

SUSTAINABLE SANITATION FOR SMALL ISLAND CITIES

Analyzing the challenges and critical success factors for
Tanjungpinang and Batam to attain sustainable sanitation



Novi Asti Lalasati – S4708717
Supervisor: Prof. Dr. Ronald L. Holzacker

Groningen, 2022

Acknowledgements

The presented document has been written to finalize my Master Study: 'Environmental and Infrastructure Planning' at the Faculty of Spatial Sciences; University of Groningen. I received my undergraduate degree in environmental geography at the Faculty of Geography; Universitas Gadjah Mada (Indonesia). I would like to express my profound gratitude to the Indonesian Endowment Fund for Education (LPDP) - Ministry of Finance of the Republic of Indonesia for providing me with a scholarship to study a master's degree in Groningen. Throughout my whole year of study, I obtained invaluable knowledge and established lifelong friends.

This Master Thesis focuses on Water and Sanitation (SDGs 6), which water is one of the three main subjects of the Master. Water has always been one of my primary interests, therefore selecting a water-related topic for my Master's thesis was not difficult. With the increasing uncertainties caused by climate change, the development of small islands, global water crisis, and the interconnectedness of people and their environments. I believe that sanitation is a highly important and pertinent topic for the development of urban areas as well as the livability of small island and coastal communities.

I would want to thank my supervisor, Ronald Holzacker, for leading me through this difficult process in a constructive and motivated manner. In addition, I appreciate the time and effort put in by my interviewees and the institutions they represent to help me gain a deeper understanding of the challenges and opportunities inherent in the development and management of sanitation (basic infrastructure) in Batam and Tanjungpinang. Last but not least, I would like to express my gratitude to all of my friends and family members who have been there for me during my study, particularly throughout my Master's Thesis.

I hope you find this Thesis to be a pleasurable and informative read.

Novi Asti Lalasati,
August 2022, Groningen.

Abstract

Providing safe, affordable, and functional water and sanitation systems that are also sustainable is a challenging task for cities of all sizes. However, small island cities are more vulnerable to the effects of climate change and water scarcity. Geographical constraints, sociodemographic characteristics, financial concerns, and institutional capacities all contribute to the achievement of Sustainable Development Goals (SDGs) 6: 'Clean Water and Sanitation'. This research, using the Indonesian cities of Tanjungpinang and Batam as case studies, reviews challenges associated with providing sanitation systems in urban small islands through a place-based approach and a multi-level governance approach.

Academic literature on small islands was used to describe the physical environment as well as the social characteristics of the islands. Interviews and data provided by the regional planning board were analyzed to evaluate water governance practices that capture economic and institutional challenges. The research concludes that economic, environmental, and human resources, as well as reformed administrative and legislative systems, are essential for achieving an effective water governance system. In addition, sustainable sanitation in small island cities provides a broad range of place-based approaches. Nevertheless, the lack of stakeholders and regulatory integration to manage water and sanitation, is both the greatest issue and the area where we can do the most feasible intervention in order to achieve SDGs 6: to ensure availability and sustainable management of water and sanitation for all.

Keywords: sanitation, water, sustainable, small islands.

List of Contents

- Abstract** 2
- List of Contents**..... 3
- List of Tables**..... 5
- List of Figures** 5
- List of Abbreviations**..... 6

- Chapter 1 Introduction**..... 8
 - 1.1. Research Background 8
 - 1.2. Research Objective and Questions 9
 - 1.3. Scientific and Social Significance of Research..... 10
 - 1.4. Thesis Outline 12

- Chapter 2 Methodology**..... 13
 - 2.1. Unit of Analysis..... 13
 - 2.1.1. Province of Riau Islands (Kepri) 13
 - 2.1.2. Kota Tanjungpinang 15
 - 2.1.3. Kota Batam..... 15
 - 2.2. Research Approach and Design 16
 - 2.3 Data Collection 18
 - 2.3.1. Document Review 19
 - 2.3.2. Semi-structured Interview..... 22
 - 2.4. Data Analysis 24
 - 2.5. Ethical Considerations 26

- Chapter 3 Theoretical Framework** 27
 - 3.1. Urban Planning and Sanitation 27
 - 3.2. Current Sanitation Challenges 28
 - 3.2.1. Inadequate and Dysfunctional System of Sanitation 29
 - 3.2.2. Lack of Attention: No One Talk about *Shit* 30
 - 3.2.3. Less Popular than Water, Less Political Will 31
 - 3.2.4. Low Willingness to Pay and Lack of Investment..... 32
 - 3.3. Concept of Sustainable Sanitation 33
 - 3.4. Spatial Context and Place-based Approach..... 34

3.4.1. Spatial Context: Biophysical Characteristic of Small Islands	35
3.4.2. Spatial Context: Sanitation Issue on Small Islands	36
3.5. Water (and Sanitation) Governance.....	37
3.5.1. Multi-level Governance	38
3.5.2. Actor Mapping and Power Analysis	39
3.6. Technical Details Regarding the Sanitation System	41
3.7. Conceptual Model	43
Chapter 4: An Overview of the Sanitation Situation in Kepri from National Standpoint.....	45
4.1. Current Situation: Ongoing Open Defecation Practice	45
4.2. National Target: From “Improved” to “Safely Managed” Sanitation	50
4.2. PPSP: An Established Program that has not reached the Goal	52
Chapter 5 Sanitation Development in Tanjungpinang and Batam.....	55
5.1. Behind the Statistics: How Challenging is it to Achieve Sustainable Sanitation?	55
5.1.1. Geography of Sanitation Inequality: Small vs Smaller Islands	58
5.1.2. Does ‘shit’ get accepted differently in different places?	62
5.1.3. Considering the Regulation, Distributing the Role	65
5.1.4. Dilemmas of Sanitation Investment	67
5.2. Taking a Look at Targets, Plans, and Outcomes.....	69
5.3. Beyond Standard Stakeholders	72
Chapter 6 Conclusion and Reflection.....	74
6.1. Conclusion	74
6.2. Reflection	76
References.....	77
Appendix 1. Interview Guide.....	87
Appendix 2. List of Questions.....	89
Appendix 3. Percentage of Households by Province Having Access to Improved Sanitation	91
Appendix 4. Percentage of Households with Access to Improved Sanitation by Regency/City in Kepri.....	93
Appendix 5. Exemplification of the Citation and Document Review Analysis	94
Appendix 6. List of Key Insights derived from Numerous Interview Transcripts	98

List of Tables

Table 1. List of Regulation and Policy Documents 19

Table 2. List of Interviewees 24

Table 3. Research Deductive Coding 25

Table 4. List of actors encountered in Water and Sanitation Governance and Program 40

Table 5. Comparison of Sewage Disposal System Types 42

Table 6. GDP and Open Defecation Index of Indonesian Provinces 49

Table 7. Profile of Domestic Wastewater Management in Tanjungpinang (Gap Rates) 57

Table 8. Profile of Domestic Wastewater Management in Batam (Gap Rates) 57

Table 9. A Summary of Sanitation Target, Plan, and Outcomes of National and Local Government 71

Table 10. Stakeholders of Wastewater Management in Batam 72

Table 11. Stakeholders of Wastewater Management in Tanjungpinang 73

List of Figures

Figure 1. Maps of Kepri 14

Figure 2. Step-by-step Research Approach 17

Figure 3. Qualitative Research Data Analysis Steps 25

Figure 4. Four Aspects of Sustainable Sanitation 34

Figure 5. Water Governance Principles 38

Figure 6. Illustration of Communal (Off Site) Sewage Disposal 43

Figure 7. Conceptual model 43

Figure 8. Sanitation Access Criteria in Indonesia 46

Figure 9. Indonesia Open Defecation Index in 2021 47

Figure 10. Percentage of Households by Province Having Access to Improved Sanitation 2021 51

Figure 11. National Streamlines of AMPL and PKP Working Group for the PPSP program ... 53

Figure 12. Percentage of Households with Access to Improved Sanitation by Regency/City in Kepri 56

Figure 13. Map of the Domestic Wastewater Sanitation Risk Area in Tanjungpinang City 2021 59

Figure 14. Batam City Imagery 59

Figure 15. Map of the Domestic Wastewater Sanitation Risk Area in Batam City 2020 62

Figure 16. Map of Free Trade Zone Area in Batam 67

List of Abbreviations

AMPL	<i>Kelompok Kerja Air Minum dan Penyehatan</i> Water Supply and Sanitation Working Group
BAPPENAS	<i>Badan Perencanaan Pembangunan Nasional</i> National Development Planning Board
BAPPEDA	<i>Badan Perencanaan Pembangunan, Penelitian dan Pengembangan Daerah</i> (Regional Development Planning and Research Board, Tanjungpinang)
BAPPELITBANGDA	<i>Badan Perencanaan dan Penelitian Pengembangan Pembangunan Daerah</i> (Regional Development Planning and Research Board, Batam)
BP Batam BIFZA	<i>Badan Pengusahaan Batam</i> , known as BIFZA Batam Indonesia Free Zone Authority Agency
BPS	<i>Badan Pusat Statistik</i> Central Bureau of Statistics
BPPW	<i>Balai Prasarana Permukiman Wilayah</i> Regional Board for Settlement Infrastructure (under the Ministry of Public Works and Housing)
DOH	Department of Health
DOE	Department of Environment
DPWSP	Department of Public Works and Spatial Planning
DHSP	Department of Housing, Settlements, and Parks
EEZ	Exclusive Economic Zone
FSTP	Faecal Sludge Treatment Plant
KEPRI	<i>Kepulauan Riau (Kepri)</i> Province of Riau Islands
MDGs	Millenium Development Goal(s)
MOF	Ministry of Finance
MOH	Ministry of Health
MPWH	Ministry of Public Works and Housing
NAWASIS	National Water and Sanitation Information Services
NGO	Non-Governmental Organization
PDAM	<i>Perusahaan Daerah Air Minum</i> Local drinking water supply enterprise
PKP	<i>Kelompok Kerja Perumahan dan Kawasan Permukiman</i> Housing and Settlement Area Working Group
PPSP	<i>Percepatan Pembangunan Sanitasi Permukiman</i> Acceleration of Residential Sanitation Development Program

POKJA	<i>Kelompok Kerja</i> Working Group
RPJMN	<i>Rencana Pembangunan Jangka Menengah Nasional</i> National Medium-Term Development Plan
RPJMD	<i>Rencana Pembangunan Jangka Menengah Daerah</i> Regional/Local Medium-Term Development Plan
SIDS	Small Island Developing State
SUSANA	The International Advocacy Network Sustainable Sanitation Alliance
SDGs	Sustainable Developments Goal(s)
UPTD	<i>Unit Pelaksana Teknis Daerah</i> Regional Technical Implementation Unit)
UU	<i>Undang-undang</i> (National) Law
WaSH	Water, Sanitation, and Hygiene
WatSan	Water and Sanitation
WWTP	Waste-water treatment plant

Chapter 1 Introduction

1.1. Research Background

Among seventeen United Nations Sustainable Development Goals, SDG 6 focuses on water, sanitation, and hygiene (WaSH). SDG 6 was developed in recognition of the fact that access to clean, properly managed water, sanitation, and hygiene are essential interventions for primary health concerns and could reduce global disease burdens by about ten percent (Cameron, Hunter, Jagals, & Pond, 2011). Despite the wide-ranging positive implications that improved sanitation can have on social, economic, and environmental development, it continues to receive a disproportionately small amount of attention. I contend that if inadequate sanitation conditions exist along the so-called "service chain" (that is, containment, transit, treatment, reuse, and disposal), they act as a barrier to the accomplishment of many other goals related to sustainable development. Inadequate sanitation also comes with its own set of inherent societal complications. In areas where sanitation facilities are insufficient, the lack of these amenities frequently reflects patterns of social exclusion of certain groups of people (Rusca et al, 2017).

Indonesia has a population of 153 million in urban areas and 117 million in rural areas (BPS, 2021a). In urban areas, it was estimated that the total amount of wastewater (domestic, commercial, and industrial) and storm water runoff was 14.3 km³/year, although the capacity of municipal wastewater treatment was only 0.3 km³/year (FAO, 2021). The majority of black water is treated in individual or communal septic tanks, while grey water is dumped untreated into water bodies. Domestic wastewater has the potential to contaminate both groundwater and surface water, which can have a negative impact on the overall quality of the water, and more specifically on aquatic life as well (Djuwita et al., 2021). Recent discourse on domestic wastewater in Indonesia has been primarily centred on treatment technology and management (Firdayati et al. 2015; Harahap et al. 2021), yet the critical analysis of its features is still somewhat low. Currently, it is not possible to distinguish between the environmental effects of gray and black water (Widyarani et al., 2022).

In any case, sustainable sanitation is not only related to SDGs target number 6, but also to other points of the SDGs, such as goal number 14 on 'underwater life' and goal number 3 on 'health and well-being'. For instance, the implementation of sustainable sanitation can address the causes of diseases and decrease the probability of sea water contamination (Nisaa, 2021). Thus far, development of small islands has not produced optimal results or resulted in sustainable development (Supriatna, 2007). The high population density and limited available land contribute to the risks of environmental degradation, both of land and marine ecosystems. Environmental concerns on small islands have a significant impact on the availability of safe

drinking water, which is generally classified as scarce (UNOPS, n.d.). This is exacerbated further by the issue of climate change, which requires the government to take complexity and uncertainty into account when formulating policies, including those relating to wastewater management.

According to Budiharjo and Sujarto (1999), the archipelago's development requires a variety of sustainable changes in ideas, thoughts, and approaches. Small islands require a tailored management, given their unique ecological and social characteristics. There are two provinces in Indonesia with the title as 'archipelagos' or *Kepulauan*: the Riau Islands and the Bangka Belitung Islands. The Province Riau Islands or ***Kepri*** (*Kepulauan Riau*) comprises the second-largest cluster of small islands, after Papua, and is strategically located in the Malacca Strait, closely neighbouring Singapore, and Malaysia. Kepri consists of five regencies (rural, *kabupaten*) and two cities (urban, *kota*), which are Tanjungpinang and Batam. These two cities are distinguished by their distinct characteristics; with Tanjungpinang representing the provincial capital and possessing a long history and strong Malay cultural roots, meanwhile Batam is designed as an industrial city with a diverse population and rapid-infrastructure growth (Hutchinson & Negara, 2021).

Kepri is one of only two provinces in the Sumatran Region with "safely managed sanitation" index exceeding the national average (Nawasis, 2021a). However, this province has not yet achieved 100 percent universal access to sanitation; open defecation is still prevalent (Nawasis, 2021b). An assessment of the challenges and efforts made by the government in the cities of Tanjungpinang and Batam can be useful for ensuring the sustainability of sanitation in other small island cities.

1.2. Research Objective and Questions

The sanitation in the Riau Islands exposes a development conundrum characterized by a relatively high number of safe sanitation facilities, yet there's a continued practice of open defecation on the area. For it is essential to explore current challenges and the potential improvement towards more sustainable sanitation in small island cities, this research is aimed at answering the following research question:

“What are the challenges and potential improvements that can be done to promote sustainable sanitation in specific areas, such as small island cities?”

In order to answer this question, the case studies of Tanjungpinang and Batam were selected to illustrate the water and sanitation issues in small island cities. A place-based approach in planning to highlight the unique geographical characteristics of the research area

and a multi-level governance approach to illustrate how national, regional, and local policies may be integrated with the involvement of multiple stakeholders, were taken for analysis. There were, therefore, three sub-questions arranged to answer the primary question, those were:

1. What are the challenges that must be addressed in order to achieve sustainable sanitation in Tanjungpinang and Batam?
2. How can these challenges be addressed by integrated sanitation targets, plans, and outcomes at all levels of government?
3. What role does the local government play in achieving sustainable sanitation?

1.3. Scientific and Social Significance of Research

In the last three decades, many small islands have seen changes in human settlement patterns, socioeconomic, and environmental conditions. On the matter, these alterations may have concealed the consequences of climate change (Nurse et al., 2014). As The World Bank (2022) mentions, small islands are the most vulnerable to climate change. One of the most noticeable effects is water scarcity, for instance, freshwater supply in small island environments has always presented challenges and has been an issue raised in all previous IPCC reports (Nurse et al., 2014). On many small islands rainwater is the main source of water for human consumption (Eras-Almeida & Egado-Aguilera, 2020). On high-elevation volcanic and granitic islands, small and steep river catchments respond quickly to rainfall events, and watersheds typically have limited storage capacity. At the same time, porous limestone and low atoll islands have less 'runoff surface' and water quickly enters the groundwater lens (White and Falkland, 2010).

Rapidly expanding demand, land use change, and population growth pressure limited freshwater reserves in those ecosystems (Emmanuel and Spence, 2009; Cashman et al., 2009; White and Falkland, 2010). The study that is done in relation to the water issues of small islands mainly analyses, from a quantitative point of view, the need of striking a balance between supply and demand. In fact, water quality, specifically groundwater on those cases, has also been neglected. Numerous studies have demonstrated the strong relationship between water and sanitation (Moreno et al., 2020; Usman et al., 2016; Komarulzaman et al., 2016; J. Cameron et al., 2011; Krause, 2010) as seen also on the SDG 6. Nonetheless, there is more empirical evidence on the demand for water services than there is for sanitation services (Krause, 2010). This is supported by the fact that, according to statistics published (recorded on August 5, 2022) on the Google Scholar page between 1982 and 2022 only 39,700 articles

(in English) were retrieved using the keyword "sanitation small islands". In comparison, the number of studies on "freshwater small islands" was 53 times more widespread with over 2 million publications. Aligned with these findings, academic discussion about water on small islands written in Indonesian reach 68,600 articles while sanitation only presents 10,400. Still in the past three decades, a huge discrepancy in water and sanitation research continues.

Research related to 'water' scarcity in the city of Tanjungpinang was carried out by a master student at the Faculty of Spatial Sciences of University of Groningen, in 2021 (Pasaribu, 2021). Perhaps since similar research pertaining to water scarcity has become a popular topic in urban planning practice and education (He et al., 2021). Due to the inseparable link between water and sanitation, this study aims to help narrow the gap on an under-discussed topic, namely sanitation. It is basic infrastructure that must be provided by all cities in order to ensure that human rights are upheld (Bos, 2016). In Indonesia, domestic wastewater is one of the largest contributors to wastewater caused by human activities. Domestic wastewater that is untreated or inadequately treated can reach groundwater and surface water through infiltration, leakage, or direct discharge. The problem of domestic wastewater contamination in the environment, particularly in urban areas, is mostly attributable to inadequate on-site treatment of black water and direct discharge of grey water to water bodies (i.e. river, lake, sea). There is not a single study that has been conducted in Indonesia that reports the factor of wastewater creation that results from the use of clean water based on direct measurements (Widyarani et al., 2022).

A better water management strategy is required to avoid future crises and to ensure that all people have equal access to clean water and proper sanitation at an affordable price, as mandated by SDG 6 (UNDP, 2015). Since Indonesia does not yet have a policy framework underpinning wastewater management on small islands, this research will aim to help develop recommendations that will provide an overview of the need for "distinctive treatment" when implementing sanitation policies and programs on large and small islands. Domestic wastewater management, including water from latrines and non-latrines, is regulated by the Minister of Public Works and Public Housing Regulation 04/2017 on the Implementation of a Domestic Wastewater Management System. The regulation, however, does not elaborate the system, for managing domestic wastewater, on specific ecosystems which results in no foreseen differences for management between continental areas (large islands) and small islands. A small island's carrying capacity is markedly different from that of a large island, and due to the extreme scarcity of water resources on small islands, groundwater is extremely vulnerable to contamination. Furthermore, discharging human waste into the sea endangers marine life and, indirectly, many economic sustainability of the community (Marfai et al., 2018). As the largest

archipelagic province in Indonesia, Kepri can offer a comprehensive perspective on the topic of sustainable sanitation in the small islands.

