water accessibility on premises but now the charge of these services is only accepted by the high- and middle- income in Dar es Salaam (Beard and Mitlin, 2021). Hygienic desludging with technology innovation is a high cost sanitation service in Dar es Salaam and its cost-benefit is low, which discourages private sectors to invest (Seleman et al., 2020). Although the public benefit of this sanitation service is high, the price of it is high and most people can't afford it (Seleman et al., 2020; Parikh et al., 2021). Improving modalities of water and sanitation service provision serving the urban poor is the priority and

the biggest challenge to achieve social justice in Dar es Salaam's urban planning process (Pieter et al., 2014; Beard and Mitlin, 2021).

2.3 Water and sanitation governance trajectories in Dar es Salaam

Dar es Salaam's water and sanitation governance experienced several significant shifts in the past two decades, some actions and interventions reflecting characteristics of some specific periods of time. Under Tanzania's policy instruments of the national Water Sector Reform Programme and the Water Policy of 2002, Dar es Salaam started to coordinate all urban resources for an integrated water supply system, which also has an impact on sanitation service governance (Kombe et al., 2015). With the Water Sector Development Programme (WSDP), the roles and functions of different institutions and stakeholders are clearer and strengthened, which is a crucial issue to have a great influence on the governance reform for water and sanitation improvement in Dar es Salaam (Kombe et al., 2015). Before 2000, private water vending was always a dominant way for all income classes to access potable water, which is an important complement to deficient public water supply to ease uneven water distribution in Dar es Salaam (Kjellen, 2000). Through the 5-year negotiation, the Government of Tanzania had a cooperation with the City Water, a joint venture consisting of German, British and Tanzania companies, signing a 10-year contract in 2003, to lease Dar es Salaam's water supply infrastructure from the state-owned to the privatization (WaterAid, 2008). At the same time, Dar es Salaam Water and Sanitation Services Project (DWSSP), a strategic project supported by the International Development Association (IDA) of the World Bank (WB), the African Development Bank and the European Investment Bank, started to be implemented to improve access to urban water and sanitation services for the poor, focusing on supporting water and sanitation infrastructure investment and related private sector development (World Bank, 2003). Although DWSSP gave strong financial support to the 10-year lease contract, the official first time of private sector participation in Dar es Salaam's water supply failed in the end, terminated by the government in May 2005 because of mutual breach of the contract (WaterAid, 2008). Inadequate public and private sector governance and financial problems dominantly contributed to the failure (WaterAid, 2008). Taking lessons from the failure, Dar es Salaam Water and Sewerage Corporation (DAWASCO), a new publicly owned company, was established to replace the role of the private sector, having a identical power position of governance with Dar es Salaam Water and Sewerage Authority (DAWASA), the most reliable public sector for water management before (Kombe et al., 2015; WaterAid, 2008). At this period of time, residents weren't satisfied with the institutional performance in water and sanitation services and the way of community-based management showing advantages in

field works encouraged residents to participate in the decision-making process, sufficiently using community resources and neighborhood associations to fill the service gaps contributed by centralised institutions to achieve self-help and independent local governance (Kyessi, 2005; Mwakalila, 2007). With the development of community-based management in Dar es Salaam, residents gradually have played a more essential role in water and sanitation service delivery and the value of their involvements are recognized in government-community partnerships which are also commonly identified as public-public partnerships (PuPs) (Dill., 2010). However, Dill (2010) notes the limited capacity of community involvement because of its independence which is not only the strength but also the shortcoming. Water and sanitation services are basic public goods and their provision highly depends on the state and the market with economic and social considerations, which many related issues can't be addressed only by community resources (Dill., 2010).

In the recent decade, the governance focused on everyday practice governance and local strategies to build an integrated water and sanitation network serving all. Urban planning starts to play a significant role in the process of governance and with its tools, more and more models become more scientific. Learning from previous failure modes of practice, the impact of urban poverty on water and sanitation governance is huge and inevitable in Dar es Salaam, which can't be neglected in the planning process. Peri-urban communities try to develop need-driven practices to address the insufficiency of public water and sanitation service provision and fill in the governance gap of policy-driven practices (Hofmann, 2011; Kombe et al., 2015). Jenkins et al. (2014) highlights the safety and sustainability of sanitation services in poor communities and raises the importance of monitoring and evaluation of sanitation management and functionality in the policy implementation. Because of the rapid development of local organizations, more flexible partnerships are involved in Dar es Salaam's water and sanitation strategies and Pastore (2015) notes the significance of reworking the relation between local practice and city governance for the local innovative strategy implementation in the dynamic planning process. Trust between residents and service providers is vital and it will impact residents' satisfaction. Different with formal providers having public credibility, informal and private providers in Dar es Salaam face challenges in trusting, which better habituation to the cooperation and the great capacity of community and social engagement can help them improve the trust (Munro and Kweka, 2021). For water and sanitation improvement, the networked city is ideal for coordinating multiple stakeholders and all kinds of resources and at the same time a network extension shouldn't be overlooked, which can seek more potential public benefits for those living in the peri-urban areas and the fringe of Dar es Salaam (Andreasen and Møller, 2016; Monstadt and Schramm, 2017).

2.4 Some Issues Affecting Water and Sanitation Governance in Dar es Salaam

Dar es Salaam has intense rainfall contributed by the coastal location and climate change and with poor urban drainage systems it is at the risk of flooding (Smiley and Hambati., 2019). Flooding is a common type of natural disaster, which can greatly destroy the living environment and have a great impact on water and sanitation. Floods contribute to poor quality of drinking water, bringing fecal contaminants into it, which causes cholerae outbreaks (Islam et al., 2007). In Dar es Salaam, the poorest residents living in informal settlements suffer the worst impact of flooding (Smiley and Hambati., 2019). Informal settlements have poor living conditions, such as poor housing, ageing infrastructures, lack of drainage systems and limited community resources, which increases the disaster risk and shows poor community resilience to floods. Therefore, resilience improvement in those Dar es Salaam's flood-prone areas is an essential consideration in local water and sanitation governance (Sweya et al., 2019).

Besides, industry activities and land use are concerned in the governance. With industry development, most water sources are polluted especially those in upstream areas of Ruvu River, a main source of surface water in Dar es Salaam (Smiley, 2013). And locations of industry activities to residential areas have a great impact on water accessibility, which is a challenge for the governance to keep the balance between economic benefits and wellbeing. Unfair water and sanitation provision existed in colonial Dar es Salaam and it stayed until now, sufficient services providing for the rich and low-income groups having no access to it. There is strong relationship between urban land-use planning and infrastructure investment, bringing strengthened water and sanitation inequalities in postcolonial Dar es Salaam (Smiley, 2013). Kombe et al. (2015) notes that the coordination between land planning and the provision of public services like piped water systems is urgently required to achieve real decolonization in urban Dar es Salaam.

2.5 Research gap

Based on the above literature review, the situation of water and sanitation in Dar es Salaam is not optimistic. Public health is strongly affected by water and sanitation. Previous studies not only focus on water and sanitation themselves and direct physical health outcomes but seek links of a variety of related factors covering economic, environmental and social aspects that contribute to Dar es Salaam water and sanitation inequalities. Finding routes to water and sanitation equity in Dar es Salaam is a process that tries to establish connections with the whole urban planning, therefore the coordination of different kinds of resources with comprehensive considerations to build an implementation network is crucial. Many

researchers focus on strengths and weaknesses of Dar's water and sanitation policies in their implementation process but don't analyse how related interventions affect water and sanitation equity in a public health perspective. Many vulnerabilities show between water and sanitation equity and health justice, which makes water and sanitation governance out of control easily. But few studies pay attention to those interactions between the governance and health justice in Dar es Salaam, which is the main research gap this dissertation will fill in. Two significances of filling this gap are listed as follow:

- Filling the gap can help to have an evaluation system for Dar es Salaam's water and sanitation policies and set a baseline for their implementation, precisely monitoring and controlling the process to achieve water and sanitation equity.
- Filling the gap benefits the conceptualization of health justice and its application to specific cases, which forms a systemic framework with multiple disciplines for future homogeneous study and the practice.

3. Analytical Framework

The dissertation will draw health justice as a key concept for the analytical framework. Justice is not only the final mission of public health but also a vital organising principle for public health resource management (Gostin and Powers, 2006). At first, health justice is an approach for using related policies and laws to minimize health disparities, which many academic discussions focus on policy implications (Marchand, 1998). With urbanization, urban health is a new proposed concept enriching the notion of health, which highlights the significance of the urban environment to health and wellbeing of urban dwellers (Vlahov and Galea, 2003). The urban environment consists of the natural environment and the built environment, combining different public health functions to achieve health justice. Resnik and Roman (2007) raise a variety of urban environmental causes of health inequalities, including physical, social, cultural, economic and legal perspectives of living environment, and highlight the relationship between justice and health inequalities, noting the main concerns in this relationship is distributive justice of social benefits and procedural justice of social policies in urban planning. Social justice to public health is significant and its achievement will balance individual and collective interests and lay a solid social foundation for just health policy implementation especially for those policies serving the disadvantaged groups in the urban cities (Gostin and Powers, 2006; West, 2007). Social determinants of health (SDOH), an approach of urban planning, provides all kinds of aspects from individuals to the whole society for repairing social systematic disadvantages to achieve health justice,