1.4. Thesis Outline

This thesis is systematically divided into six chapters.

Chapter one is an introduction that includes the background of the research, research objectives and questions, the scientific and social significance of the research, and the thesis outline.

Chapter two describes the methodology applied in this research. This chapter outlines the unit of analysis, research approach and design, data collection method, data analysis method, and ethical considerations.

Chapter three presents the theoretical framework of this research. This chapter proposed a conceptual model that explains the links between spatial context, governance, and institutional arrangements in water and sanitation issues.

Chapter four presents the overview of current situation, index, and target of sanitation at national and provincial (Kepri) level.

Chapter five presents the results of sanitation challenges, targets, and potential improvements in Tanjungpinang and Batam divided into several sub-chapters on biophysical features and governance.

Chapter six includes the conclusion and reflection of this research. The conclusion section elaborates on the research questions and results. The reflection section describes the study's limitations and suggest further and future research possibilities.

Chapter 2 Methodology

2.1. Unit of Analysis

2.1.1. Province of Riau Islands (Kepri)

For the research on the case study, it is crucial to define a clear boundary (Stake, 1995; Yin, 2017), therefore, the time frame and spatial boundary shall be determined (Yin, 2017). According to BPS (2021b), Kepri is an archipelagic province that has the second greatest number of islands in Indonesia—more than 2400 islands—, this study uses two cities located within this province as the unit or focus of analysis. Even though the Province of West Papua has the greatest number of islands, inhabitants dominantly live on the mainland. Meanwhile, all Kepri areas are considered as ‘small islands’ according to UU No.1/2014 on the Management of Coastal Areas and Small Islands, which stated: “The small island is an island with an area smaller than or equal to 2,000 km² (two thousand square kilometres) and including its ecosystem as a whole”.

The Riau Islands has 2.2 million people and 8,200 square kilometres of land spread across 2,000 islands in 240,000 square kilometres of water. The most well-known island groups include: Batam, the province's economic engine; Bintan, the cultural heartland and the location of the provincial capital; Tanjungpinang; and, Karimun, a fishing and shipping hub near the Strait of Malacca. These island groups are quite outwardly focused and multi-ethnic, but the province also includes Natuna, Anambas, and Lingga, which are more isolated, rural, and homogenous areas (Hutchinson & Negara, 2021). Kepri only has 2 cities (in Indonesian: Kota) and 5 regencies (in Indonesian: Kabupaten). There are several distinctions between a City and a Regency in Indonesia. For instance, cities have (1) a higher average regional GDP than regencies, (2) a lower population density than regencies, and (3) in terms of government structure, a city is formed by several districts (Kecamatan) and sub-districts (Kelurahan), while a regency is formed by districts (Kecamatan) and villages (Desa). The village is a separate autonomous region in the district area; thus, it has its own budget, including district revenue (NA3, UU No.6/2014).

Tanjungpinang City is located on the island called Bintan with a land area of 1,173 square kilometres, Batam City has a similar name with its own island with an area of 1,595 square kilometres. Tanjungpinang City and Batam City are the case study of this research as seen on Figure 1. Again, these two cities are highly distinguishable by their distinct characteristics, with Tanjungpinang representing as the provincial capital and possessing a long history and strong Malay cultural roots. Meanwhile, Batam is designed as an industrial city with a diverse population and rapid infrastructure growth.

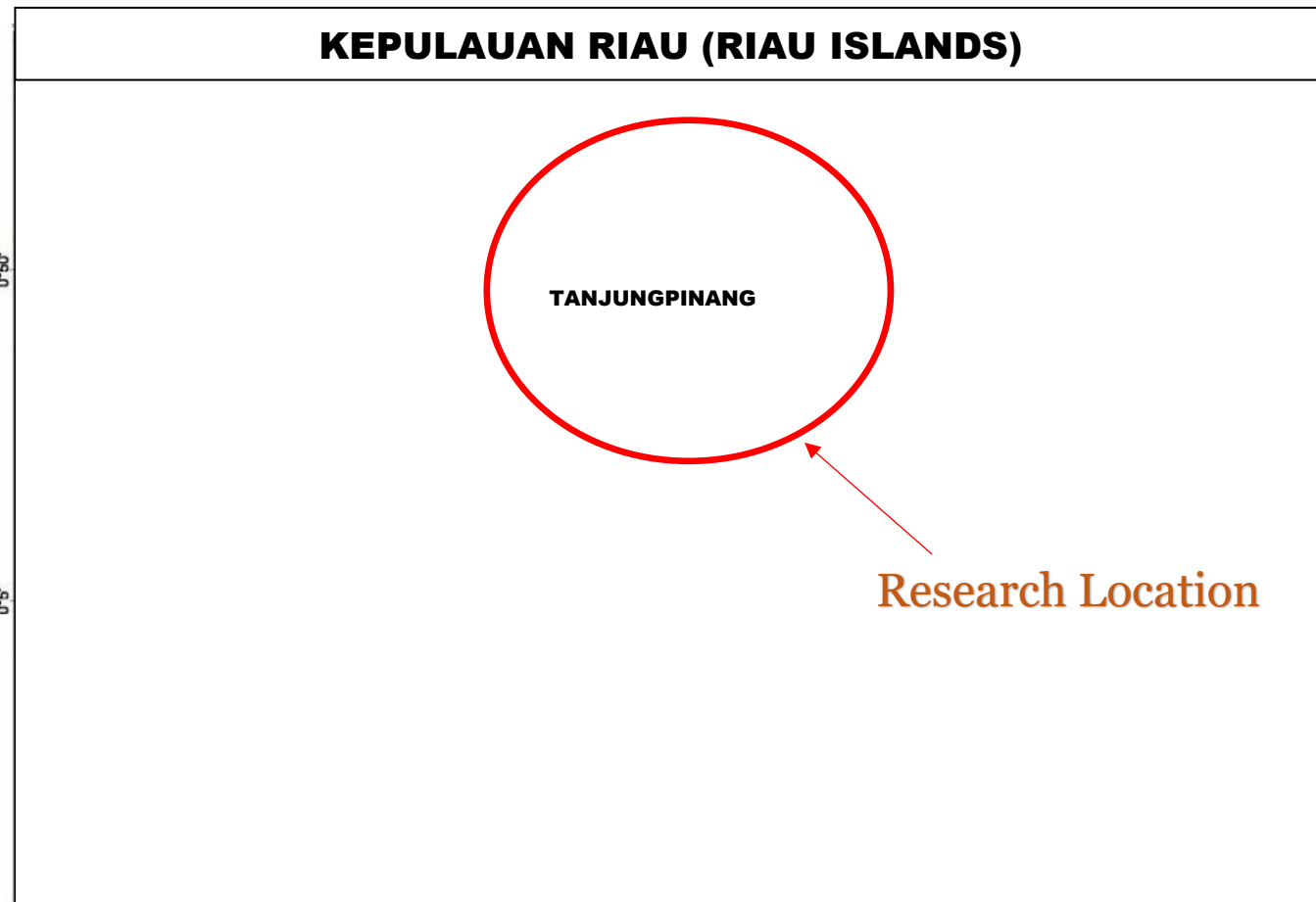


Figure 1. Maps of Kepri
Source: BPK Kepri [Audit Board of Kepri], n.d.

2.1.2. Kota Tanjungpinang

The establishment of the Province of the Riau Islands was announced in 2002 and went into effect in 2004. On Bintan Island, a new provincial capital is being constructed. The young provincial civil service is still finding its footing and is reaching out to the province's more remote regions to foster a sense of shared identity. The islands, which have been a region open to trade and commerce for centuries, have absorbed diverse communities over time. Despite this, the rapidity and magnitude of the recent population growth have spawned an influential ethnonationality sentiment in the local political context. The population growth has changed the Riau Islands' demographics and politics. As a result, the Riau Islands have periodically shifted their policy frameworks away from manufacturing-related growth and toward traditional activities such as fishing and farming (Hutchinson, 2015).

Tanjungpinang is situated in the southern part of Bintan and comprises four districts and 18 sub-districts. The city's population was approximately 86,000 in 1990 and nearly 135,000 in 2000, representing a 4.5 percent annual growth rate. It explains how approximately 34% of the land is comprised of built-up areas. Latest projections place the population of Tanjungpinang at approximately 227,663 (BPS Tanjungpinang, n.d.). It is estimated that Tanjungpinang received 2,400 immigrants annually for the five years prior to the last population census in 2010 (BPS, 2011), and that immigrants accounted for approximately two-fifths of the city's population growth between 2000 and 2010. This is a slightly smaller contribution than that of migrants to Batam's population growth.

2.1.3. Kota Batam

The Riau Islands are an important location for manufacturing in Indonesia, despite the fact that they are only a small part of the archipelago. In 1989, spurred by foreign direct investment (FDI) into Singapore and Johor, the Indonesian government reformed Batam's investment regulations, then all Batam's areas became part of an exclusive economic zone. Later, it was managed by BIFZA (Batam Indonesia Free Trade Zone Authority) and BP Batam (Batam Management Agency). This reform allowed more private sector participation, investment in physical infrastructure and began a working relationship with Singapore to develop its human resource base and market with the island.

Since its emergence in Batam and then Bintan in the late 1990s, the export-oriented sector has altered the social fabric, urban centres, and day-to-day lives of its citizens. Over time, the modern manufacturing sector has expanded to include shipbuilding and ship repair (Hutchinson & Negara, 2021). Many Indonesians have moved to the Riau Islands for formal sector jobs, changing Batam City's face.

Living conditions in Batam have dramatically improved as a result of this growth. Recent estimates indicate that the per capita income of Kepri is IDR 117 million (\$8,550), while Batam has the highest income per capita among the province. This is the second-highest per capita income in Indonesia, only exceeded by the Jakarta's capital region (BPS, 2021c). In terms of demography, the population of Kepri has increased from approximately 500,000 in 1990 to over two million today. The majority of this growth has occurred in Batam, whose population is now approximately 1.37 million (Bapelitbangda Batam, 2019). This rapid growth has strained urban areas and public services. Moreover, the large influx of people and the province's manufacturing-based growth model have important environmental implications (Hutchinson & Negara, 2021).

2.2. Research Approach and Design

The design used in this research methodology was originally created by researchers at University College London (UCL). It was developed by Fuso Nerini et al. (2018), who identified relationships between energy and the SDGs, and Parikh et al. (2021), who extended it to sanitation at a global scale. The current research extends these findings by applying the methodology to a particular context. In addition, it contributes to the body of research that has examined how the targets interact with one another, several of which have required context-specific case studies (see for example Dawes, 2019; Nilsson, et al., 2016; Pham-Truffert, et al., 2020). Earlier study on the connection between sanitation and SDGs targets has been conducted using the same methodology. For instance, Diep et al. (2020) conducted the study with step-by-step information depicted in Figure 2.

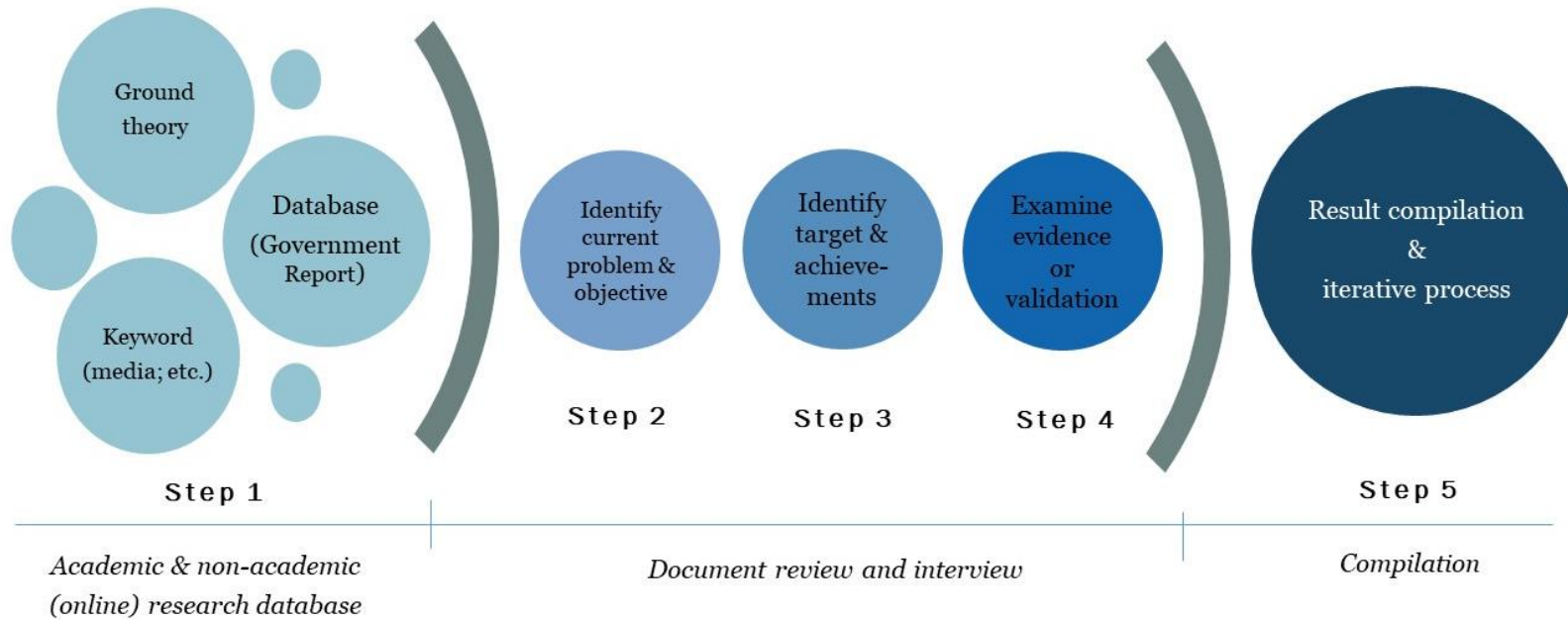


Figure 2. Step-by-step Research Approach
 Modified from source: Diep et al., 2020.

Diep et al. (2020) uses four phases to uncover synergies and trade-offs in sanitation management in Brazil. The focus of this thesis is to adopt these steps in order to identify the primary drivers and obstacles to sustainable sanitation (universal access) in the site where the research will be conducted.

Step 1: searching academic and non-academic online research databases for information. Priority was given to academic books and journal articles, but also included were conference papers, academic theses, and grey literature, such as reports from non-governmental organizations. The collection of findings was conducted in both Indonesian and English. In addition, official documents such as city strategic sanitation plans and national statistics are utilized in the subsequent step of research.

Step 2: identify current sanitation problem and action that have been performed based on the data collection in step 1. Learn where the government stands in relation to the challenges it must overcome and the objectives it seeks to accomplish at the present time.

Step 3: identify targets and measures of sanitation action progress. This step offers information regarding the degree and method of the action's success. This was accomplished by studying relevant papers and conducting interviews with the concerned parties, Bappeda/Bappedalitbangda (Regional Development Planning and Research Board), either in provincial or municipal level.

Step 4: internal validation by examining evidence of publishing of present conditions and to-be-attained goals via media publication and discussions with community organizations (areas deemed successful or unsuccessful by the government).

Step 5: reach conclusions by identifying the challenges and potential improvements to the accomplishment of sustainable sanitation.

2.3 Data Collection

This research comprises three parts of data and information collecting. The first part is the collection of secondary information and data using literature research to obtain theoretical studies pertaining to the concept of sustainable sanitation in the context of Tanjungpinang and Batam City, relevant stakeholders, and a review of legal and regulatory aspects relating to the implementation of the sanitation system. The second part is the collecting of primary data, which involves conducting interviews with the various government actors. The third part is triangulation, which verifies the dependability and validity of written materials and interviews.

The section will elaborate on the semi-structured interview, gathering of policy documents, and other literature.

2.3.1. Document Review

Secondary data, such as sanitation policy documents; publication; reports, etc., were collected as part of the data collection process. The author conducted a content analysis of the policy document in order to determine the general arrangements for sanitation measures and interventions conducted by government entities. This literature review is also used to identify the sanitation governance principles that present the greatest challenges in the study area. The selected principles next serve as the foundation for determining indicators for assessing the quality of existing sanitation and determining the next set of goals, based on the arguments supported by the sources that have been examined. The author then uses the information gleaned from these documents to cross-check the data received from the respondents.

The authors compiled several documents containing national and regional (provincial and municipal) water and sanitation governance regulations and policies, listed in Table 1. However, there are three primary documents that represent the sanitation situation and objectives in the location of the research, including:

1. National Strategic Plan of Sanitation 2020-2024
2. City Sanitation Strategy (SSK) Batam City 2018 – 2022
3. City Sanitation Strategy (SSK) Tanjungpinang City 2018 – 2022

Several additional documents, such as publication materials, were subsequently obtained from the relevant agencies. These are supporting documents obtained both prior to and following the interview.