indicating the demand of social justice to public health is more than fair distribution of healthcare resources in emergencies and a short term (Gostin and Powers, 2006). Urban planning, the practical tool of policy implementation, affects the urban outcomes directly and its justice will reorient the way to health justice. Based on the above analysis, to achieve health justice, environmental, social, and planning determinants are involved and the justice of them is affected in the process and becomes the dominant part to reflect and evaluate the situation of health justice. To address the research question of this dissertation, the analysis of health justice for water and sanitation governance in Dar es Salaam will have the discussion from environmental justice, social justice and planning justice to answer how the governance affects health justice in a dynamic process. The content for analysing from three main aspects is listed as follow:

- Environmental justice: It refers to distributing resources and building access to all kinds of urban services equally for every social group and sector to avoid environmental hazards and disadvantages (Frohlich and Abel, 2014). The balance of living environmental risks and benefits to improved water and sanitation for different groups between before and after the governance is a focus in the analysis.
- Social justice: The relationship coordination between different communities and stakeholders is the main task of social justice. Through Dar's water and sanitation governance, changes of all kinds of relationships to affect water and sanitation equity will be analysed.
- Planning justice: It is a practical perspective and highly relates to the policy implementation process. Spatial planning is the key part of achieving planning justice. It's essential to analyse changes in the decision-making process and how spatial planning affects access to improved water and sanitation under Dar's governance.

4. Methods

Literature review and case study are adopted as research methods in this dissertation. In previous parts, through collecting academic materials from professional journals, academic books and official websites, literature review provides important findings about Dar es Salaam's water and sanitation and helps to give a way for critical thinking, laying a solid foundation for case study. In the next part, three cases selected from published research reports will be analysed and discussed by the analytical framework to explore the answer of

the research question that is how current Dar's water and sanitation governance affect health justice.

Kombo (Ilala Municipality), Keko Machungwa (Temeke Municipality) and Tandale Slum are three case study sites of Dar es Salaam. The focus of each case analysis is different and reflects characteristics of different stages in the governance process. The case of Kombo focuses on the significant shift from policy-driven to needs-driven for water and sanitation service provision. The second case discusses community-based water and sanitation service management in Keko Machungwa, an informal settlement. The third case analyses the health impact assessment of water and sanitation governance serving children, adolescents and women in Tandale Slum, an area with severe urban poverty. Based on the secondary data and existing findings in field works, the analysis and discussion of these three cases will be reliable and effective, which can have the significance for reference in the future.

5. Case Analysis and Discussion

5.1 Case of Kombo

Kombo is in Ilala Municipality and Vingunguti Ward, located in the northeast of Dar es Salaam. It's one of the areas with the highest population density. As a designated industrial area, Vingunguti Ward developed many industries to boost the local economy and provided more employment opportunities in the 1970s, which attracted migrants to settle down. More migrants need more settlements to live and more land to support the provision of urban services such as water, sanitation and healthcare services. As one of the most rapidly-developing settlements, Kombo serves over 20% of the Vingungiti Ward's population and now faces the main challenge of resource distribution. Separated by the main roads, Kombo is formed by two parts, "Kombo Chini" and "Kombo Juu", respectively characterised by a low lying location's proximity to oxidation ponds and the upper area with less available land (Kombe et al., 2015).