Table 1. List of Regulation and Policy Documents

National Regulation and Policy	Code
<p><i>UU Republik Indonesia Nomor 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup</i></p> <p>[Indonesian Law No. 32 of 2009 on Environmental Protection and Management]</p>	<p>NA1</p>

<p><i>UU Republik Indonesia Nomor 1 Tahun 2014 tentang Perubahan atas Undang-Undang Nomor 27 Tahun 2007 tentang Pengelolaan Wilayah Pesisir dan Pulau-Pulau Kecil</i></p> <p>[Indonesian Law No.1 of 2014 Amendments to Law No.27 of 2007 on Coastal and Small Islands Management]</p>	NA2
<p><i>UU Republik Indonesia Nomor 6 Tahun 2014 tentang Desa</i></p> <p>[Indonesian Law No.6 of 2014 on Villages]</p>	NA3
<p><i>UU Republik Indonesia Nomor 23 Tahun 2014 tentang Pemerintah Daerah</i></p> <p>[Indonesian Law No.23 of 2014 on Regional Government]</p>	NA4
<p><i>Rencana Strategis Direktorat Sanitasi 2020-2024, Direktorat Jenderal Cipta Karya, Direktorat Sanitasi, Kementerian Pekerjaan Umum an Perumahan Rakyat</i></p> <p>[National Strategic Plan of the Directorate of Sanitation 2020-2024, Directorate General of Human Settlements, Directorate of Sanitation, Ministry of Public Works and Housing]</p>	NA5
<p><i>Surat Edaran Menteri Dalam Negeri No.660 Tentang Pedoman Pengelolaan Program Percepatan Pembangunan Sanitasi Permukiman PPSP Di Daerah, Kementerian Dalam Negeri</i></p> <p>[Ministerial Circular of the Minister of Internal Affairs No.660 on Guidelines for the Management of the PPSP Settlement Sanitation Development Acceleration Program in Local Level]</p>	NA6
Regional/Local Regulation and Policy (Batam)	Code
<p><i>Peraturan Daerah Kota Batam Nomor 4 Tahun 2016 tentang Perlindungan dan Pengelolaan Lingkungan Hidup</i></p> <p>[Batam City Local Law No.4 of 2016 on Environmental Protection and Management]</p>	BT1
<p><i>Peraturan Kepala BP Batam No. 28 Tahun 2020 tentang Pengelolaan Tarif Layanan dan Tata Cara Pengadministrasian Keuangan Sumber Daya Air, Limbah dan Lingkungan pada Badan Usaha Fasilitas dan Lingkungan</i></p>	BT2

<p>[BP Batam Head Ordinance No. 28 of 2020 on Management of Service Tariffs and Procedures for Financial Administration of Water, Waste, and Environmental Resources in Facilities and Environment Business Entities]</p>	
<p><i>Strategi Sanitasi Kabupaten/Kota (SSK): Kota Batam Tahun 2018 – 2022, November 2017, Pokja Sanitasi Kota Batam, Percepatan Pembangunan Sanitasi Permukiman (PPSP) Direktorat Pengembangan PLP, Direktorat Jenderal Cipta Karya, Direktorat Sanitasi, Kementerian Pekerjaan Umum an Perumahan Rakyat dan Pemerintah Kota Batam</i></p> <p>[City Sanitation Strategy (SSK): Batam City 2018 – 2022, Latest published in November 2017. Document of Batam City Sanitation Working Group - Acceleration of Residential Sanitation Development (PPSP) by Directorate of PLP Development, Directorate General of Human Settlements, Directorate of Sanitation, Ministry of Public Works and Housing, and Batam City Government]</p>	<p>BT3</p>
<p><i>Materi Advokasi Profil Sanitasi dan Usulan Kebijakan Pembangunan Sanitasi 2021-2026 Kota Batam, Pendampingan Implementasi SSK 2021. Pokja PKP Kota Batam</i></p> <p>[Advocacy Material for Sanitation Profile and Proposed Sanitation Development Policy for 2021-2026 Batam City. Assistance in Implementing SSK 2021 by Batam City Sanitation Working Group]</p>	<p>BT4</p>
<p><i>Rencana Penerapan L2T2 dalam rangka One Bill, Unit Usaha PEngelolaan Lingkungan, 2022, BP Batam</i></p> <p>[L2T2 Implementation Plan for One Bill Policy 2022, Environmental Management Business Unit, BP Batam]</p>	<p>BT5</p>
<p>Regional/Local Regulation and Policy (Tanjungpinang)</p>	<p>Code</p>
<p><i>Profil Sanitasi Kota Tanjungpinang 2017/ Strategi Sanitasi Kabupaten/Kota (SSK): Kota Tanjungpinang Tahun 2018 – 2022, November 2017, Pokja Sanitasi Kota Tanjungpinang, Percepatan Pembangunan Sanitasi Permukiman (PPSP) Direktorat Pengembangan PLP, Dirjen Cipta Karya, KemenPUPR dan Pemerintah Kota Tanjungpinang</i></p> <p>[Tanjungpinang Sanitation Profile Book/ City Sanitation Strategy (SSK): Tanjungpinang City 2018 – 2022, Latest published in November 2017. Document of Tanjungpinang City Sanitation Working Group - Acceleration of Residential Sanitation Development (PPSP) by Directorate of PLP Development,</p>	<p>TJ1</p>

Directorate General of Human Settlements, Directorate of Sanitation, Ministry of Public Works and Housing, and Tanjungpinang City Government	
<p><i>Materi Advokasi Profil dan Paket Kebijakan Sanitasi 2021-2026 Kota Tanjungpinang, Pendampingan Implementasi SSK 2021. Pokja PKP Kota Tanjungpinang</i></p> <p>[Advocacy Materials for Sanitation Policy Packages and Profiles for Tanjungpinang City 2021-2026. Assistance in Implementing SSK 2021 by Tanjungpinang City Sanitation Working Group]</p>	TJ2
<p><i>Paparan Pokja PKP Kota Tanjungpinang dalam Coaching Clinic (CC) 3. Pendampingan Implementasi SSK 2021. Pokja PKP Kota Tanjungpinang</i></p> <p>[Public presentation of Coaching Clinic (CC) 3 Tanjungpinang City. Assistance in Implementing SSK 2021 by Tanjungpinang City Sanitation Working Group]</p>	TJ3

2.3.2. Semi-structured Interview

For the study, semi-structured interviews were held with government actors. A semi-structured interview that combines predefined and open-ended questions with spontaneous queries (Flyan, 2015) was taken as the chosen approach. Relevant government actors were selected at various levels, including both directly and indirectly involved actors. The research identifies governmental elites based on their responsibilities and competencies. To collect information and data, assess sanitation and water governance indicators set before and based on their understanding, and raise follow-up questions to better understand governance concerns and issues, several respondents from the listed players were selected for interviews.

Due to spatial constraints, the interviews were conducted via Google Meet, Zoom, and WhatsApp. Interviews were recorded and transcribed for analysis. All interviews were performed with the stakeholders' informed agreement to respect ethics and privacy (see Appendix 1. Interview Guide). The author explains the study's goal and guarantees confidentiality. The following are the questions asked during the interview, Appendix 2 contains a more comprehensive list of questions. This list is based on a synopsis of ground theory and current sanitation challenges, which can be found in chapter 3.

1. Clear allocation of roles and responsibilities

- Are the roles and responsibilities of agencies involved in water and sanitation governance articulated in a clear and concise manner? If not, please elaborate on whether there is overlap and inefficiencies of roles and responsibilities.

- Which organizations have roles and responsibilities that overlap?
 - What effects does fragmentation and lack of coordination have on water and sanitation governance? How can these overlapping areas be rectified?
2. Policy coherence
 - Are related policies clear, or are there overlaps and redundancies? Please provide examples of overlaps between policies.
 3. Capacity development
 - Do the agencies involved have the capacity to carry out their roles and responsibilities? If the answer is no, please provide the reasons why the organizations whose limitations you are familiar do not have the capacity to fulfil the request.
 4. Data and information
 - Are the data at your organization of sufficient quality to carry out the tasks and responsibilities? If not, please explain how it could be improved.
 5. Governance-financing nexus
 - Does your organization have sufficient funding to govern water and sanitation efficiently? If no, do you have any suggestion mechanisms for increasing finances?
 6. Regulatory frameworks
 - Are the laws and regulations that govern your agency's mandate adequate to achieve efficiency in water and sanitation governance? If not, are regulatory and legislative reforms possible?
 7. Equity across users, territories and generations
 - Do all users have equal access to a reliable water and sanitation service?
 - Do all settlements have equal access to a reliable water and sanitation service?
 - Do you think that water and sanitation pricing is equitable for all users?
 8. Stakeholder engagement
 - Is there sufficient participation of stakeholders by water and sanitation governance agencies? If not, what do you believe to be the causes of low participation or limited engagement
 9. Monitoring and evaluation
 - Do all stakeholder involved monitor and evaluate their performance adequately? If you believe that this activity is adequate or inadequate, please explain why.

The aforementioned question is an overview of the information-gathering process for this study, but it does not preclude the interviewee from providing additional data. This interview

process was conducted between July-August of 2022 with eight respondents, as shown in Table 2. The information was provided by each respondent in accordance with their education, experience, organizational background, and position within the organization.

Table 2. List of Interviewees

No.	Name	Agency/Organization	Code
1	Urip R.	Staff of BPPW Kepri – Supervision of Individual Consultants	UR
2	Panca S.	Individual Consultant; Provincial Facilitator for PPSP Batam 2021	PS
3	Dandy D.	Individual Consultant; Provincial Facilitator for PPSP Tanjungpinang 2021	DD
4	Tri Wahyu R.	(Interim) Head of Bappelitbangda Batam	TW
5	Qurniati F.	(Junior) Planner of Bappelitbangda Batam; Head of the Natural Resources and Environment Subdivision	QF
6	Anisa K.	(Junior) Planner of Bappelitbangda Batam	AK
7	Surjadi	Head of Bappeda Tanjungpinang	SJ
8	Iyus R.	Unit Manager of Environmental Management Business, Environmental Facilities Business Sub-Board, BP Batam	IR

2.4. Data Analysis

The data analysis methods used in this study are based on the theoretical framework that was developed. Most of the coding for the analysis is derived from interview transcripts and document reviews then analysed by deductive coding method (Baarda, 2014). Deductive coding is a top-down methodology in which users begin by creating a codebook containing initial set of code or particular objectives. This set may be derived from the research questions, an existing research framework, or a theory (Saldana, 2009). The research questions serve as the basis for data organization and the rest of the subsequent procedures. Figure 3 illustrates the steps involved in this phase of analysis. After the data has been received and checked for

relevance, the primary (interview) and secondary (document) data sources and materials are then grouped and used as a set of code, as is shown in Table 3.

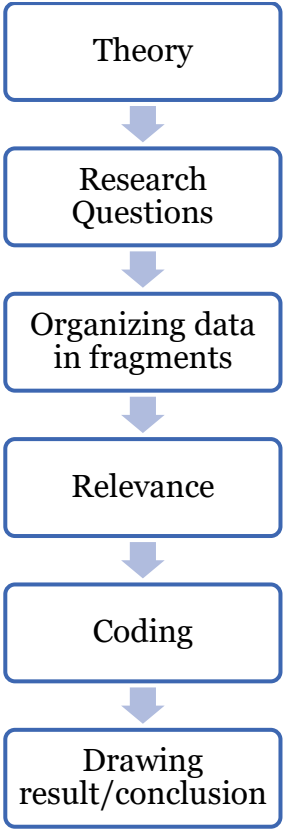


Figure 3. Qualitative Research Data Analysis Steps
Source: Baarda, 2014

Table 3. Research Deductive Coding

Research Questions		Documents	Interviews
Question 1 What are the challenges that must be addressed in order to achieve sustainable sanitation in Tanjungpinang and Batam?	Environmental/ Biophysical	NA2, BT1	IR, QF
	Social	NA5, BT4, TJ2	PS, DD, AK
	Financial	NA3, NA4	TW, SJ, IR
	Institutional	NA1, NA4, NA6	IR, UR

Question 2 How can these challenges be addressed by integrated sanitation targets, plans, and outcomes at all levels of government? (potential improvements)	Targets	NA5, BT3, BT4,	IR, TW, SJ
	Plans	TJ1	IR, AK, QF
	Outcomes	NA5, BT5,TJ3	PS, DD
Question 3 What role does the local government play in achieving sustainable sanitation?		NA6, BT2, BT3, TJ1,	TW, SJ

2.5. Ethical Considerations

This study examines a number of prevalent norms in the broader Indonesian culture, including norms of etiquette in conducting interviews with stakeholders, legal norms pertaining to government and public issues, and moral norms that include good intentions in the research for the benefit of society and knowledge in spatial planning. This study adheres to the following ethical principles: researchers respect the rights of respondents; researchers regard the right of respondents to acquire open information pertinent to the research. Respondents have the freedom of choice and are not coerced into participating in research. The researcher prepares the informed consent form, respects the privacy and confidentiality of research subjects, and the research will result in the disclosure of personal and limited information. This research is conducted with integrity, prudence, professionalism, humanity, and consideration for factors of precision, accuracy, precision, intimacy, psychological, and religious sentiments of respondents.

Chapter 3 Theoretical Framework

3.1. Urban Planning and Sanitation

In 2008, urban historian Martin V. Melosi wrote *The Sanitary City*, a monumental history of the provision of sanitary services in the United States. Throughout the course of the book, Melosi explains how sanitation systems have evolved in a manner that reflects the dominant and growing understandings of public health and disease throughout the course of United States history (Melosi, 2008). The entrenched nature of physical sanitary infrastructures and the institutions that developed to support the continued operation of these public investments have complicated the planning of sanitary systems that better serve the public and protect the nation's ecosystems from water-borne pollutants. This inherent momentum of infrastructure, also known as route dependence, has hindered significant modifications of sanitary procedures to the present day. However, increasing environmental degradation and infrastructure deterioration are compelling several municipalities in U.S. to develop fundamentally new sanitation solutions for their cities.

At the end of the nineteenth century and the beginning of the twentieth century, broad adoption of sanitary sewers in the United States supplanted numerous decentralized alternatives as the main approach to urban sanitation (Melosi, 2008). Reforms altered the urban built environment so drastically and permanently that sanitary services became indispensable to urban existence as the "circulatory system of the city" (Melosi, 2008, p. 1). During the reform era, sanitary interventions took the form of 'special purpose planning,' also known as functional planning, which targeted specific topical concerns as opposed to the holistic approach characteristic of the twentieth-century rational planning paradigm (Neuman & Smith, 2010, p. 26). By establishing and institutionalizing the concept that centralized authorities may undertake large-scale interventions in the public sphere for the public good, these changes laid the ground for the creation of the contemporary planning profession, and some historians view these interventions as the earliest expressions of city planning.

Peterson (1979) in Neuman & Smith (2010) states that while these early initiatives in urban reform are not synonymous with modern urban planning, sanitary reforms were a "stimulus to city planning" and "sanitary reformers functioned as city planners to the extent that they supported systematic, large-scale restructuring of cities" (p. 84). According to Black & Fawcett (2008), Sir Ronald Ross, the 1902 Nobel Prize laureate in Medicine, remarked of sanitation, "*Great is sanitation, the greatest work... that one can do. What is the use of preaching high moralities, philosophies, policies, and arts to people who dwell in appalling slums? ... We must begin by being cleansers.*" Scholars argue that planners have gotten

detached from the more practical parts of urban planning as concerns for social and justice planning have moved to the forefront (Black & Fawcett, 2008).

On 17 December 2015, the UN General Assembly resolved the right to safe drinking water and the right to sanitation which adopted consensus resolution A/RES/70/169: “the human right to sanitation entitles everyone, without discrimination, to have physical and affordable access to sanitation, in all spheres of life that is safe, hygienic, secure, socially, and culturally acceptable and that provides privacy and ensures dignity.” (Bos, 2016). Despite the past study has elucidated the strong relationship between urban planning and sanitation systems at both the communal (liveable city) and individual (human rights) levels, the sanitation sector continues to face several global and local challenges.

3.2. Current Sanitation Challenges

It is estimated that inadequate sanitation access is responsible for the deaths of 432,000 people around the world each year due to diarrheal diseases, which disproportionately affect more vulnerable communities (WHO, 2019). In addition, the release of untreated sewage into the natural environment poses a threat to the environment because it impacts terrestrial and marine ecosystems and negatively impacts biodiversity over the long run. According to research by LIXIL, WaterAid, and Oxford Economics (2016), the lack of sanitation services resulted in an economic loss of US\$222.9 billion worldwide in 2015. This loss was attributed to increased death rates, higher healthcare costs, and decreased levels of productivity.

Currently, 40% of the world's population lacks access to adequate infrastructure for water, sanitation, and waste management, especially in developing countries (Mendoza, 2019). Yet, municipal governments in developing countries are unwilling or unable to provide adequate water and sanitation (Rosemarin et al., 2015). More than 90% of wastewater in developing countries is discharged untreated into water bodies (Mendoza, 2018). Individually and collectively, these practices have caused or accelerated environmental degradation. Lack of sanitary facilities forces most people, especially in informal settlements, to dispose of open ground and drains around houses. It should be noted, however, that because there is no organized system for disposing of wastewater, a significant amount of this wastewater collects and accumulates in the settlement's open drains. Excreta are safely disposed of on-site or treated off-site for 39% of the world's population (2.9 billion people). Two out of every five people (1.2 billion) live in rural areas (WHO, 2019; UNICEF, 2015).

Limited government sanitation services force communities to improvise or make do, resulting in higher prices for alternative water and sanitation providers (Jacobi et al., 2010).

New strategies and methods are required to improve sanitation, ensure equitable access for everyone, and protect human health and environmental resources from moving towards the goal of achieving sustainability. The new strategies will require political will, more openness to learning from personal experiences and others, and innovative approaches that apply a mix of technologies and systems (Letema, 2012). There is also the need to involve intended users of any sanitation services. Involving intended users implies listening to them, crafting policies they find appropriate, and engaging in sustainable design.

3.2.1. Inadequate and Dysfunctional System of Sanitation

The Joint Monitoring Programme for Water Supply and Sanitation reports that "improved" sanitation use increased from 54 percent to 68 percent globally (79 percent to 82 percent in urban areas) between 1990 and 2015 (UNICEF, 2015). However, the definition of "improved sanitation" refers only to the hygienic separation of human excreta from human contact, such as the use of a toilet or latrine, and does not address poorly functioning or malfunctioning systems. Therefore, these numbers do not represent "sufficient" sanitation coverage. About 1.5 billion people in urban areas use toilets connected to a sewerage network that releases untreated sewage, with 69% in Asia, 12% in Europe, 11% in South America, 5% in Central and North America, and 4% in Africa (Baum et al., 2013). Particularly, many cities in low- and middle-income countries face pressures to expand sewerage but are unable to provide sufficient collection and treatment systems.

Many urban residents use pit latrines, pour-flush toilets, and septic tanks (Jenkins et al., 2015). These systems must be periodically emptied (or replaced, in the case of some pit latrines), and safe waste disposal and treatment can be costly for users and difficult to implement in densely populated informal settlements. This leads to poor management of pit latrines and septic tanks, which can contaminate the environment e.g., groundwater (Banerjee, 2011; Shivendra & Ramaraju, 2015). Small and medium-sized cities have fewer resources and fewer revenues to provide adequate wastewater treatment and faecal sludge management. Even in countries with a higher per capita income, such as Sweden, smaller urban centres are closing their sewage treatment plants and constructing expensive pipelines to larger cities in the vicinity (Länsstyrelsen, 2013 in Andersson et al., 2016).

According to MacDonald et al. (2017), there are several reasons for Small Island Developing States to be unable to effectively manage water and sanitation management, due to their small size, geographic isolation and expansion, environmental fragility, small and predominantly rural. At the same time, rapidly urbanizing populations, and limited human and financial resource bases. As with other Pacific Island countries that categorized as a small island, e.g. Fiji, Kiribati, and the Solomon Islands are frequently unable to provide their

populations with adequate WASH services. Additionally, these small island nations are confronted with significant difficulties to achieve adequate and functional sanitation system due to a changing climate, the impact of extreme weather events such as tropical storms, drought, heavy rainfall, and flooding, and difficulties associated with rising sea levels (Hadwen et al., 2015).

Therefore, environmental factors must be a primary consideration for the sanitation system. The challenges posed by a region's biophysical characteristics necessitate the development of unique solutions, as simply constructing toilets on land is insufficient. In the planning of a sanitation system, other environmental factors such as water resources, types of settlements, and the terrestrial and aquatic life of biota must be given careful consideration. The question that arises from the perspective of planners in this research is whether small island cities have the same opportunity in a dialogue on sanitation system planning by considering their spatial characteristics, which are distinct from those of cities on large islands, which occupy sentient civilian areas. Whether or not urban development has recognized the geographical challenges and incorporated them into coordinated efforts across a variety of domains, ranging from education to politics. Nevertheless, planning that takes the place-based approach into account is an effective tool for meeting the demands of the public for infrastructure (Kruger & Williams, 2007).

3.2.2. Lack of Attention: No One Talk about *Shit*

Several publications by Sarah Jewitt, a professor of Human Geography and Development at University of Nottingham, discussed among gender and sanitation-related issues. One of her extraordinary works is titled "Geographies of shit: Spatial and temporal variations in attitudes towards human waste" (2011). She paved the way for academics to liberalize the use of the word "shit" in an effort to lessen the academic society's fear and taboo surrounding the faecal topic. In addition, George (2008) also mentioned that one of the reasons the failure of providing sanitation systems is lack of academic curiosity. Therefore, concerns regarding sanitation and the use of the word "shit" ought to also be brought up in the context of the socio-political sphere.

Sanitation can be part of central issue on decision makers agenda if public and government acknowledge the issue itself, as Black & Fawcett (2008, p. 10) mentioned "*squeamishness that surrounds the subject with silence and taboo must be tackled head on... today's sanitary crisis requires that we dismantle the last great taboo and learn to talk about... shit*". Spatial inequalities in access to sanitation and the resulting effects on human, environmental, and economic health have received insufficient attention due to taboos surrounding human waste. It has been estimated that the global goals (MDGs and SDGs) on

sanitation target will not be met until 2076 – a situation that has been described as a 'hidden international scandal that is killing millions of children every year' by a committee from the House of Commons International Development Committee (2007).

Mary Douglas's in Jewitt (2011) define dirt as "matter out of place" and her concept of pollution and taboo as ways cultures create and police social and environmental boundaries are useful for understanding shit as taboo. Individual (private) acts of defecation quickly become a significant and difficult-to-police public problem, reflecting broader tensions between private production and public management of faecal matter (Hawkins, 2006). Hawkins also elaborates on this theme, arguing that *shit "... is most threatening to the self must be rendered out of sight as quickly as possible"* (Hawkins, 2006, p. 46) and highlighting the effectiveness of sewers in transforming "*shit to effluent, from private waste to public problem*" (p. 67).

Most sanitation strategies focus solely on the physical construction of toilets (hardware), and failures typically result in the operation and maintenance process due to a lack of attention from the community and government; consequently, their concern is the software in the sustainable sanitation process. Inappropriate, top-down sanitation interventions that prioritize 'hardware' while ignoring broader political ecologies and 'software' (socio-economic, cultural) dimensions are among the broader problems impeding the development of solutions for inadequate sanitation. This, in turn, has prevented a comprehensive analysis of the reasons why different sanitation systems succeed or fail in different cultural contexts (Jewitt, 2011).

People are often resistant to adopting sanitation, sometimes due to locally specific cultural taboos, but frequently because they actively prefer defecating in the open. In many cases, approaches emphasizing personal hygiene have been more effective than environmental issue and communal well-being. A highly effective initiative in Java Indonesia, for instance, linked sanitation to purity and environmental cleanliness: messages reinforced by local imams who prohibited people without pit toilets from marrying or attending the Haj (Black and Fawcett, 2008). The sanitation governance must facilitate dialogue with external actors i.e., NGOs, traditional and religious leader, women communities, and others.

3.2.3. Less Popular than Water, Less Political Will

Sanitation issues will not be resolved purely by enabling new technologies. Instead, a bottom-up, horizontal, and multi-stakeholder approach to problem-solving could solve some sanitation issues. Water and sanitation governance is a process aimed at resolving conflicts between diverse stakeholders over the resource. At least 85 percent of water utilities worldwide are governed by governments, but most of these utilities perform poorly (Araral & Wang, 2013). Numerous studies suggest that granting them autonomy is a crucial solution, but the

political economy of water makes this more challenging to implement (Araral, 2008). When the government strictly controls and manages water, it seems to leave sanitation to individual responsibility since most people use on-site systems (e.g., septic tanks). This reveals a political commitment gap in the SDGS 6 agenda, which entails essentially integrated water and sanitation.

In many cities, unsustainable sanitation systems are a result of insufficient attention and investment from decision-makers to address urban areas' critical sanitation needs. A global challenge is a need for dedicated resources, such as financial, human, and technical capacity, to support sustainable sanitation. This includes repairing and rebuilding ageing urban infrastructure in the middle- and high-income countries and providing universal access to urban sanitation services in low-income nations. Additionally, political will is required to implement adequate policies and regulations to ensure sustainable systems, as there is poor compliance in many areas with existing sector regulations and a lack of sanitation safety plans in regions without local laws (Rheingans & Moe, 2006).

A lack of political will to address sanitation in the decision-making has been a persistent problem for more than 60 years, which continues to impede the effectiveness of water and sanitation governance (Mycoo, 2018). Granting performance rewards, enhancing cost recovery, and improving revenue generation, which is essential for fiscal and decision-making autonomy, is a novel approach that could be adopted. Good corporate governance—including utility autonomy, performance management and compensation, professional staff, and progressive leadership, among others—is one of the most critical factors for a public utility's success (Tortajada, 2006).

3.2.4. Low Willingness to Pay and Lack of Investment

Individuals' willingness to pay for sanitation is typically considered to be lower than their willingness to pay for water, similar to their awareness of the benefits of sanitation services (McIntosh, 2003). This statement is consistent with the fact that global sanitation coverage rates are lower than water service coverage rates (Krause, 2010). Whittington et al. (1993) thoroughly examined the willingness to pay for improved sanitation services in Ghana and concluded that the willingness to pay is generally sufficient to cover the costs of ventilated pit latrines but not the costs of sewer connections. Individual demand for safe services is associated with positive external benefits for the neighbourhood. The full benefits of sanitation services are only likely to materialize if users possess an adequate level of hygiene education.

Despite the fact that the costs of water and sanitation service can vary significantly due to differences in climate, location of freshwater sources, quality of fresh water, topography, and spatial population patterns, the private costs exhibit typical patterns due to the characteristics

of technologies or infrastructure that needed (Noll, 2002). It is necessary to make relatively large investments in capital assets (dams, canals, pipes, and sewers), which results in relatively high fixed capital costs. According to Komives et al. (2005), fixed capital costs account for up to 65% (water) and 80% (sewerage) of total expenditures for most water and sanitation governance. One implication of this cost structure (and the underlying supply technology) is that the average costs of water and sanitation systems tend to decrease over a broad range of products. Additionally, assets have very long typical lives; for water, this ranges from 20–40 years, and for sanitation (sewerage), this ranges from 40–60 years. Because of this, it is possible to postpone maintenance and replacement investment expenses for quite some time, and as a result, the water and sanitation provider can be "underfunded."

3.3. Concept of Sustainable Sanitation

The World Health Organization (WHO) defines sanitation as "the provision of facilities and services for the safe disposal of human urine and faeces". Sanitation is widely understood to relate to the act of providing such toilet facilities and water services (UN, n.d.). In some circumstances, the term sanitation also refers to the distribution of purified water for family or communal consumption. However, for the purposes of this study, sanitation will only relate to the first meaning in term of domestic wastewater management. There are numerous sanitation-related concepts, including water safety plan (WSP), sanitation safety plan (SSP), Community-Led Total Sanitation (CLTS), and Community-Led Urban Environmental Sanitation (CLUES), and many others. Nonetheless, this study employs the concept of sustainable sanitation.

The International Advocacy Network Sustainable Sanitation Alliance (SuSanA) provides a definition of sustainability in sanitation based on five criteria. These criteria are as follows: 1) health and hygiene; 2) environment and natural resources; 3) technology and operation; 4) financial and economic issues; and 5) socio-cultural and institutional aspects (2018). These sustainability criteria, especially regarding to the conservation of the environment and natural resources, are consistent with the underlying philosophy of the SDGs and are represented in a significant number of SDGs targets. As per Rosemarin et al. (2012) mentioned sustainable sanitation as a system that helps protect and promotes human health, minimizes environmental degradation and depletion of biodiversity, and technically and institutionally adequate, socially acceptable, and economically feasible in the long term.

Since past few years, a number of academic researchers have incorporated the idea of sustainable sanitation into their own work (Rosemarin et al., 2012; Bao et al., 2013; Uddin et al., 2014; Okurut et al., 2014; Andersson et al., 2016; Mara, 2018; Odagiri et al., 2021). Suggests

that this idea is still applicable in the modern world given that the global agenda for providing universal access to sanitation facilities for all people has not been accomplished since the MDGs and SDGs were put into place. The four aspects considered in the concept of sustainable sanitation are shown in the following illustration (Figure 4).



Figure 4. Four Aspects of Sustainable Sanitation

Sanitation is one of the most critical basic services for ensuring the safety, resilience, and sustainability of cities and human settlements. Sustainable sanitation systems require infrastructure that is dependable, robust, and durable throughout the service delivery chain, with an emphasis on affordable and equitable access for everyone. Consequently, preserving water quality is a vital objective of sustainable sanitation, which must continue emphasizing the significance of groundwater protection through the appropriate planning and implementation of sanitation systems (SuSanA, 2018).

3.4. Spatial Context and Place-based Approach

Sustainable sanitation highlights environmental concern, in simply, planning of sanitation system must acknowledge the spatial or place context. Academics, legislators, communities, and key stakeholders are increasing their focus on place-based approaches to natural resource and community concerns. Sense of place, attachment to place, place meanings, place dependency, place identity, and place planning are emerging more frequently in academic and governmental papers, as well as in the mainstream media. At a fundamental

level, place ideas acknowledge that understanding emotional linkages and symbolic meanings of habitats is essential for comprehending the ramifications of environmental change and why conflicts over resource management become so controversial (Brandenburg & Carroll, 1995; Greider & Garkovich, 1994; Kemmis, 1990 in Greear, 2005). Inherent to these notions is also the realization that traditional market-based decision frameworks (Galliano & Loeffler, 1999) and western approaches to science have resulted in an underrepresentation of certain meanings and values that people frequently identify with nature, place, or landscape (Williams & Patterson, 1996 in Kruger, 2007).

According to Galliano & Loeffler (1999), planning procedures are gradually acknowledging the significance of the meanings and values that people attribute to locations, as well as the feelings, experiences, rewards, and satisfaction that individuals derive from being in such places. Place-based planning processes offer a forum in which administrators can engage in conversation with the residents, businesses, and tourists of a particular area who have a vested interest in its future. Place-based planning that involves the public helps people understand what Clarke (1971, as quoted in Galliano & Loeffler, 1999) calls "the interactive unity of people and place." Place-based planning is "an endeavour to establish a more democratic, egalitarian method of defining, describing, and valuing locations" (Cheng et al., 2003, p. 101). It is viewed as a means of fostering relationships and sharing power. The approach respects the individuality of each landscape and circumstances, therefore a "one-size-fits-all" template cannot be used.

3.4.1. Spatial Context: Biophysical Characteristic of Small Islands

According to Mujiyani et al. (2002), there are three major problems related to small islands management in Indonesia: (1) the increasing ecosystem degradation due to environmentally unfriendly behaviour, particularly for small islands with dense populations and islands used as economic activity hubs such as tourism; (2) the island community's socioeconomic development is still severely minimal, and as a result, there is an economic gap. This is due to the fact that economic business is only controlled by a small group of people; and (3) due to their remote position and inadequate transportation infrastructure, several small islands are secluded.

Small islands are vulnerable to climate change and prone to exploitation, it also has specific characteristics. These characteristics reflect into a relatively small land area, poor water absorption, a high proportion of rains and landslides draining into the sea, a limited and volatile capacity for clean water, an abundance of endemic species, vulnerability to natural disasters (cyclones), and increasing sea levels (Ramesh & Ramachandran, 1999). There needs

to be more consideration given to the planning of small islands in order to achieve the sustainable development.

The majority of naturally produced freshwater on small islands is groundwater, which is replenished mostly by precipitation. On small islands, despite the importance of groundwater as a naturally occurring source of freshwater, there are frequently few hydrogeological data to guide water management and conservation (Holding et al., 2016). On numerous inhabited low-lying coral islands, the groundwater lens provides a crucial source of freshwater for domestic consumption and agricultural purposes. Lenses are highly vulnerable to salinization by lateral saltwater intrusion and contamination by pollutants, particularly human and animal wastes (Dillon, 1997).

3.4.2. Spatial Context: Sanitation Issue on Small Islands

Groundwater as a source of drinking water may be jeopardized by sewage contamination. This is a particularly serious issue on small and low-lying tropical islands, where surface water supplies are often unavailable and population densities in urbanising areas are rising faster than centralised sewage collection and treatment facilities. On these islands, the soils are often thin, and the aquifers are highly permeable; therefore, they can only be tapped at shallow depths without drawing in salt water. These conditions contribute to a significant risk of microbial and nitrate contamination of groundwater, which can have severe and recurrent effects on the health of local communities that rely on groundwater (Dillon, 1997).

The contamination of groundwater supplies by sewage systems is a universal concern that is especially severe for low-lying island settlements. It is assumed that sanitation systems consist of latrines (or cesspits), septic tanks, and common effluent schemes. Most of the literature on sanitation effects on groundwater quality refers to septic tanks. Septic tanks release water to the soil profile at a higher elevation than is practicable for a latrine, providing for a greater thickness of the unsaturated zone through which infiltration occurs and, thus, a greater degree of contaminant attenuation before the wastewater reaches the water-table. Consequently, it is anticipated that the effects of simple latrines on groundwater quality will be larger than those of septic tanks, which have been extensively studied in the scientific literature (Dillon, 1997). Although qualitative information is available, quantitative research on the effects of latrines on groundwater was not found in the review of the relevant literature (Dillon, 1997).

3.5. Water (and Sanitation) Governance

A governance system is the set of rules and the structures that control and mediate relationships, decision-making, and enforcement from the perspective of an institution. “Water governance” divvy up on what water, when and how, and who has access to water and related services. It includes political, institutional, and administrative rules, practices, and procedures (formal and informal) through which decisions are made and implemented, stakeholders express their interests and concerns, and decision-makers are held accountable for managing water resources and delivering water services (Lerebours, 2016; Wehn et al., 2020). Meanwhile, “sanitation governance” refers to the rules, roles, and relationships that allow sanitation systems to function or not. Nonetheless, in the manual of “Governance of Water and Sanitation” both issues are referred in the same context of governance system which called “Water Governance” (Wehn et al., 2020).

Consequently, this governance system includes national governments, local authorities, the private sector, civil society, and other project stakeholders. There are actors (stakeholders), rules (laws and regulations), objectives, and a situation where the political arena has means and limits, and various actors have different strategies. The OECD (Organisation for Economic Cooperation and Development) has created a set of 12 principles to define, analyse, and assess water governance (Lerebours, 2016). These principles provide a framework for planning, tracking, and implementing effective, efficient, and inclusive water policies. These principles have been developed and discussed through a bottom-up and multi-stakeholder process within the OECD Water Governance Initiative, an international platform established in March 2013 with more than 100 members from diverse water-related sectors i.e., public, private, and not-for-profit (Wehn et al., 2020).

The 12 OECD Water Governance Principles are organized into three groups (illustrated in Figure 5). **Effectiveness** relates to policy objectives that are clear, achievable, and consistent. This includes encouraging managing authorities to coordinate, water management at the right level, policy coherence, and the availability of suitable capacities within managing institutions. **Efficiency** emphasizes sustainable water management at the lowest societal cost. This requires robust and accessible water data, efficient and transparent financial resources, clear, transparent, proportional regulatory frameworks, and creative governance approaches. **Trust and engagement** are intended to ensure stakeholder inclusion and the legitimacy and integrity of the water sector. This relates to the integrity and transparency of the sector, encouraging stakeholders to participate in drafting and implementing water policies, promoting a balanced approach to the interests of users, the environment, and future generations, and ensuring the regular monitoring and evaluation of policies.

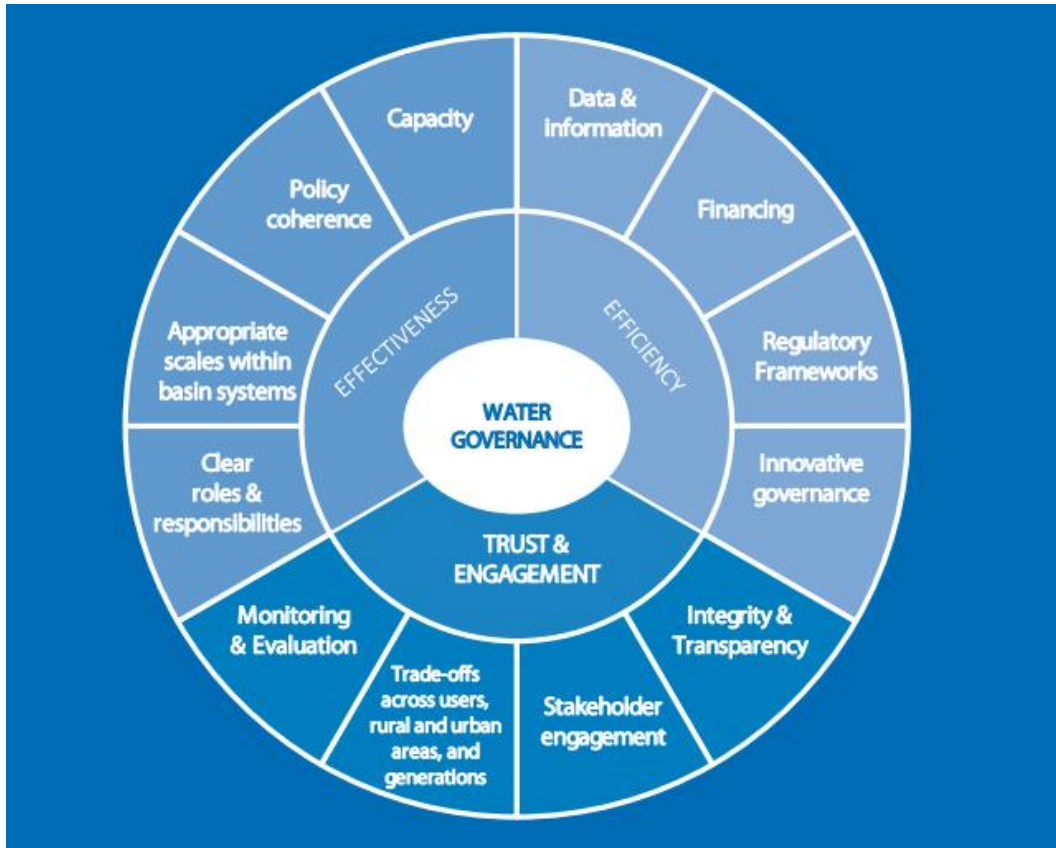


Figure 5. Water Governance Principles

Source: OECD (2015), WGI (2015), Principles on Water Governance, Paris in Lerebours, 2016, p. 14

There are several principles have to be assessed, however considering the spatial context of small islands, the primary evaluation criteria for water governance derived from the OECD and applied to the case study were: 1) multi-level governance, 2) policy coherence, 3) capacity, 4) data and information, 5) the governance-financing nexus, 6) regulatory framework, 7) stakeholder engagement, 8) trades-offs or equity among users, people, and places, 9)and monitoring and evaluation. The selection of these criteria is based on previous research in Mycoo (2018) on water governance assessment in achieving SDGs 6 in in Caribbean Small Island Developing States (SIDS) and Pasaribu (2021) on water governance in Tanjungpinang. In order to assess the water and sanitation governance in Tanjungpinang and Batam, this research utilize multi-level governance approach and mapping the power and actors involved.