Due to the long-term industrial pollution and the planning limited by the area's geographical features, water and sanitation services are complained most among all kinds of living conditions by residents, especially the low-income group. Water and sanitation provision in Kombo is mainly need-driven, which is different from the policy-driven practice in other peri-urban areas of Dar es Salaam (Kombe et al., 2015). The biggest problem brought by the need-driven practice is poor affordability and the other related problems concern the

financial shortage and insufficient coordination. To address these problems in the need-driven practice, the water and sanitation reform in Kombo was continuously conducted in the past decade. Because of the piped water supply intermittent in lower lying locations, residents depended on boreholes to access water despite its poor quality for drinking (Kombe et al., 2015). For boreholes operating, three systems were necessary to be set for better management, which were responsible for community institution management, community practice and private individuals. At present, Federation of the Urban Poor and community water committees are the main systems in Kombo's water supply and the communal involvement for private individuals is lacking. Kombo combined water and sanitation improvement, integrating improved toilets with wastewater treatment and water supply systems, which reduced water and sanitation infrastructure investment costs but still found 85% of residents use traditional pit latrines (Kombe et al., 2015). With local community participation, the Centre for Community Initiatives (CCI) had a pilot sewerage system with the innovative simplified and cost-effective technology in Kombo to serve more households accessing improved sanitation at home.

5.1.1 Environmental Justice

The need-driven practice of water and sanitation in Kombo has a great impact on environmental justice, which provides multiple ways to decrease inequalities of the resource distribution that is contributed by the living environment but still has some shortcomings. Different from those areas with the policy-driven practice, the demand of water and sanitation in Kombo is more urgent and under demographic and historical complexities. The heritage of historical industry development and the migrant wave make the living environment disadvantaged for health and lack the priority position in urban planning contributing to limited access to community empowerment and voice expression. Most industry factories built in the 1970s are located in the higher locations and over years without the refreshment of infrastructure and updating the wastewater treatment technology, water with industrial contaminants flow to those lower lying areas where the majority of settlements and housing are located, which increases the risk of cholera outbreaks and water-washed diseases. After the 2000s, with the industry development center moving to the south, more and more industry factories were abandoned in Kombo. Without the demolition from the government instruction, these factories occupy much land and lower the efficiency of the land use. The number of migrants is out of accomodation capacity of Kombo and all kinds of resources are overstretched especially available land for housing. In the past, migrants acquired land in Kombo by purchasing but now most of them are tenants. Those housing for renting has limited access to improved water and sanitation and is not easy to regenerate

facilities by tenants because of poor housing quality, high cost and limited affordability. Now Kombo has a small-scale economy and the main source of employment is petty trading, which limits local residents' income even resulting in the unaffordability of basic water and sanitation services. There is a big gap between water and sanitation service needs and these services' accessibility and affordability for the low-income group living in the poor environment and the need-driven practice can exactly provide the efficient short-term solutions to mitigate the latency of the policy-driven practice.

In the need-driven practice of Kombo, expanding the coverage of water and sanitation service provision is the focus to fix poor services and low coverage of DAWASCO piped water supply systems and sewerage systems, in which those who live in lower housing areas can have equal opportunities to access safe water and sanitation services. At the same time, the flexibility of resource mobility becomes higher because of integrated water and sanitation improvements. We can tell the practice in Kombo not only ensures sufficient water and sanitation resources for provision but also concerns those related physical conditions for the service delivery in the built environment, which can decrease distributive inequalities. However, through such need-driven practice to achieve health justice, it will have limitations in the long-term consideration. Some water and sanitation services provided by private sectors in Kombo are used for income generation and its provision will be affected by the market, which is difficult to keep high service quality and remains vertical disparities in different groups. Water and sanitation services are public products and health is the public benefit. From the long-term perspective, without the public policy regulation, health justice can't be achieved rootly under the need-driven practice.

5.1.2 Social Justice

Multiple partnerships participate in the water and sanitation practice of Kombo, rebuilding social relationships working for water and sanitation equity. Access to safe water and sanitation is a human right to ensure public health in urban life but disadvantaged groups always face difficulties to have it. In Kombo, Federation of the Urban Poor and community water committees play key roles in water supply community-managed systems, maily coping with the boreholes operating. Federation of the Urban Poor supports the work of community water committees and contributes to protect the public interest of the poor. Community water committees are established at the government level and its members are from local communities, therefore it can gather community resources easily and has the social cohesion to achieve cooperation with local authorities.

Water from boreholes is the dominant substitute of piped water in Kombo to address basic water needs of those whose households suffer unreliable water supply. The price of borehole water depends on two aspects. On the one hand, different boreholes are financed by different stakeholders and the charge of them are different. Those financed by private individuals have higher charge fees than the public ones. On the other hand, the distance of water transport and the amount of water affect the price directly. For the convenience of water transport, most boreholes are located in the center of Kombo. Poor housing areas are in the fringe, far from the center locations. And the average number of poor household members is six and the water consumption of these households are higher than the others (Kombe et al., 2015). Therefore, in most cases the urban poor can't pay for water services and some private individuals refuse to provide services for them, which consumers and service providers can't trust each other. The involvement of the Federation of the Urban Poor and community water committees tries to address this trust problem through negotiation and ease the tense social relationship between the poor and those social groups with local power, which can decrease the social discriminatnion and expand the access to all kinds of potential services beneficial to poor people's health. At the same time, the internal social arrangements are reorienting to make more poor people access public resources for social equity.

5.1.3 Planning Justice

With the integrated water and sanitation improvement, the efficiency of the land use in Kombo is the biggest consideration in urban planning. To build more water and sanitation infrastructures around settlements for improving living conditions, available land is required. But now most residents in Kombo are tenants. To acquire the land, the government not only needs to gain the permission of the landholders but also should communicate with tenants to ask for their aspirations and protect their interests and rights for better living, which increases challenges for planning. Most land with tenancy is used for housing in Kombo. Many disadvantaged living conditions resulting in poor health outcomes in Kombo relate to housing planning. Good water and sanitation planning can improve the functions of housing and maximize the land value for the better built environment. Through accessing land for public facilities, the need-driven practice in Kombo combines water and sanitation improvement to achieve an integrated provision system, which improves the efficiency of the land use and decreases the spatial injustice. Besides, Kombo's water and sanitation planning updates informal settlement areas, gradually making these areas transform to peri-urban and urban areas, in this case all kinds of inequalities resulting from unbalanced urban development and insufficient urban planning can be diminished. Based on the

need-driven practice, contextualised needs of water and sanitation are concerned in Kombo's urban planning. In the early stage of water and sanitation planning, the evaluation of contextualised needs is essential to ensure the adequacy of facilities especially in those areas with social complexity like Kombo, which can collect voices from different groups to affect the decision-making process.

5.2 Case of Keko Machungwa

Keko Machungwa is an informal settlement in Temeke Municipal of Dar es Salaam. The content of this case is the involvement of community groups in water management projects. Although water issues are the focus in the case, it also highly relates to sanitation problems, which is representative for analysis to reflect Dar es Salaam's local water and sanitation governance. Keko Machungwa faces severe water problems. Without water network systems provided by DAWASA, communities in Keko Machungwa have to use water from unreliable and unsafe sources, which can't meet households' daily needs and causes the prevalence of waterborne diseases. A study conducted by the Centre for Community Initiatives (CCI) in 2011 revealed the biggest challenge for sustainable development of Keko Machungwa in a decade was how to access clean and safe water, which makes community groups realise the importance of water issues and initiative a water project with CCI and Jenga Fund (Tanzania Urban Poor Federation TUPF, 2014).

In the preparation of the project, a community-led investigation was through enumeration and mapping to help local officials know the situation of water and sanitation in Keko Machungwa and existing community resources that can be used for urgent issues addressing and future planning (TUPF, 2014). Finance is significant in the project's implementation. Jenga Fund, known as Urban Poor Fund, gave loans to community groups to launch the project and have the capacity for leverage finance (TUPF, 2014). Supported by Jenga Fund, communities integrated electricity systems for pumping water to facilitate the physical conditions for the project.

The project started in 2012 and would continue for 8 years (TUPF, 2014). In the implementation of the project, community participation was crucial in the process. Keko Machungwa had 6 community groups with a total of 200 people, including youth and women groups (TUPF, 2014). Community groups did savings and loans and financed efficiently to mobilise more and more communities to join this water and sanitation development agenda. Community members participated in training provided by CCI, gaining the knowledge of related managed skills. In the daily practice, members helped to dig trench for laying pipes and they would also get labour charges (TUPF, 2014). Community data were collected,

analysed and documented in the whole process. And finance reports were presented by the community committee on weekly meetings to ensure everyone was aware of it. Due to multiple water providers, the market was competitive and managing competitors became a challenge for the community. The engagement of the local government was at a low level and the main role that the government played was monitoring.

5.2.1 Environmental Justice

Based on communities, resource management in Keko Machungwa becomes sufficient and health inequalities resulting from unfair distribution become less. Before the project, it's difficult for households to access safe and sufficient water for addressing domestic needs. Keko Machungwa is far from Dar es Salaam's city center and lacks the connection with the DAWASA water network system, thus residents have to access water from different unreliable sources. Some water sources like boreholes are nearby toilets and water from them is dirty and polluted. But without monitoring of water quality, some vendors still sell them to residents for income generation, which those living far from water sources and lacking time for on-the-spot water fetching will have the high risk of getting poor water.