3.5.1. Multi-level Governance

Multi-level governance is a framework for comprehending the linkages across many levels of government, as well as with the private sector and non-governmental players, through national, regional, and local policies (OECD, 2010). This framework is required in order to handle the challenges associated with water and sanitation. Any multi-level governance

framework will have at least two distinct dimensions of action and power, and both are worthy of consideration: the vertical dimension across scales or levels of governance, and the horizontal dimension of governance (Bulkeley & Betsill, 2005; Hooghe & Marks, 2003). The vertical dimension of multi-level governance acknowledges that national governments cannot effectively implement national water and sanitation programs without strong collaboration with regional and local governments as agents of change. To take action, however, cities cannot be effective and cannot operate independently from other government agencies. Local policies, for instance, govern the specifics of land use, human settlement, and infrastructure planning, but national development trajectories, policies, technical standards, national budgets, and financial objectives typically limit the room for action and the opportunity for change (Sathaye et al., 2007). It appears from this that actions taken on a local basis may either empower or constrain what is feasible at the national level, and vice versa.

Along the horizontal axis, horizontal co-ordination at the local level encompasses more than mere alliances of local authorities. It is primarily concerned with the many forms of coordination between local jurisdictions within the same urban metropolitan area, the same rural area, or between urban and rural areas. This aspect is not only connected to the requirement of better coordination among line agencies or institutions, but it also deals with cross-cutting policies, which is why it is a highly significant component for urban development policies in general and for environmental issues in particular. Horizontal governance activities include providing a "voice" or influence in the policy dialogue process to business, research, and environmental non-governmental organizations (Gough & Shackley, 2001). This research applies actor mapping and power analysis in order to gain a better understanding of the network of multi-level governance.

3.5.2. Actor Mapping and Power Analysis

Governance systems related to sanitation includes many actors that mostly interact with in the field, as OECD Manual of Governance of Water and Sanitation mentioned below (Table 4). Due to the plethora of actors in the sector, it is essential, prior to initiating a programme, to identify all parties working in the sector, their roles and duties, and the necessary regulatory frameworks. This makes it possible to identify the key players with whom to collaborate, keep an eye upon, and so on. The team will then be able to better target its interlocutors, minimize inappropriate engagement, and improve coherence, efficiency, and durability. Mapping actors and analysing power and information transfers can help to identify unofficial yet influential stakeholders, as potential allies and opponents of a program, and map relationships between actors and networks of influence, thereby determining which stakeholders to target for advocacy purposes. The first step in mapping actors and analysing power is to determine the roles and responsibilities of the sector's various stakeholders.

The very act of compiling a list of all those with formal or informal sway over the issue inspires a more broad and innovative perspective. Mapping stakeholders is also an effective method for identifying the principal decision-makers and individuals directly involved in the decision or able to exert genuine influence. Thus, the objective is to categorize stakeholders as targets, collaborators, opponents, or change beneficiaries.

Table 4. List of actors encountered in Water and Sanitation Governance and Program

Public Sector	Private Sector	Civil Society	External
<ul style="list-style-type: none"> • Ministries (including water, health, the environment, and agriculture) • Water companies • National and global water authorities • National regulatory authority • Drainage basin organisations • National statistical organization • Observatories • Parliament • Courts • Local governments and institutions • (Anti-corruption, human rights, etc.) Commission • Political parties • Politicians 	<ul style="list-style-type: none"> • Public service enterprises (water companies) • Water suppliers • Corporations and businesses • Associations or unions for commerce • Professionals (water salespeople, latrine emptiers) • Banking and financial institutions 	<ul style="list-style-type: none"> • Community members • Water users • Water supply committees • Consumer advocacy groups • Media • Religious Organizations • Research centres • Universities • Social movements and key figures • Trade unions • National non-profit organizations • Community institutions • Traditional authorities 	<ul style="list-style-type: none"> • Bilateral donors • Multilateral donors • International multilateral organisations (UN, World Bank, OECD, etc.) • International NGOs

Source: ODI Research and Policy in Development, Stakeholder Analysis, in Lerebours (2016)

3.6. Technical Details Regarding the Sanitation System

Domestic wastewater contains three components: faeces, urine, and sullage. Blackwater contains faeces and urine, whereas greywater contains sullage. Urine and faeces may contain pathogenic, nitrogen, and phosphorus-based microorganisms. Generally, sullage or greywater contains fat (oil), detergents, and other substances originating from kitchen, laundry, and other non-toilet waste. The mixture of faecal matter is referred to as excreta, while the combination of excreta and rinse water (shower) is referred to as blackwater (Asmadi & Suharno, 2012). There are two types of domestic wastewater management systems and services in Indonesia: (1) on-site wastewater treatment and disposal systems consisting of septic tanks or similar facilities, both at individual and community scale; and (2) newly created off-site or centralized wastewater collection, treatment, and disposal systems consisting of public sewage networks and wastewater treatment plants (WWTP).

On-site systems produce sludge, also known as septage, which must be collected through a process called desludging, transported, and treated either in specialized sewage and excreta treatment facilities Faecal Sludge Treatment Plant (FSTP) or whenever integrated into public WWTP. In addition to private latrines, IPLT may also receive excreta from public bathing, washing, and latrine facilities. Several elements, including population density, settlement type, water source point, groundwater water table, financial capabilities, and operation and maintenance system, influence the choice of sewage disposal system. Table 5 provides a comparison of on-site and off-site systems.

Off-site sewage disposal, also known as communal, is suited for densely populated places due to the limited acreage available for building sanitation facilities. The communal arrangement provides many latrines and toilets for five or six homes that share a single septic tank. The septic tank can be constructed in the center of many houses so that all latrines have equal access to it. This sort of sewage disposal system is appropriate for densely populated areas since it takes a minimal amount of land but provides access to latrines for multiple houses. Each household can perform its own latrine maintenance, but sewage disposal is undertaken collectively (shown in Figure 6).

The installation of municipal sewage disposal is considerably more than a simple application of technology; it is also a social change intervention. If sanitation improvements in urban and rural regions are to be accepted by the community, relevant social and cultural issues must be taken into account during design and implementation. The successful implementation of local sanitation systems is contingent upon social structure, trust, self-health and environmental conceptions, sanitation and health-related beliefs, and the will to change (WHO, 1992).

The primary treatment structure of the local system is located on or near the residential wastewater source. Local systems are technically, fiscally, and institutionally appropriate for rural areas. The local system affords the household (family in residence) the option to be accountable for its management and upkeep. The centralized system is more complex, requires more organized management, and is more expensive. Nevertheless, the local system has clear limits. Soil and groundwater characteristics can make it difficult or impossible to adopt local system solutions. In addition, a large population density will raise the potential of environmental contamination, particularly if this system is located upstream of a water source (WSP, 2011)

Table 5. Comparison of Sewage Disposal System Types

Off Site System	On Site System
<p>Advantages:</p> <ul style="list-style-type: none"> • Provides convenient service • Uses a sophisticated technology • Suitable for high density areas • Prevents pollution of water and soil • Has a relatively long lifespan • Accommodates to store entirety domestic wastewater in the service area 	<p>Advantages:</p> <ul style="list-style-type: none"> • Utilizes a simple technology • Relatively low budget • System is extremely private due to its precise location. • Constructed and managed by an individual • Individually operated and maintained • Possesses direct benefit value
<p>Disadvantages:</p> <ul style="list-style-type: none"> • Requires a large budget • Operation and maintenance must be performed by an expert and cannot be performed by an individual • The duration of planning and development is relatively lengthy • Long-term benefits are limited to households in service areas 	<p>Disadvantages:</p> <ul style="list-style-type: none"> • Cannot be implemented everywhere due to differences in regional physical conditions such as population density, soil permeability, etc. • The function is limited to storing feces (blackwater) • Operation and maintenance are difficult • The potential for water and soil contamination is relatively high

Source: Nurhidayat and Hermana (2009)

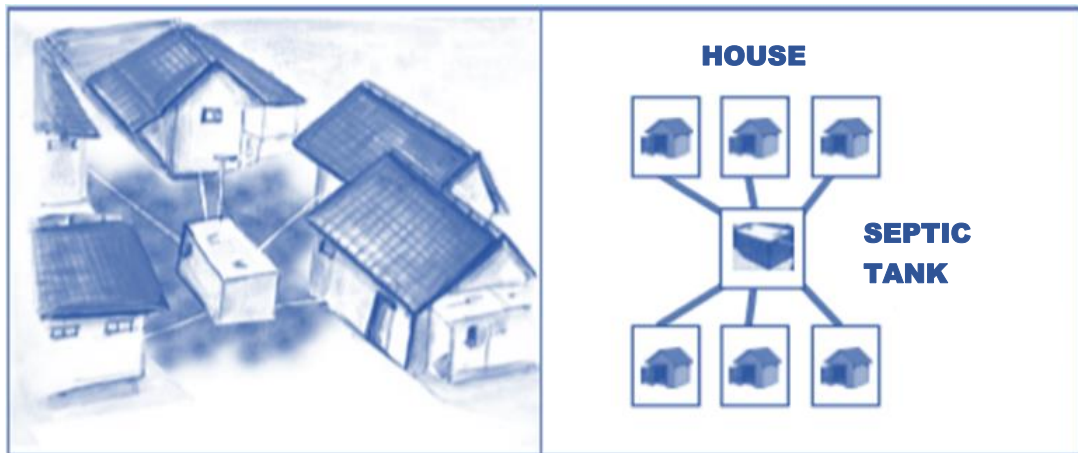


Figure 6. Illustration of Communal (Off Site) Sewage Disposal
Source: WSP, 2009

3.7. Conceptual Model

The figure 7 demonstrates conceptual model of this research. Identifying the spatial context connected to environmental and social circumstances in Tanjungpinang and Batam, as well as the institutional framework and financial arrangement that can be viewed from multi-level governance through stakeholder mapping and analysis, is performed to determine the challenges and potential improvements to sustainable sanitation in small island cities.



Figure 7. Conceptual model

Several academic discourses describe at least four sanitation challenges, including system incompatibility due to regional **biophysical differences** and the lack of **social awareness** on sanitation issues. These two challenges encompass environmental and social facets of the concept of sustainable sanitation and can be evaluated using a place-based approach. This research will examine the environmental and social capacities of the two cities in the context of sanitation, for instance, the availability of alternative uses of clean water sources besides ground water and the demographics (socio-economic) of the population based on the settlement type or economic zone.

Another challenge toward sustainable sanitation is the institutional capacity to govern regulations and gain political legitimacy. In addition, it pertains to financial resources and their allocations. This can be analysed using a multi-level governance approach in order to gain a better understanding of the relationship that exists between the various stakeholders involved. Assessing actors' power can help identify institutional and financial issues in Tanjungpinang and Batam.

Chapter 4: An overview of the sanitation situation in Kepri from national standpoint

4.1. Current Situation: Ongoing Open Defecation Practice

In southeast Asia, 55 percent of the population lacks access to contaminant-free drinking water (known as "improved" drinking water source) and one billion people lack sanitation facilities that separate humans from their excreta, known as "improved sanitation" (WHO, 2019; UNICEF, 2015). Therefore, the need for a specific programs and plans focused on water and associated sanitation and hygiene is relevant for Indonesia. Provision of WaSH is a long-standing and wicked problem in Indonesia that has never been fully resolved. Attaining adequate sanitation targets under the Millennium Development Goals (MDGs), which ended in 2015, and the Sustainable Development Goals (SDGs), which continue to be implemented, has not been optimally accomplished thus far (WSP-EAP, 2015).

During the early stages of the Millennium Development Goals' implementation, Indonesia released program 100-0-100, which has been in existence for over two decades. This program aims to provide 100 percent access to clean drinking water, eliminate all slums, and provide 100 percent access to improved sanitation (WSP, 2009). It was originally slated to end in 2015, but was extended to 2019 (Coconuts.co, 2015). Following that, it was prolonged once more until 2024 in accordance with the RPJMN (National Medium-Term Development Plan) for 2020-2024 (PPN/Bappenas, n.d.). Due to the fact that 5 percent of the population still practices open defecation and 80.29 percent of the population has improved sanitation, Indonesia has not yet achieved universal access to sanitation until today (Nawasis, 2021b, 2021c).

Improved sanitation means having access to a toilet with a latrine that is connected to the on-site system, which is a septic tank. The Indonesian government divides improved sanitation into two categories: basic and shared. Five levels of sanitation criteria have been spelled out in detail by the national government (see Figure 8). The five aforementioned criteria are used to determine the national sanitation index per province.

Open defecation refers to users who do not have sanitation facilities at all. This includes covert discharge defecation, which occurs when users of sanitation facilities dispose of their faecal matter in a pond, rice field, river, lake, sea, or other types of open space area.

Unimproved refers to users in urban areas who have toilet with a gooseneck latrine, but substructure is a simple pit or users who rely on public toilet (sanitation facilities).

Shared refers to users in urban areas who share sanitation facilities (toilet) with more than one household. The toilet consists of gooseneck latrine and communal septic tank. Yet, the septic tank never or very rarely pumped.

Basic refers to individual house sanitation facilities use a gooseneck latrine and septic tank. However, the septic tank is never or very rarely pumped.

Safely managed refers to individual house sanitation facilities that are safely managed use a gooseneck latrine and septic tank that are cleaned up at least once every five years or are connected to a wastewater treatment plant (WWTP).



Figure 8. Sanitation Access Criteria in Indonesia
Modified from source: MPWH, 2020

The Indonesian government, via the Central Bureau of Statistics, gathers data on sanitation improvements per household based on a variety of criteria. According to SUSENAS Kor data (National Socio-Economic Survey) published on the Nawasis portal in 2021b, the percentage of open defecation is 5 percent. Compared to data from 2020, the prevalence of open defecation has decreased by 0.5%. At least fourteen of the thirty-four provinces have an open defecation index lower than the national average (<5%). Kepri is one of four provinces with an index below 1%, though the other provinces, Java and Kalimantan, are geographically located in the large island region (DKI Jakarta, DIY, and Southeast Kalimantan). This criterion also demonstrates, among other things, that the percentage of people in eastern Indonesia who defecate in the open is still relatively high, as shown in Figure 9.



Figure 9. Indonesia Open Defecation Index in 2021
Modified from source: Nawasis, 2021b

Inequality in rural and urban sanitation continues to be a topic of discussion in both government and academic circles. Some suggested that this was due to disparities in economic capacity and accessibility barriers (Irianti & Prasetyoputra, 2021). In general, eastern Indonesia has a lower Gross Domestic Product (GDP) than western Indonesia, with the exception of Papua Barat (West Papua), which is the only eastern province in the top ten highest GDP rankings. West Papua has the seventh-highest GDP in the country, and a significant portion of its GDP is derived from mining extraction (BPS Pabar, 2021). Despite the economic potential, this province has not yet reached the national benchmark for sanitation access. The costs incurred for sanitation purposes are unquestionably subject to additional government oversight, as Rheingans & Moe (2008) refer to this situation as a result of a lack of political will. The manner in which sanitation is prioritized in the government's infrastructure spending budget warrants further examination.

According to Irianti & Prasetyoputra (2021), accessibility is the second factor contributing to sanitation disparities in Indonesia. Unless Papua Barat has a robust economy, transportation and distribution access could be the factor contributing to the region's poor

sanitation access. It is interesting to note that the Kepri have higher sanitation index when discussing the accessibility of the distribution of goods or materials that are expensive due to transportation difficulties. In fact, this province consists of thousands islands and heavily relies on boats and other forms of sea transportation for local transport. Accessibility is also related to obstacles in the installation of sanitation facilities which can lead to a dysfunctional system. Changing climate, extreme weather, drought, heavy rainfall, and flooding, and rising sea levels make it more difficult for small islands to achieve adequate and functional sanitation (Hadwen et al., 2015).

Current data indicates that Kepri have a low rate of open defecation. However, regardless of how small the number is compared to the national rate, Kepri have not yet achieved the 100-0-100 goal of eliminating open defecation. The two factors discussed at the national level may not be necessarily the most significant obstacles to WatSan management in Kepri. Based on this criterion, Kepri's economic strength as the province with the fourth-highest GDP demonstrates its success in gaining access to sanitation. Kepri is one of 14 provinces with a lower open defecation rate than the national average (see Table 6). Seeking how the government allocates funds for sanitation needs and coordinates them in a more detailed institutional arrangement, as outlined in the three main pillars of the Water Governance Principles (Lerebours, 2016), must be examined to determine whether the economy poses a challenge or offers opportunities for sustainable sanitation in Kepri. On the other hand, Kepri have difficult geographical access compared to other provinces which are not archipelagic region. Knowing how Kepri is addressing these issues can provide a more complete picture of other factors that contribute to the realization of sustainable sanitation for other small island cities. Yet, sanitation index in Indonesia also be evaluated based on other criteria, this also has a connection to the sanitation targets at local and national level.

Table 6. GDP and Open Defecation Index of Indonesian Provinces

No.	Province	GDP Per Capita* (Thousand Rupiah)	Open Defecation Index**
1	DKI Jakarta	274709.59	BN
2	Kalimantan Timur	182540.82	BN
3	Kalimantan Utara	155080.62	BN
4	Kepri	130125.23	BN
5	Riau	129852.59	BN
6	Sulawesi Tengah	81733.04	AN
7	Papua Barat	73539.00	AN
8	Jambi	65193.22	AN
9	Kalimantan Tengah	62912.85	BN
10	Jawa Timur	60043.33	AN
11	Sulawesi Selatan	59656.24	BN
12	Kep. Bangka Belitung	58338.82	BN
13	Sumatera Utara	57569.79	AN
14	Sumatera Selatan	57487.44	AN
15	Banten	55210.65	AN
16	Sulawesi Utara	54043.18	AN
17	Papua	54034.26	AN
18	Sulawesi Tenggara	52293.97	AN
19	Bali	50381.21	BN
20	Kalimantan Selatan	46712.68	BN
21	Jawa Barat	45299.58	BN
22	Sumatera Barat	45293.75	AN
23	Kalimantan Barat	42282.9	AN
24	Lampung	40950.42	BN
25	Maluku Utara	40302.32	AN
26	Di Yogyakarta	40229.83	BN
27	Bengkulu	39143.43	AN
28	Jawa Tengah	38669.11	BN
29	Gorontalo	37170.45	AN
30	Sulawesi Barat	35036.02	AN
31	Aceh	34680.46	AN
32	Maluku	26072.98	AN
33	Nusa Tenggara Barat	26002.48	AN
34	Nusa Tenggara Timur	20581.13	AN

* GDP Regional based on Applicable Price, Sort Largest to Smallest
Source: BPS, 2021d

** BN = Below National Index (<5%)
AN = Above National Index (>5%)
Source: Nawasis, 2021b

4.2. National Target: From “Improved” to “Safely Managed” Sanitation

Although 73 percent of urban Indonesians had access to proper sanitation in 2010, this statistic is based solely on access to basic sanitation, which does not guarantee the availability of a safe collection and disposal system for domestic wastewater and faeces. Only 1% of wastewater and 4% of faecal sludge have been collected and treated safely (Harahap et al., 2021). This is suspected to be the cause of faeces contamination of water sources and septic tank explosions. Since Ministry of Health (MOH) drinking water quality study, UNICEF Indonesia (2020) cites that nearly 70% of household drinking water sources are contaminated with faeces. In February 2022, UNICEF Indonesia utilized the findings of this study to launch the #DihantuiTai (English: Ghosted by *Shit*) campaign. Although, Indonesia has made significant strides in enhancing the quality of basic sanitation, there is still a great deal of room for improvement. However, the percentage of homes that have toilet facilities with closed connections to their septic tanks and who clean their tanks on a consistent basis at least once every five years (Safely Managed Index) is lower than 8% (CNN Indonesia, 2022). As a direct consequence of this, improper management of faecal waste results in pollution of the environment and the water sources in the vicinity.