After the project, with the participation of the community members, the process of water supply is transparent. Communities appoint water points for selling and collecting and several community members are responsible for one water point, managing time to avoid queue waiting and organizing related service resources such as push carts for water transport. Residents can gain more information to decide what time and where to get water, which helps to save time and ensure the quality of community services. Keko Machungwa's project to affect environmental justice is through improving the flexibility of service provision and the efficiency of resource use from a software perspective rather than changing physical conditions in the environment from a hardware perspective, which makes every community member have easy access to water services in the living environment. At the same time, a limitation of the project is obvious. Without physical environment improvement, relying on service management to decrease environmental inequalities is not a sustainable way. Making bricks without straw is impossible, thus the good physical environment is the foundation of improved water and sanitation and it can't be neglected in the process of achieving environmental justice.

5.2.2 Social Justice

Community water project in Keko Machungwa ensures equal opportunities of participation for everyone. A community needs to keep the balance between individual interests and

collective interests to achieve equity, which mobilising the whole community members and groups to achieve one goal is the best way for it. A success of community participation not only needs determination and group cohesion but also requires related skills and capacity for feasible solutions and scientific management. In Keko Machungwa's communities, groups and members don't have the experience of water management before and they lack essential skills to cope with all kinds of problems in the participation. Therefore, the training from CCI is crucial for community groups and members to make them catch the opportunity and be qualified to participate in accessing water rights.

In the project, voices from communities are dominant and powerful. The government and other public sectors dominate water and sanitation services to ensure their functions serve the public health as much as possible. In most cases, such a top-down approach overlooks voices from powerless social groups such as the poor, the disable and the politically marginalized, which neglects potential problems in local communities and contributes to many failures of local interventions. In the practice of Keko Machungwa, the government is not in the dominant position and has the cooperation with communities to support them, empowering communities to self-manage. We can notice that youth and women play important roles in the practice, which is different from the past situation where their power is underestimated and their voices are ignored. The shift from top-down to bottom-up also has a great impact on community internal arrangements and relationships in Keko Machungwa. All community activities related to the water project are well-documented and reported to the public. In this process, all community members and groups need to monitor themselves and each other to ensure good social outcomes, which requires to build close and deep relationships and have trust with each other to avoid conflicts and ensure a transparent and justice process. At the same time, the credibility of the community committee is acknowledged by the public to avoid discrimination and bureaucracy, which ensures no more social inequalities in the implementation.

5.2.3 Planning Justice

The land planning for this water project has limitations. Keko Machungwa is an informal settlement and available land for water and sanitation infrastructure and service delivery planning is limited. The living environment around most households has limited spaces and lacks proper spatial planning for addressing other living needs besides housing. Land resources that Keko Machungwa's communities can access to plan for the water project are volunteered. Without the legal enforcement of land provision from the government, it's difficult for communities to make an agreement on land planning with landholders and here shows a great conflict between individual and public interests. Although communities gain a

few land resources in the end, limited and distributed land can't build an integrated water and sanitation provision system in Keko Machungwa, contributing to the failure of service delivery to end users. That's also why Keko Machungwa's communities don't focus on improving the physical environment for water and sanitation.

In terms of the decision-making process, regular meetings ensure that everyone in communities has the right to express their opinions and through voting to make the final decision. Based on weekly community records, strengths and weaknesses in the practice are clear for discussion and communities can make adjustments promptly. Finance management is the focus in Keko Machungwa's decision-making process. To ensure sufficient finance in the planning, communities try to save the cost and get income generation, which every financial activity is listed in the report for monitoring and evaluating. And the participation of multiple stakeholders also helps to monitor the process and improve its transparency to achieve justice.

5.3 Case of Tandale Slum

The prevalence of slums is high in Dar es Salaam and it brings a lot of problems concerning public health affecting vulnerable groups most. These problems worsen over years, which sets challenges for urban planning. Tandale is one of the slums in Dar es Salaam and over 65% of the population is children, adolescents and women (United States Agency for International Development USAID, 2019). Poverty is the dominant characteristic of slums and with the high percentage of vulnerable groups, the economic capacity of Tandale slum becomes much worse. Most residents migrate to Tandale from rural areas through social connections with acquaintances who are from the same ethnic background, therefore ethnicity is a very important social factor in Tandale slum communities (USAID, 2019). As the formation of Tandale has a solid ethnic foundation, slum upgrading may not be entirely good for communities because it would break the internal social networks and worsen community vulnerabilities, which is also the biggest concern and challenge in the official planning.

This case focuses on the assessment of water, sanitation and hygiene (WASH) serving children, adolescents and women in Tandale slum. WASH in Tandale greatly impacts the nutrition status of children and adolescents and maternal services. Assessment is a crucial part in the water and sanitation governance and it's also a good result-oriented approach to improve interventions. Directing at vulnerable groups, water and sanitation governance in Tandale faces social complexities and through building an assessment system the local governance finds determinants to control and evaluates how controlled interventions have impacts on environmental, social and planning justice to achieve health justice. Those

aspects for the assessment include cost of water, sanitation facility provision, waste drainage services, access to healthcare services and social behavior education (USAID, 2019).

5.3.1 Environmental Justice

The poor quality of drinking water is a big problem in Tandale. Many households in Tandale treat drinking water by boiling and separating the buckets of drinking water with other utensils to avoid water contamination (USAID, 2019). However, such rough ways can't improve the water quality rootly and children with weak immunity easily get diarrhea and infection that destroys digestive system and contributes to malnutrition even the high mortality of the under-five. Children face the high risk of suffering poor health outcomes but have limited access to healthcare services. In most cases, children can't get emergency medical treatment in time and cause the worst results. Compared with neighborhood areas, Tandale has fewer clinics and even no specialised children's medication centers are provided. Accessing public clinics' services in Tandale requires waiting a long time although the price is low. Therefore, parents avoid taking their children to public clinics to get treatments unless the emergency situation happens. Tandale's private clinics are more than public ones and their services are more efficient, but service prices are so high that most households can't afford them. We can see the service delivery in local governance falls in the tricky situation, which causes insufficient service provision around the living environment and worsens health inequalities.

Besides children's healthcare services, pregnancy health service provision faces the same problem but even worse. The health status of the new-born is highly related to maternal status. Poor water and sanitation bring terrible health outcomes to pregnant women in Tandale. In terms of physical health, women's nutrition status is affected and the morbidity of transmission diseases is high such as HIV, which accumulates risks of giving birth. And traditional pit latrine is the most common type of sanitation facilities in Tandale and its design is not friendly for pregnant women using. No sanitation facilities are equipped for pregnant women in their living environment. In terms of mental health, violence and sexual harassment happen to pregnant women when they use public sanitation fancilities, which hurts their dignity and brings negative phycological effects. The pregnancy health service in Tandale is essential for addressing women's vulnerabilities in the living environment but the quality of its provision is still at a low level without comprehensive considerations of health outcomes from poor water and sanitation.

5.3.2 Social Justice

In the assessment, affordability is the key concern of water and sanitation services in Tandale, which is highly related to employment and income. There are limited employment opportunities in Tandale and most residents are unemployed. The local economy relies on informal entrepreneurial activities and most unemployed people earn low incomes through it (USAID, 2019). Monthly costs on basic services in the slum are over most residents' income. To be able to survive, some people even participate in risky activities such as prostitution (USAID, 2019). In fact, the price of water and sanitation services in Tandale is much lower than the average level of Dar es Salaam but it is still out of slum dwellers' affordability. Low affordability blocks access to improved water and sanitation, limiting possible investments and cooperation from multiple stakeholders to offer better services. Therefore, developing the local economy and creating more employment opportunities are the priorities in Tandale slum to minimize social disparities to access equal water and sanitation services.

The participation of different stakeholders is a good perspective to reflect and assess the equity of water and sanitation services. The assessment of Tandale focuses on the health interests of children, adolescents and women. These vulnerable groups are constantly concerned by the whole society and all of them have social organizations that can help to protect their social rights, express their voices and have proposals beneficial to their interests. We can see these organizations like Tandale Youth Development Center (TYDC) and Tanzania Media Women's Association (TAMWA) have good cooperation with public sectors and other social stakeholders to get rights and interests of water and sanitation for vulnerable groups, which is also a moderated way for upgrading Tandale slum to avoid to break its internal strong social networks that are based on ethnicity.

5.3.3 Planning Justice

In the assessment of the aspect of access to healthcare services, the official planning tries to integrate formal and informal service systems to decrease health risks of poor water and sanitation for vulnerable groups. In Tandale, most existing healthcare services are informal and highly rely on communities and neighborhoods, which can serve to regulate health behaviors and support health education to prevent diseases. Formal healthcare systems are good at providing more professional medical services for disease treatment, decreasing the risk of physical damage. Although there are service differences between formal and informal systems, the integration of them greatly addresses the healthcare service gap to achieve planning justice.