The explosion of the septic tank is an additional cause for concern. The Bappenas Directorate of Urban, Housing, and Settlements reported in 2019 that there was an explosion in Cakung that resulted in fatalities (Nawasis, 2020). Even the office building for the House of People Representative (DPRD) in Bontang was affected by the same incident (Sartika, 2019). It demonstrates that the development of sanitation infrastructure is not taken seriously by both individuals and government institutions. According to Esrey et al. (1998) in Jewitt (2011), the majority of people currently deal with sewage using only "flush and discharge" systems or "drop and store" approaches, which lack adequate plumbing connections or sewers. Sanitation appears to still have a low profile, making it difficult to attract serious attention and investment in infrastructure development. Yet, sanitation requires not only physical structures and the government's financial capacity to develop WWTP or FSTP, but also the participation of the community. In 2018, 85.29 percent of urban households in Indonesia use septic tanks as sanitation facilities. Despite this, only 1-2 out of 10 households have emptied their septic tank within the past five years (Nawasis, 2020).

Improved sanitation, such as sewer collection and conveyance systems, can still cause environmental and health issues without proper resource allocation, especially final wastewater treatment. In the Pacific Islands, for instance, improperly maintained and sized septic tanks have contributed to the deterioration of groundwater quality, which exacerbates the problem of water insecurity (Adeoti et al., 2020). Similarly, public sewerage systems that discharge untreated sewage into water bodies are likely to harm the biodiversity of fragile

ecosystems, such as coral reefs, upon which tourism activities in small island regions depend heavily. Inadequate investments in wastewater treatment, among other factors, hinder the operation and maintenance of existing infrastructure systems. In light of SDGs 6's expectations and the fact that 80.29% of Indonesians now have access to "improved" sanitation (existing facilities), the Indonesian government has set a new target to be attained by 2030. The government has now established a goal for "safely managed" sanitation. MPWH is cited in the Directorate of Sanitation Strategic Plan Document 2020 (see Table 1, NA5). The main sanitation target for domestic wastewater is the increase of households with access to basic sanitation to 90%, including 15% of households with access to sanitation that is safely managed. This target is planned for 2024 in accordance with the 2020-2024 RPJMN and Presidential Regulation No. 18 of 2020.

According to BPS 2021 statistics, at least 18 of Indonesia's 34 provinces have achieved the national percentage for improved sanitation, one of which is Kepri (Figure 10). Kepri themselves have reached 91.62 percent, meaning that the national goal for 2020-2024 has been surpassed. However, this achievement does not match the number of safely managed sanitation facilities, as Kepri only reached 12% (BT4, TJ2). As global problems are related to dysfunctional and inadequate systems, it is important to evaluate whether a region has a valuation scheme, willingness to pay, political will, and robust water and sanitation governance. In addition, in what extend urban development has recognized geographical challenges and integrated them into education and politics (Kruger & Williams, 2007).

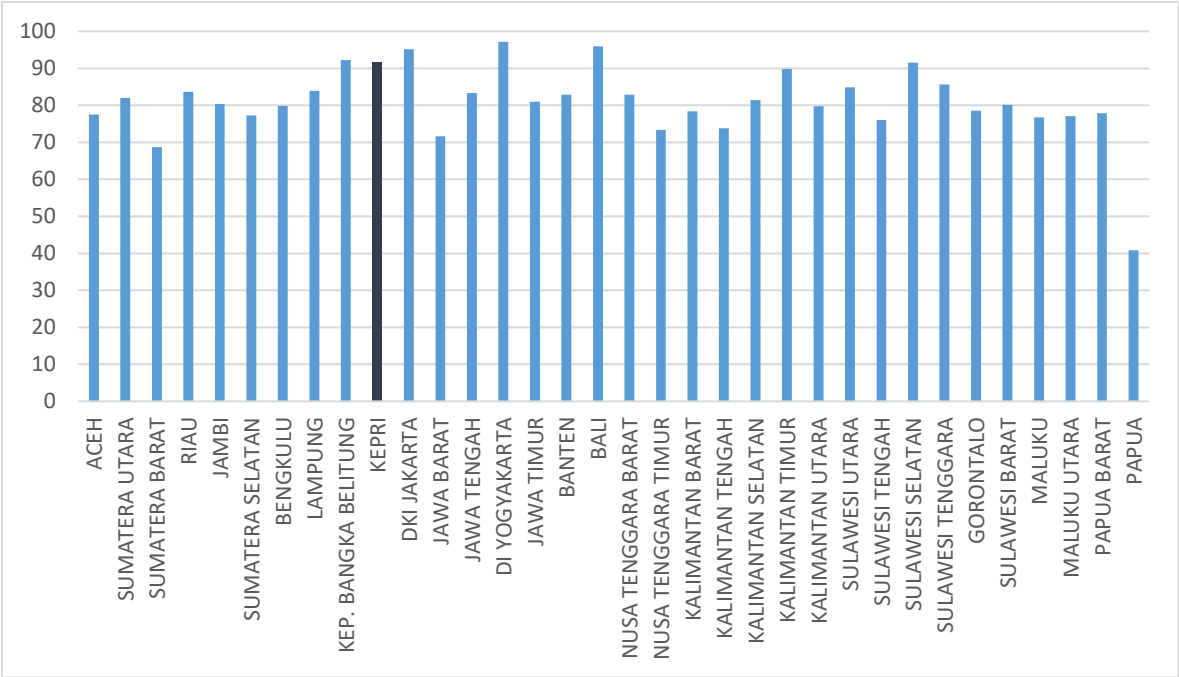


Figure 10. Percentage of Households by Province Having Access to Improved Sanitation 2021
Source: BPS (Appendix 3)

4.2. PPSP: An Established Program that has not reached the Goal

Prior to establishing the target for expanding access to safe sanitation, the Indonesian government faced the challenge of ensuring that at least 50 percent of the population had access to improved sanitation. Since 2009, the Indonesian government has been working to develop sanitation in accordance with Millennium Development Goal 7 (MDGs) on water and sanitation. Ever since, the government has pledged to halve the number of people who lack access to safe drinking water and adequate sanitation by 2015. During the 2009 National Sanitation Conference, the Vice President of Indonesia launched the PPSP program, a long-term initiative (Nawasis, 2020). *Percepatan Pembangunan Sanitasi Permukiman* (PPSP) is a program for accelerating of residential sanitation development run by MPWH that focus on three subject which are wastewater, solid waste, and drainage. This program has several goals, main three of which are as follows (AMPL, n.d.):

1. Put an end to **open defecation** in urban and rural areas by 2014.
2. Elimination or at least reduction of waste destined for landfills at their points of origin and management of waste in a way that is friendly to the environment
3. Reduction of flooding in 100 districts/cities covering a total area of 22,500,000 hectares

PPSP aims to reach 330 cities/regencies throughout Indonesia by 2015. In fact, the accomplishment's outcomes were much more impressive than expected. This program has been ongoing since then (AMPL, n.d.). Although the government views the program as an achievement, the wastewater component lags the other two areas: solid waste and drainage. Goal 1 of the PPSP has not yet been achieved, but this does not indicate that the program has failed. Indonesia has shown a strong commitment to achieving MDG 7 and, subsequently, SDGs 6 through this program. PPSP is anticipated to serve as a framework for numerous sanitation sector development-related activities. Currently, each municipality maintains its sanitation development by referring to SSK (City Strategic Sanitation Document) created for that municipality through PPSP.

PPSP also became the basis for the creation of two working groups (in Indonesian called as POKJA), namely POKJA AMPL and POKJA PKP. AMPL is a working group that focus on water supply and sanitation, while PKP is a working group for housing and settlement. Both organizations operate under the auspices of the MPWH, which collaborates with numerous other institutions. The following are national members of POKJA AMPL and PKP: Ministry of Internal Affairs (MIA); Ministry of Health (MOH); Ministry of Education and Culture (MEC); Ministry of the Environmental and Forestry (MEF), Ministry of Finance (MOF), and BPS. It appears that many institutions are horizontally coordinated in an effort to provide universal

access to water and sanitation. Inviting MEC to participate in PPSP demonstrates not only the extent to which this has been quantified, but also the extent to which cross-sectoral integration has been achieved. Gough & Shackley (2001) stated that horizontal governance activities could be a venue for providing a 'voice' in the policy dialogue process to other parties who do not appear to be directly in charge of the urban planning in conundrum.

Horizontal axis unquestionably contributes to the process of achieving the expected effectiveness and efficiency in water governance (When et al., 2020). However, it is inescapable that policies and subprograms could also overlap (Bulkeley & Betsill, 2005). Due to efforts to clarify roles and responsibilities, not all participating institutions deliver the same contribution and capacity. In particular, Figure 11 illustrates that AMPL and PKP working groups collaborate on PPSP program under the auspices of four major organizations. OECD (2010) explains that identifying key players reduces inappropriate engagement and improves coherence, efficiency, and durability. Mapping actors and analysing power and information transfers can help identify unofficial yet influential stakeholders as potential allies and opponents of a program. Mapping relationships between actors and networks of influence can help determine which stakeholders to target for advocacy purposes. At least four significant government institution strengths can be identified in the implementation of the program carried out by Pokja AMPL and PKP. However, the roles of the private sector, civil society, and other external groups remain unclear.

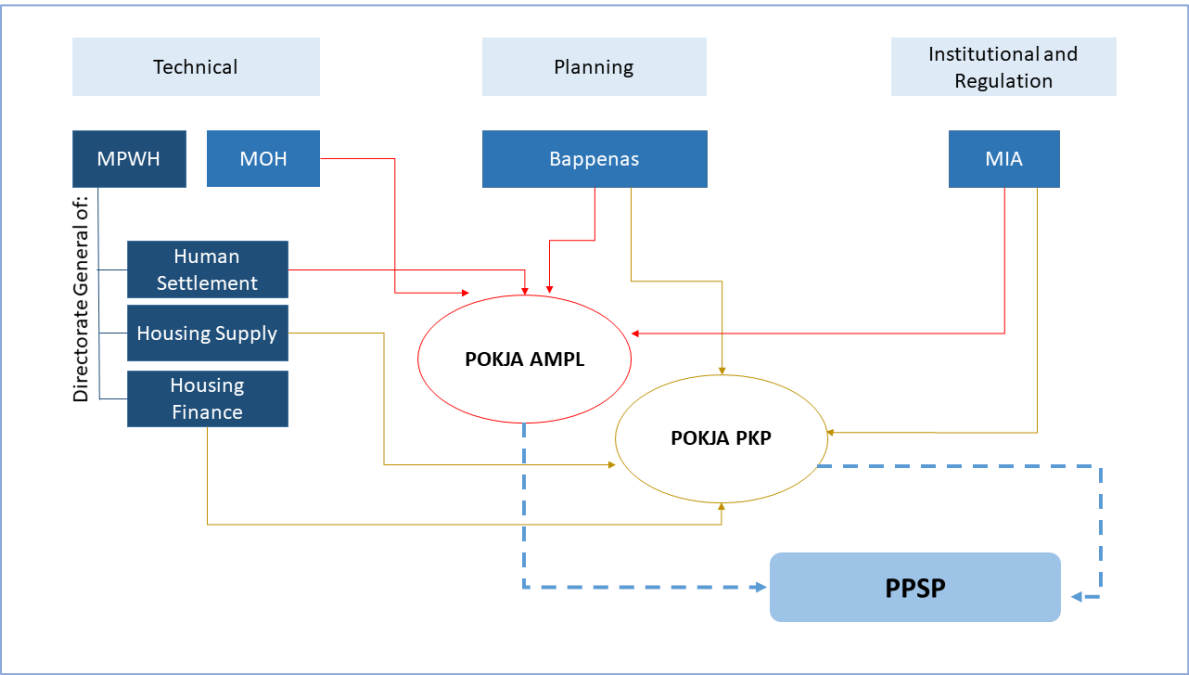


Figure 11. National Streamlines of AMPL and PKP Working Group for the PPSP program
 Modified source: Mustar et al., 2018, p. 4

Coordination for PPSP is established not only at the national level, but also at the subnational and local levels. Presently, nearly every province and city have its own AMPL and PKP working group. The regional planning board or Bappeda, which may also be referred to as Bappedalitbang in some other cities, oversees planning and coordination that takes place between the various local institutions for PPSP program. These two agencies (Bappeda and Bappedalitbang) have different names, but they perform the same function and operate under the supervision of Bappenas. National, provincial, and local municipalities seek to synchronize sanitation development objectives and strategies through PPSP. It shows how multi-level governance work within horizontal and vertical coordination. The national government, via BPPW (Regional Board for Settlement Infrastructure under the MPWH), provides financial and technical assistance by hiring individual consultant for a city/regency. Regrettably, this assistance is not provided to all cities. Local governments must meet certain requirements in order to receive such assistance such as strong commitment from mayor and governor (political will), high population, and inadequate sanitation coverage (NA6). This aid is intended to guide local governments as they complete the *Buku Putih Sanitasi*, a document contains an assessment of the city's sanitation conditions, and its findings act as a guideline for the SSK document (according to UR, PS, DD interview).

Currently, not all of Indonesia's cities have progressed to the formulation stage of the SSK. Tanjungpinang and Batam are two cities in the Kepri that have been designated as SSK for 2018-2022 (BT3, TJ2). These two cities even received assistance in 2021 for the implementation of the SSK. PPSP seems to be a successful national program when viewed from the perspective of how political legitimacy has kept this program running through all three presidential terms. This accomplishment can be measured in terms of the program's continued existence. Nonetheless, the 2014 goal to eliminate open defecation has not been met, neither locally (in Tanjungpinang and Batam) nor nationally. This fact demonstrates that bigger difficulties need to be examined, or, from an optimistic standpoint, that there is still room for improvement. As an archipelagic nation, Indonesia requires this optimistic perspective in order to guide small island cities in their efforts to achieve SDGs 6.

Chapter 5 Sanitation Development in Tanjungpinang and Batam

5.1. Behind the Statistics: How Challenging is it to Achieve Sustainable Sanitation?

Small islands, typically characterized by their small size, remoteness, and prone to environmental threats, present unique development challenges. The small landmass and population of small islands impose limitations on their domestic technical and institutional capacity, prevent economies of scale, and cause land competition (Adeoti, 2022). Infrastructure that is sustainable, resilient, and inclusive plays a key role in addressing these challenges and presents opportunities to capitalize on the one-of-a-kind resources that are inherently present on small islands. The characteristics of biophysical feature, social capital, investment capacity, and coordination through stakeholders are required to be incorporated into the infrastructure planning. Sustainable sanitation requires much more than the construction of infrastructure such as septic tanks or wastewater treatment facilities. It incorporated how a city and its planning could provide a valuable service to the public over an extensive period of time, requiring a commitment from the government and the community (Melosi, 2008).

As stated in the previous chapter, Kepri have made significant sanitation advancements in comparison to other provinces in Indonesia (Figure 10). In view of the foregoing, even due to their geographical characteristics, Kepri are able to exhibit positive sanitation development metrics. BPS reports that in 2021, Kepri had a higher percentage of households with access to improved sanitation than the national average of 91.62 percent (Appendix 3). However, the number does not indicate that sanitation outcomes in Kepri have been met equitably each city/regency. BPS Kepri reports updated data on the percentage of Kepri households with improved sanitation in 2017-2019 (Figure 12). The data shows that Tanjungpinang and Batam have the lowest percentage compared to other (rural) regencies. It thus exemplifies the significant disparity in sanitation development between the two cities and provincial accomplishments, as well as the serious problems in small island urban areas. Surprisingly, the numbers that were published by BPS Kepri are not equivalent to the ones that were contained in the sanitation policy advocacy materials and SSK documents that have been produced by the two cities (BT3, BT4, TJ2, and TJ3). After only one year, BT4 mentioned that 94.9% of Batam has access to improved sanitation. Meanwhile, Tanjungpinang claims to have achieved 86.7% in 2021 (TJ3). Table 7 and 8 depict information cited from BT4 and TJ3.

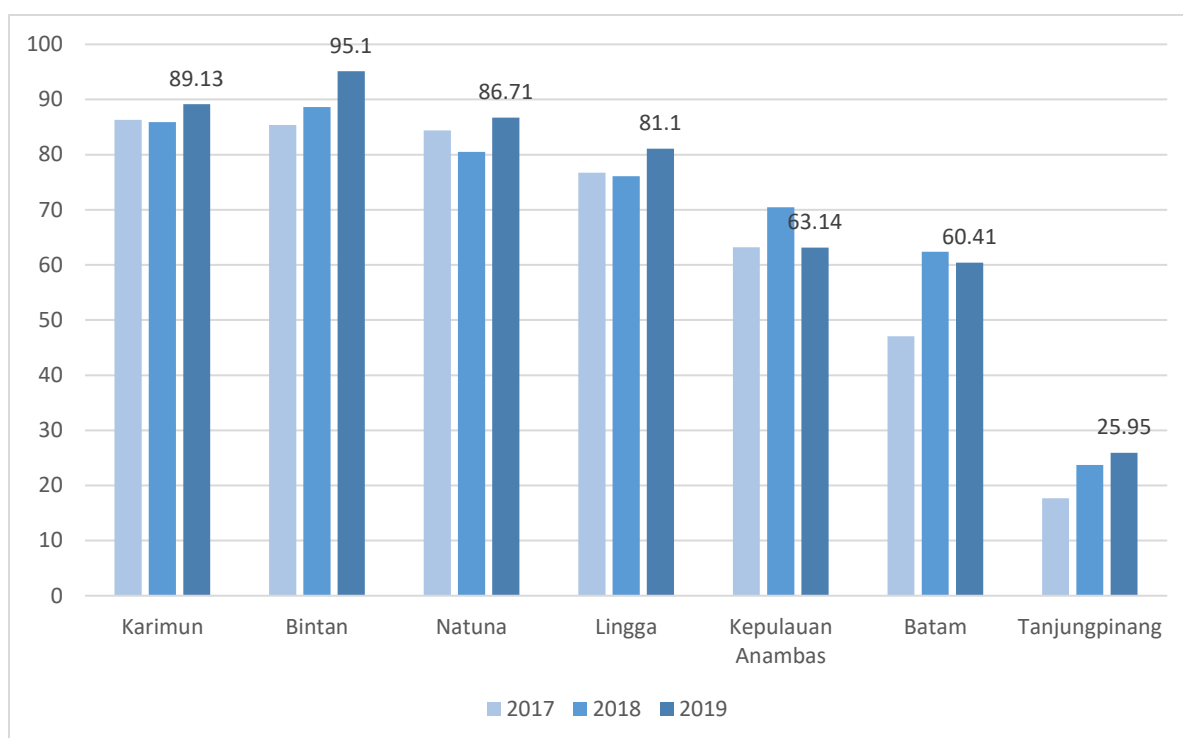


Figure 12. Percentage of Households with Access to Improved Sanitation by Regency/City in Kepri
Source: BPS Kepri (Appendix 4)

Considering the disparity between these numbers, it is possible to conclude that several WatSan Governance principles appear to be questionable. One of those principles is provision of data and information. It is a component of the efficiency pillar and the foundation for synchronizing other aspects including financing, regulatory frameworks, and innovative governance (Lerebours, 2016). The bias in information from government institutions such as Bappeda, BPS national, and BPS regional demonstrates an insufficient horizontal and vertical relationship. Any multi-level governance framework will have at least two distinct dimensions of action and power, and both are worthy of consideration: the vertical dimension across scales or levels of governance, and the horizontal dimension of governance (Bulkeley & Betsill, 2005; Hooghe & Marks, 2003). In the realm of trust and engagement, there are two principles whose validity must be challenged, first is monitoring and evaluation, and second is integrity and transparency. These two principles are essential for the development of long-term policy and coordination. Both have a significant impact on the determination of inclusive planning and its implementation. On the other hand, the failure of these two principles can also lead to ongoing sanitation problems, such as shortcomings in system selection or design (Baum et al., 2013), a lack of public attention and support (Black & Fawcett, 2008), and inadequate investment in sanitation infrastructure (Komives et al, 2005).