Another issue that affects the slum planning justice is the involvement of dwellers in the decision-making process. The quality of involvement has two aspects for assessment. One is what people discuss most, the other is what way is effient to get information. Those ideas slum dwellers express most are about problems, challenges and their expectations of water and sanitation services but few opinions are about solutions, which shows that dwellers don't fully participate in the planning process and the final decisions are basically made by the local officials (USAID, 2019). Limited by the poor education and few practical experience, it's reasonable that dwellers fail to give ideas for intervention implementation. Thus community education in the planning process is essential to inspire dwellers to use their rights effectively. Besides, different communication platforms show different levels of dwellers' involvement. In official meetings, such as those held by the government and other official key informants, dwellers show low involvement. In contrast, community interviews held by NGOs can have a heated discussion and gain lots of information from dwellers easily (USAID, 2019). Therefore, creating diverse and right platforms for dwellers' expression is required to achieve planning justice for water and sanitation in the slum.

6. Conclusions and Recommendations

Water and sanitation equity has great significance for urban health in Dar es Salaam. Every health impact contributed by water and sanitation will trigger more than one vulnerability in the urban city. And because Dar es Salaam is experiencing insufficient urbanization, those triggered vulnerabilities will be more complicated under interactions of different social determinants. Therefore, the process of seeking routes to water and sanitation equity to achieve health justice in Dar es Salaam is full of challenges and has a deep dynamic relationship with urban development.

Routes to water and sanitation equity in Dar es Salaam are not immutable. They are reoriented based on the local situation over time. Also, it's not possible for them to just focus on one aspect to achieve health justice. The integration of all urban services is the final way for water and sanitation governance to have its equity and the only concern is how to integrate them efficiently and effectively.

Based on the literature reviews and case studies, the research question, namely how the current water and sanitation governance of Dar es Salaam affects health justice, can be addressed clearly. In general, the current water and sanitation governance has double-edged effects on health justice in Dar es Salaam but the positive effect is over the

negative one, which means that some progress is made in past decades although it happens at a low speed. Analysing from three ways, environmental justice, social justice and planning justice, which can serve to achieve health justice, several key issues in the implementation are raised as follows and some recommendations are attached for the future governance.

First, environmental justice is easily affected by changing physical conditions, which is the most effective perspective that can see governance outcomes in a short time. Setting a baseline of it is a good way to track and evaluate the process of daily practice, adjusting interventions in time to address health needs. At the same time, the cost of water and sanitation environmental improvement is the highest one and before implementation sufficient investigations are essential for making interventions cost effective.

Second, social justice is slowly affected in the long-term implementation of interventions. Internal social relationships such as public-private cooperation can be changed once the governance happens, but expected outcomes and the implications will show after a long time, which is difficult to identify problems and faces the latency of moderated actions and policies. Thus this process will take a lot of time and face much social pressure. Social justice is through enriching and strengthening urban rights of water and sanitation to achieve health justice, which faces lots of social conflicts that exist for a long time. Water and sanitation are essential services to health in the urban daily life and it's not realistic to devote much time to look forward to long-term outcomes, although the achievement of social justice can rootly access water and sanitation equity. To support the process of social justice, having the evaluation of existing policies before interventions and relying on a policy foundation to propose solutions can help to ease tense relationships among different stakeholders and inspire to reorient policies to improve the efficiency.

Third, planning justice is the practice perspective and is directly affected by the governance through the whole process. This aspect is the most effective one that brings the most advantages to health justice, especially the improvement of decision-making process which ensures everyone has the right of participation. Urban planning is a dynamic and active process and its flexibility is advantaged for upgrading water and sanitation services in informal settlements of Dar es Salaam. In the next step, systematic and integrated planning connecting water and sanitation services in the peri-urban areas is required to decrease spatial inequalities for health justice.

In the future, water and sanitation will still be a global concern and its sustainable development is a long-term goal in urbanization. Dar es Salaam is a good case to reflect water and sanitation problems and challenges of peri-urban areas and support theoretical

work for research, which similar areas can draw it for reference but do not follow its interventions totally. The secret for good water and sanitation governance is based on the local situation. With more and more practical experience, global water and sanitation governance gradually have a standardized formula, but it is unwise to limit ways for future governance. Keeping the diversity and flexibility of the governance can inspire more routes to water and sanitation equity.

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