Table 7. Profile of Domestic Wastewater Management in Tanjungpinang (Gap Rates)

Criteria	RPJMN Target 2020-2024 (%)	Target - 2024 (%)		Short-term target	Achievement in 2021 (%)	Gap to Target 2024 (%)	Gap to Short-term Target (%)
		Kepri	Tanjungpinang	Tanjungpinang			
Safely-managed	15%	12.0%	12.0%	10.0%	2.7%	9.3%	7.3%
Improved:	90%	90.0%	95.0%	75.0%	86.3%	8.7%	-11.3%
Basic (improved)	0%*	0%**	83.0%	65.0%	82.5%	0.5%	-17.5%
Shared (improved)	0%*	0%**	0.0%	0.0%	1.1%	-1.1%	-1.1%
Unimproved	0%	0.0%	0.0%	0.0%	4.2%	-4.2%	-4.2%
Open Defecation	0%	0.0%	0.0%	0.0%	10%	-10.0%	-10.0%

Source: TJ3, p. 6.

Table 8. Profile of Domestic Wastewater Management in Batam (Gap Rates)

Criteria	RPJMN Target 2020-2024 (%)	Target - 2024 (%)		Short-term target	Achievement in 2021 (%)	Gap to Target 2024 (%)	Gap to Short-term Target (%)
		Kepri	Batam	Batam			
Safely-managed	15%	12.0%	17.0%	14.0%	11.0%	6.0%	3.0%
Improved:	90%	90.0%	100.0%	96.0%	94.9%	5.1%	1.1%
Basic (improved)	0%*	0%**	83.0%	82.0%	83.2%	-0.2%	-1.2%
Shared (improved)	0%*	0%**	0.0%	0.0%	0.6%	-0.6%	-0.6%
Unimproved	0%	0.0%	0.0%	0.0%	1.2%	-1.2%	-1.2%
Open Defecation	0%	0.0%	0.0%	2.0%	4%	-4.4%	-2.4%

Source: BT4, p. 18.

In essence, statistics can only provide a broad overview of an actual condition. Therefore, the process of extracting details regarding the challenges currently facing by the cities of Tanjungpinang and Batam can be accomplished by analysing the data collected via sanitation profiles (SSK), media coverage, and interviews with local government (Bappeda/Bappedalitbangda), representative of national government (BPPW), and planning practitioner (individual consultants). In accordance with the notion of sustainable sanitation, these findings have been classified into the following four categories: environmental, social, financial, and institutional. It is expected that Tanjungpinang and Batam will be able to describe how small island cities are attempting to combat the stigma of water and sanitation infrastructure marginalization through the following descriptions of the challenges they encounter.

5.1.1. Geography of Sanitation Inequality: Small vs Smaller Islands

Tanjungpinang City has a land area of 131.54 km², while Batam City is 1034km². As the provincial capital of the Riau Islands, Tanjungpinang has the smallest land area of any of the cities or regencies there (BPS Kepri, 2022). In addition, the city has the fewest number of small islands located outside of the mainland (Bintan). At least two separate small islands in Tanjungpinang are inhabited and classified as sub-district (*Kelurahan* or urban village) entities, namely Penyengat and Kampung Bugis. According to the data (TJ1), Penyengat is the only high-risk area for environmental damage due to inadequate domestic wastewater management (see Figure 13). Penyengat is a popular tourist destination in the Riau Islands, but infrastructure development there has been hampered by inadequate transportation access that can only be reached by small boats (Murtiono et al., 2021). Additionally, the majority of the residents live in houses that are built on the sea, also known as floating or stilt houses, which makes it nearly impossible to install piping and construct septic tanks (Lalasati & Hadi, 2019). Batam, a second study location, also exhibited poor sanitation in the smaller island regions.

Batam City is an administrative area consisting of more than 370 islands. It is comprised of three large islands: Batam Island, Rempang Island, and Galang Island (BT3, BT4). The Batam City Government and BP Batam classify these three islands as mainland areas, while the rest areas (smaller islands) are identified as hinterlands (see Figure 14). The population of the mainland is 1,105,906, while the hinterland has only 51,786 inhabitants. Although the number of residents in the hinterland is smaller, the majority of open defecation in Batam city, which accounts 12,481 households, 63% occurs in this geographical area (BT4). This circumstance demonstrates that disparities in sanitation are not only present on a large scale (national and provincial), but that they also exist on a more localized level.

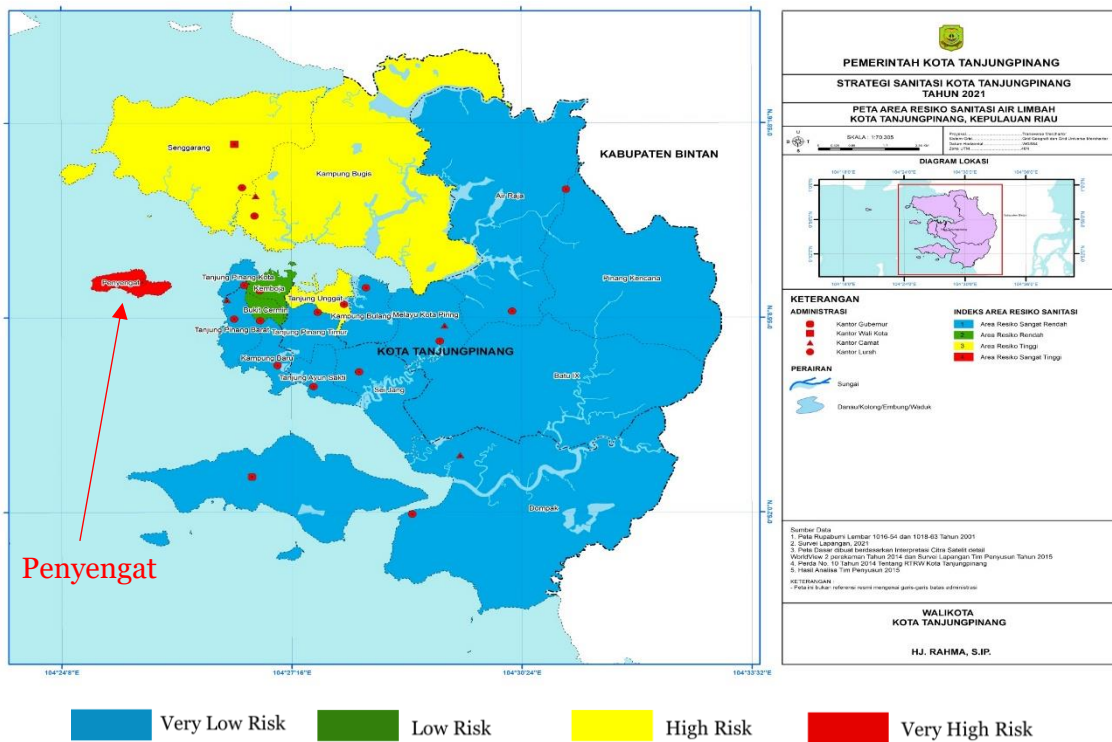


Figure 13. Map of the Domestic Wastewater Sanitation Risk Area in Tanjungpinang City 2021
 Source: TJ2, p.11



Figure 14. Batam City Imagery
 (Three large island: Batam, Rempang, Galang, refer as 'Mainland')
 Source: Google Earth, 2020

According to Mujiyani et al. (2002), several small islands are marginalized due to their remote location and inadequate transportation infrastructure. Small islands' remoteness makes establishing wastewater treatment infrastructure difficult, which hinders sustainable water management. For example, only one-third of the population in Small Islands Developing States (SIDS) has sewer connections, and only 59% of wastewater undergoes secondary water treatment (Adeoti et al., 2022). Nonetheless, improvements to water treatment infrastructure are still a distant possibility for a number of island nations. Head of Natural Resources and Environment Subdivision of Bappelitbangda Batam, QF, mentioned the technical problems of sanitation regarding the biophysical features on Small Island.

Even though households in the smaller island areas (of Tanjungpinang and Batam) are utilized their toilet with a latrine and septic tank. Given that there are no faecal-degrading trucks (vehicles) that can reach these areas, access to safely managed sanitation seems practically impossible. Transport access can only accommodate a limited number of passengers and two-wheeled vehicles.

The individual consultant for PPSP Batam City (PS) emphasizes that geographical factors pose the greatest obstacles to achieving SDG 6 for the city:

Basically, there is no problem on mainland Batam because it has been effectively managed of using a regional (city-scale) WWTP... in contrast, hinterland areas (small islands outside the larger islands) have problem due to geographical constraints. Even though on a communal scale WWTP can reach 50 households, due to the location of stilt houses that are far apart (inland settlements), no more than ten households can connect. The length of the pipe from the communal WWTP to the houses is approximately thirty to fifty meters.

Small islands are geographically isolated from mainland clearly difficult achieving sustainable sanitation. It does not mean that the mainland does not face significant problems. IR (Unit Manager of Environmental Management, BP Batam) and TW (Interim Head of Bappelitbangda Batam) reported that the Batam mainland area has seven WWTPs, but that 86.29% of wastewater in Batam City is still managed improperly (BT3). Unsafe management can lead to the pollution of water bodies, including the sea, rivers, and even reservoirs, which are sources of clean water and drinking water in both. The discharge of feces and other domestic waste water into the Duriangkang Reservoir not only reduces the reservoir's water quality, but also increases sedimentation, which has the potential to cause flooding or impair the reservoir's performance (Danielf, 2022; Sugiyanto, 2020)

Geographic constraint between small islands and the mainland makes achieving sustainable sanitation challenging for the hinterland community. Yet, it does not imply that there are no significant problems on the mainland. According to according to IR and TW, Batam mainland has seven WWTP sites, but 86.29% of wastewater in Batam City is still improperly managed (BT3). Unsafe management can result in the contamination of water bodies, such as the ocean, rivers, and even reservoirs, which are sources of both clean water and drinking water. In Batam, the discharge of faeces (domestic wastewater) that contaminate the Duriangkang Reservoir not only decreases the water quality and jeopardizing the health of water users. Also, it increases sedimentation, which has the potential to cause flooding and impair the reservoir's performance (Danielf, 2022; Sugiyanto, 2020) According to IR, the technical aspect of the construction of pipe connections for a city-scale WWTP in Batam was the cause of the difficulty in ensuring proper wastewater treatment. The process of working on the off-site house pipe connection to WWTP Batam Centre was hampered because at several locations, it was only discovered that there was a permeable soil layer after drilling had been done. This ended up causing a delay in the project. It is also responsible for the contamination of groundwater and reservoirs with faeces.

Currently, Batam Island is the only location in Batam City with a low risk for wastewater pollution. Even the other two major islands are classified as high-risk (Figure 15). Although the area of the island at high risk emerges spacious, the majority of people live on Batam Island. Due to the use of household standards in the measurement of sanitation rate, this tends to make Batam City's sanitation access superior to that of Tanjungpinang. Nonetheless, the whole geographical challenge makes it abundantly clear that the issue of sanitation is a question of equality, as mandated by SDGs6 'no one left behind' and the principle of water governance, which must resolve trade-offs between specific territories, users, and generations (OECD, 2015). The place-based approach could perhaps serve as a planning framework for sanitation infrastructure because it takes into account more than just the abiotic characteristics of a location, such as land area, clean water sources, and soil type. In addition, biotic components, such as biodiversity and the sustainability of potentially polluted marine and terrestrial ecosystems, as well as long-term health of human beings, are considered. This approach also raises emotional factors such as shame, comfort, and human relationships with the natural environment in which they live and work (Galiano & Loeffler 1999).

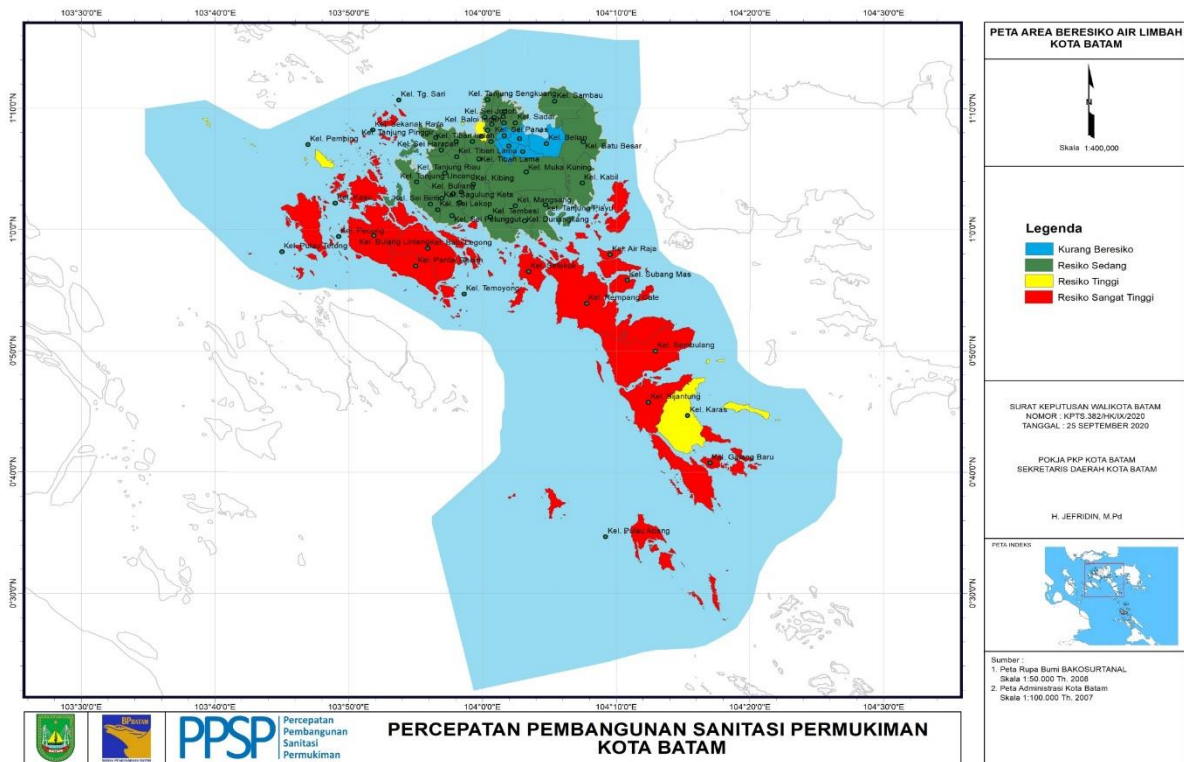


Figure 15. Map of the Domestic Wastewater Sanitation Risk Area in Batam City 2020
Source: BT4, p.35

5.1.2. Does 'shit' get accepted differently in different places?

Geography has an impact on more than just the choice of infrastructure for dealing with how domestic wastewater is managed and where human waste is stored. In addition to influencing the ways in which people conduct their lives and the norms they adhere to in various aspects of life. Escobar (2001) emphasized that culture and environment exist in-situ and that people are connected to the places where they reside. He argued that people mobilize around places because they have personal and collective ties to them. Spatial variations have an impact on the ways in which people manage their livelihoods strategies and even their concern toward environmental issue. Recent research has investigated the "where" question in relation to urban policy and planning issues at the intersections and interstices of space and place, such as place-making, urban design, and identities (Agyeman, 2013). It focuses on the possibility of culturally inclusive spaces and practices, as well as the broader challenges of planning for sustainability in increasingly sociocultural cities, which Fincher & Jacobs (1998) refer to as "cities of difference."

The ideas that Fincher and Jacobs brought up are coherent with the place-based approach. Appreciating the physical and non-physical differences in the area opens the door to an inclusive dialogue based on a comprehensive understanding of the concept of "better

living conditions" for all. Anguelovski argues (2014) that people's sense of belonging to a specific location emerges from their interactions with the natural and built environments as well as the social and political structures of that location. People who reside in urban areas differ from those who reside in rural areas, as well as the events that transpired in the case study area. Communities on the islands of the archipelago have their own unique set of socioeconomic traits that set them apart from those on the continent, where major cities like Java and Sumatra are located. From local point of view, residents of Batam and Tanjungpinang who live on small islands far from the city centre (mainland) likely have distinctive social characteristics due to differences in transportation accessibility and sanitation facilities availability.

The ethnographic investigation into cultural attitudes towards *shit* in Ghana (van der Geest, 1998 in Jewitt, 2011) reveals that faeces are taboo among the Akan community, where the emptying of toilet buckets and cleaning of public lavatories is done by *krufoo* (in local language refers to 'people of the night') from Sierra Leone and Liberia. No member of the Akan community would ever consider performing such filthy and low-paying labour. Once *shit* are still considered taboo to discuss, even in the context of social interactions, it will be difficult for stakeholders to pay close attention to the provision of sanitation access (Jewitt, 2011). She continued by stating that breaking the taboo and bringing the topic of excrement to the forefront is necessary to achieve inclusive sanitation development, which includes bridging the gap between those who live in disadvantaged and slum areas. The greater the variety of social geographies represented by diverse cultural backgrounds, the greater the likelihood of developing an engaging strategy and plan for potential users.

According to research conducted by Mardotillah et al. (2019) on the influence of beliefs, knowledge, and attitudes on access to latrines in urban Indonesia. Most people believe that the toilet is a filthy place due to the fact that it is used to dispose of human waste. In order to avoid this, they prefer to construct a toilet outside the home or close to a body of flowing water, such as a river or sea. This appears to be the cause of the ongoing open defecation problem in Indonesia. In accordance with Mardotillah et al. (2019), belief remains the primary foundation for social norms in Riau Islands as well. Riau Islands which were previously part of the Islamic Malay Kingdom also have views regarding the disposal of human waste. According to Hutchinson and Chong (2016), the community that lives on these islands is expected to protect their home from any "filthy and messy" activities, whether these words are interpreted directly or indirectly. Evidence like this suggests that people, especially those residing in coastal areas, would rather dispose of their waste directly into the ocean.

DD, as the individual consultant for the city of Tanjungpinang, pointed out that the social aspect is a significant obstacle to the implementation of the PPSP program in this city.

Unless Batam is plagued by geographical issues and a large population, Tanjungpinang City, a pioneer in historical and cultural tourism, is a stark contrast. Although PPSP program has provided technical and financial assistance for the construction of communal septic tanks and public toilets for coastal communities, but the infrastructure is frequently not maintained as expected. According to DD, City Department of Health (DOH) is in charge for socialization prior to the construction of sanitation facilities that arranged by Department of Public Works and Spatial Planning (DPWSP).

In a social sense, the development of the Communal sewage is intended for the community by the community, but in practice, there is no pre-development trigger (socialization). When we talk about sanitation, there should be a dialogue facilitated by the Municipal Health Office so that people understand how important sanitation is for their health, and that they are expected to maintain sanitation as they already know what it means.

Sustainable sanitation is a concept that emphasizes hardware and software installation synchronization. Thus, this strategy is in line with the concern that brought up by DD. The challenges in Tanjungpinang highlight the ineffective coordination between two agencies responsible for designing the hardware and software. Sanitation achievements based on the number of toilets do not provide long-term understanding across generations if facilities are provided without first establishing the trust and knowledge of potential users.

Jewitt (2011) mentioned that many flush-toilet sewage systems do not meet the sanitation requirements of developing nations. Esray (2001) criticizes such systems for being based on nineteenth-century assumptions that human excreta are waste and can be absorbed by the natural environment. Esray (2001) argues that such systems are incompatible with sustainable development because pathogens can only be eliminated in conjunction with effective sewage treatment facilities, which are largely absent in developing countries. Thus, the pollution is transferred to the community group who are poorer and less inclined to complain. The Batam hinterland community, according to AK (junior planner at Bappelitbangda), is that group with no power to concern sanitation facilities. She stated:

Common practice of the community throws faeces directly into the sea. Regarding the provision of sanitary facilities, we are inseparable from the supply of clean water. In this manner, how we expect to achieve good sanitation if access to clean water is not secured. As I mentioned previously, our constraints in the islands are including the need to prepare a supply of drinking water and a source of freshwater; once these requirements are met, we can immediately expand to sanitation. So perhaps because it is difficult for the community to access clean water from their surrounding environment, they choose to dispose faeces directly into the sea.

It will necessitate that policymakers and development practitioners develop a deeper comprehension of the diverse spatial, socioeconomic, and cultural variations in existing sanitation practices and translate these into "improved" (and locally acceptable) sanitation systems and attitudes (Black and Fawcett, 2008).

5.1.3. Considering the Regulation, Distributing the Role

As stated in the SSK documents for Batam City (BT3) and Tanjungpinang City (TJ2), the absence of local regulations governing the management of domestic wastewater is the most significant non-technical issue. Nonetheless, according to Indonesian Law No.23 of 2014 on Regional Government (NA4), wastewater management is a regional government responsibility and a basic requirement that must be met. This responsibility is also reinforced by Indonesian Law No. 32 of 2009 on Environmental Protection and Management (NA1), which stipulates that the government is responsible for overseeing the implementation of supporting regulations pertaining to the protection of clean water sources and terrestrial and marine ecosystems. Local governments, in particular Kepri, must also take into account Indonesian Law No.1 of 2014 on Coastal Areas and Small Islands Management (NA2), which emphasizes the significance of recognizing environmental capacity (local circumstances) in this particular region. Institutional challenges arise as a result of the disconnection between the national and regional regulatory frameworks, which makes it difficult to point out the key actors involved and the power they bring.

The process of establishing regulations and the process of distributing the roles of government agencies are two things that are connected to one another. Specifically in this area, the top-down approach appears to be the most effective means of encouraging local governments to create and enact regulations. Sanitation is completely under the control of municipal governments in a lot of different countries (WHO, 2020). However, municipal service systems are subject to short-term political interests, lack accountability mechanisms, and are unable to generate or ring-fence revenue effectively. In Tanjungpinang, where there are no clear regulations regarding wastewater management, the UPTD (Regional Technical Implementation Unit) of Solid Waste Management is responsible for managing FSTP facilities. Regarding this issue, SJ (Head of Bappeda Tanjungpinang) stated that a lack of human capital and support from external organizations is one of the city's challenges. The development of sanitation in Tanjungpinang continues to rely heavily on two major institutions: Bappeda as the planner and coordinator, while DPWSP as the executor of tasks. Several other institutions were also linked to the PPSP program, but according to DD, coordination between the institutions was inefficient.

Due to its status as an Exclusive Economic Zone (EEZ) and Free Trade Zone (FTZ) Area, Batam City has special institutional powers, unlike Tanjungpinang. On October 26, 1971, the second president of Indonesia, Suharto, issued Presidential Decree No. 74 concerning the industrialization of Batam Island. With the issuance of Presidential Decree No. 74 of 1971, the Batam Authority, also known as BP Batam, was established. BP Batam is a central government entity established under Government Regulation of the Republic of Indonesia Number 46 of 2007 with the responsibility and authority to manage, develop, and grow investment to the Batam City. Before 2019, the Head of BP Batam and the Mayor were separate entities. BP Batam, as a national government agency, has a goal of achieving massive investment, whereas the Mayor, as the leader of the region, may have a similar or contradictory agenda. This has resulted in Batam's city government being divided for years, resulting in policy conflicts and incoherence.

In order to address the dualism leader issue, President Joko Widodo has granted Government Regulation of the Republic of Indonesia Number 62 of 2019 regulating organizational changes at BP Batam. The head of BP Batam is also the ex-officio mayor of Batam. According to TW, this adjustment expedites the implementation of PPSP. This is demonstrated by the allocation of separate work responsibilities between BP Batam and the government of Batam City, with the latter being coordinated by Bappelitbangda. TW mentioned:

After the issuance of PP 62/2019 (sanitation accomplishments), it speeded up, the level of coordination increased, and the openness of these two agencies increased, so that we knew what BP Batam and the Batam City Government would be doing. The acceleration was felt after the PP clarified the task allocation. However, this is related to the coordination that still needs to be improved, as this coordination will also influence the outcome in the future.

The distribution of work in the management of domestic wastewater is conducted in accordance with the boundaries of the FTZ zone. BP Batam is responsible for the entire FTZ, whereas the regional government is in charge of areas outside of the FTZ (see Figure 16). Notable is the fact that BP Batam's working area encompasses mainland areas, while the local government is responsible for water and sanitation in hinterland areas. This division of tasks appears to alleviate the substantial burden placed on local governments to ensure that all citizens have access to sanitation. However, this division also presents the following challenge which is financial capacity and sanitation expenditure.



Figure 16. Map of Free Trade Zone Area in Batam
Source: RJG, 2015

5.1.4. Dilemmas of Sanitation Investment

In many cities, unsustainable sanitation systems are a result of insufficient attention and financial support from stakeholders to address urban critical sanitation needs (Rheingans & Moe, 2006). For Tanjungpinang and Batam, both cities mentioned in their SSK document that lack of budget plays vital roles in sanitation development. Local government heavily rely on financial aid from national government through MPWH and specific allocation funding. In government-related discussions, the topic of a lack of budget for program implementation is frequently raised (Sugiyanto, 2020). However, it is not the common practice to collect wastewater levies from the public as a means of funding the system. In Indonesia, most people still use an on-site system (a septic tank) to dispose their faecal. This system was built with private funds, and as such homeowners have the authority to and full responsibility for these facilities. The wastewater management tariff may only be waived unless an off-site system (WWTP) is available. In several Indonesian cities, including Jakarta, Bandung, Medan, and Bali, the government imposes varying domestic wastewater rates (BT4, p.13). Bandung, for instance, collects 30% of the drinking water tariff, while Bali collects 25% and utilised cross subsidies through a public-private partnership.

The management of safe sanitation in Tanjungpinang and the hinterland area of Batam is solely reliant on the process of desludging faeces at least once every five years. This is due to the fact that there are no WWTP facilities with house connections in either of these areas.

Nonetheless, this condition is challenging to achieve, particularly in the Batam hinterland. Tanjungpinang, on the other hand, has insufficient funds to purchase adequate trucks for transporting the faeces to FSTP. There are only two trucks in Tanjungpinang that transport human waste: one belonging to the city government and the other to the Navy Unit Business. Additionally, the desludging of faeces costs between IDR 150,000 and IDR 250,000 per cubic meter. In practice, there is only one vehicle operating in Tanjungpinang, according to DD, so this is not only a matter of the community's willingness to pay, but also a busy operating schedule. This unscheduled desludging operation is referred to as L2T3 (*Layanan Lumpur Tinja Tidak Terjadwal*).

AK pointed that the residents of Batam are unwilling to engage in scheduled septic tank desludging (L2T2, *Layanan Lumpur Tinja Terjadwal*) due to the community's view that ensuring the availability of water is significantly more important than maintaining the condition of their toilets.

Similar to the awareness of the benefits associated with sanitation services, the willingness of individuals to pay for sanitation is typically perceived to be inferior to that of water.

It appears that the community's low willingness to pay for sanitation access is due to the indirect benefits of wastewater managements, compared to provision of clean water. Yet, BP Batam understands that investment in Batam's industry necessitates adequate infrastructure, including a WWTP. BP Batam is currently engaged in a house connection project for WWTP Batam Centre. The project was funded by the South Korean government through a soft loan program totaling USD 3,847,077.49. This megaproject is a form of G to G partnership between the central governments of Indonesia and South Korea, which is possible due to BP Batam's role (IR). The WWTP pipeline connection project is expected to be completed in 2023, and BP Batam is continuing to develop a 'one bill' payment system for drinking water supply and waste water management. Obtaining sustainable sanitation can present a dilemma. Local government must find alternative funding sources to the government's spending. However, before the government can begin to collect compensation for sanitation from the public and private sectors, it must first make a significant investment in order to construct an adequate WWTP infrastructure that includes a pipe connection to the house.

5.2. Taking a Look at Targets, Plans, and Outcomes

Challenges in the institutional and financial spheres demonstrate that there is a significant impact on multi-level governance, as evidenced by the fact that BP Batam has such high level of control and financial backing. Although the principles of water governance are not discussed in detail, the description of the linkages between multiple levels of government, the private sector, and non-governmental actors through national, regional, and local policies demonstrates a multi-level governance framework. The horizontal dimension of governance and the vertical dimension across scales or levels of governance are both important dimensions of action and power that should be taken into account in any multi-level governance framework (Bulkeley & Bettsill, 2005; Hooghe & Marks, 2003). Multi-level governance recognizes that national governments cannot implement water and sanitation ambition without strong regional and local collaboration. To take action, however, cities need support from higher level government through regulation, budgeting, monitoring, and more. In order to look into the vertical relationship, it is essential to observe the alignment of government target, plans, and outcomes from national level and local level.

In all documents (NA5, BT3, TJ1), the sanitation target to be reached between 2020 and 2024 is expressed as a percentage of safe and adequate sanitation. However, this target number seems meaningless to describe vertical axis synchronization. This research aims to explore the all level government big sanitation ambitions through narration they refer as 'mission'. Table 9 provides a summary of the sanitation targets, plans, and outcomes for Indonesia, Tanjungpinang, and Batam. The Indonesian government has set goals aimed at expanding access to safe sanitation. This goal is expected to be met in an effort to reduce urban slums. The strategy selected by the central government is a technical one that involves increasing the number of WWTP and FSTP. Even though the local government also determines the percentage of sanitation accomplishments to be attained; what the national government expects is not in line with what the city of Tanjungpinang has set as its mission. The primary mission of the city of Tanjungpinang focuses on non-technical aspects, such as the desire to strengthen legal power and the community's support for social capital. The comprehensive plan drafted by the government of Tanjungpinang is consistent with its own objective, but significantly diverges from the national target. In an effort to achieve goals, the national government appears to delegate authority to local governments to administer or create rules as necessary. This condition can bring two different meanings. First, regional autonomy is the ability of decentralization to allow local governments to respond to local circumstances. Second, regional autonomy can also be a symbol of the central government relinquishing support over lower-level coordination.

The national target is only met through collaboration with BP Batam (mainland). It seems so given BP Batam's plans to implement the one bill policy, which implies the infrastructure already exists. Interestingly, BP Batam lists investment opportunities as the first desired outcome, followed by environmental protection as the second. The planning and development of sanitation infrastructure on the mainland of Batam are primarily driven by economic considerations, demonstrating a significant difference in orientation compared to other areas. Although BP Batam and the national government agree on targets, plans, and outcomes, it seems inappropriate to include BP Batam as an example of multi-level governance along the vertical axis. Since BP Batam is a part of the central government, this can be described as a horizontal coordination relationship.

Genuinely, the vertical relationship with the central government stems from sanitation management in the hinterland regions. The city government of Batam enhances the target: the accessibility and availability of water and sanitation infrastructure for residents of small islands. But before heading any further into the technical direction, they planned a practical and systematic sanitation strategy to make a master plan. The expected outcomes are also the main feature of SDG 6, ensuring equitable access to water and sanitation services. Failure to meet national government expectations and translate them into local goals and plans is possible if the starting point and challenges are markedly different. Therefore assessing the current challenges could be ideal input for achieving sustainable sanitation. Indeed, sustainable sanitation is a bottom-up approach in which local governments should not be burdened with targets such as sanitation achievement percentages unless more essential attitude. Suppose this vertical relationship fails to stimulate sanitation development in Tanjungpinang and Batam. In that case, it is necessary to identify the strengths of local stakeholders in order to determine the horizontal pattern of coordination.

Table 9. A Summary of Sanitation Target, Plan, and Outcomes of National and Local Government

	Indonesia	Tanjungpinang	Batam	
			Mainland (BP Batam)	Hinterland
Target 2020-2024	<p>Prioritizing improved and safely-managed sanitation in settlement infrastructure development</p> <ul style="list-style-type: none"> • 90% improved sanitation • 15% safely managed sanitation 	<p>Improving domestic wastewater management by strengthening the legal and technical aspects of the sector in Tanjungpinang and public awareness of wastewater services</p> <ul style="list-style-type: none"> • 95% improved sanitation • 12% safely managed sanitation 	<p>Building high-quality and eco-friendly urban infrastructure that is compatible with Batam City's spatial planning</p> <ul style="list-style-type: none"> • 100% improved sanitation • 17% safely managed sanitation 	<p>Development of equitable basic infrastructure and accessibility advancement of hinterland planning</p> <ul style="list-style-type: none"> • 100% improved sanitation • 17% safely managed sanitation
Plan	<p>Development of safely-managed sanitation through a combination of WWTP and FSTP (encouraging septic tank desludging)</p>	<p>Formulating regional regulation on wastewater management</p>	<p>Completing the WWTP pipe connection project and implementing One Bill policy</p>	<p>Formulating masterplan for wastewater management</p>
Outcome	<ul style="list-style-type: none"> • Develop a city devoid of slums. • Create sustainable urban and rural environments that benefit the community • Development and provision of drinking water and sanitation to meet basic community needs and other sectors to promote economic growth. 	<ul style="list-style-type: none"> • Set up a domestic wastewater management master plan • Possibility of obtaining budgetary aid from the state to assist in the ratification of PERWAKO (Mayor Regulation) 	<ul style="list-style-type: none"> • Better environmental services attract investment • Establish healthy environmental conditions • Minimize water pollution 	<ul style="list-style-type: none"> • Increasing the quality and accessibility of clean water and sanitation services in hinterland • Increasing residential infrastructure in hinterland

Cited from several documents and interview

5.3. Beyond Standard Stakeholders

The stakeholders in the planning process for sanitation can be categorized as standard stakeholders and interest groups. Standard stakeholders are those with a legal obligation to take part in the process. Standard stakeholders consist of the responsible decision makers, experts, planners, and analysts for preparing and managing the process (Lahdelma et al. 2000). Interest groups consist of political groups, civic organizations, and local residents. Each interest group has its own perspective for evaluating potential alternatives and frequently has different relational preference systems, thereby creating competition and conflicts based on diverse group values. It also align with Table 4 on List of actors encountered in Water and Sanitation Governance and Program that categorized four groups: public, private, civil society, and external group.

Before beginning a program, it is essential, due to the abundance of actors in the sector, to identify all parties working in the sector, their roles and responsibilities, and the necessary regulatory frameworks. This must be done before the program can even begin. As Lahdema et al., (2000) refers to as "standard stakeholders," public organizations strongly dominate the stakeholders involved in the planning stage of sanitation development in both Tanjungpinang and Batam. According to BT4, three institutions in Batam are responsible for the management of domestic wastewater: Bappeda, BP Batam, and DPWSP. The following are the functions performed by these three institutions:

Table 10. Stakeholders of Wastewater Management in Batam

	Roles
Bappeda	Planning
DPWSP	Planning, Facility Procurement, Management, Monitoring, and Evaluation
BP Batam	Planning, Facility Procurement, Management, Monitoring, and Evaluation

These three institutions are crucial to the design and implementation of the SSK and PPSP programs. Although BP Batam is a national entity, its role in the management of domestic wastewater is coordinated with Bappeda and DPWSP (program implementers in hinterland areas). Tanjungpinang, in contrast to Batam, has more than three institutions, each of which is responsible for quite particular tasks.

Table 11. Stakeholders of Wastewater Management in Tanjungpinang

	Roles
Bappeda	Planning
DPWSP	Facility Procurement on Water and Wastewater
DHSP	Facility Procurement on Drainage, Road, and Other Settlement Facilities
DOH	Campaign on WaSH and Health Issue
DOE	Supporting for Monitoring and Evaluation
District and Sub-district	Management (in Residential Area)
NGO	unspecified

Regrettably, the role of the community, private sector, and international NGOs is still relatively minor. However, the most essential aspect of sanitation planning is the inclusion of potential users, in this case the society. Based on SSK of Batam and Tanjungpinang, the community was not involved in the planning process but was assigned the task of overseeing sanitation facilities and assisting with the monitoring process. In many cases, inappropriate treatment levels or technologies are frequently chosen, resulting in ineffective solutions, excessive costs, or disappointing outcomes. Yet, one of the primary causes of such problems is the lack of or insufficient involvement of government and nongovernment stakeholders in the early stages of the sanitation planning procedure (Bao et al., 2012). QF stated that the community (users) were not involved in the planning process because planning focuses primarily on technical issues. The Department of Health is responsible for providing sanitation and water campaigns in the community. But involving the community in the planning process is crucial for fostering trust and engagement. It appears that the local government must be willing to extend invitations to non-stakeholder groups in order to increase the number of perspectives, voices, questions, and complaints received regarding sanitation development. This is also a good step to take so that the campaign process and the design process for the construction process of the sanitation facility are not carried out simultaneously.

Chapter 6 Conclusion and Reflection

6.1. Conclusion

“What are the challenges and potential improvements that can be done to promote sustainable sanitation in specific areas, such as small island cities?”

Sanitation problems are often caused by a lack of infrastructure compared to what is needed to meet the target. In reality, however, problems in the sanitation sector also involve spatial, regulatory, institutional, funding, and community participation issues. In the context of developing sustainable sanitation services, all technical and non-technical elements are interdependent. Geographical features significantly impact the sustainability of the sanitation and water systems on the small island. Not only does geography impact the carrying capacity of the island's environment, but it also affects the administrative and functional duties of specific departments within the government area. Biophysical condition is a passive challenge that requires considerable time to address or to adapt. In the meantime, other aspects such as social, financial, and institutional challenges change dynamically alongside the mission and political legitimacy of the government. These dynamic aspects make the intervention more feasible. The most critical step that needs to be taken in order to achieve sustainable sanitation in small island cities is to make sanitation issues more well-known through both formal and informal channels. It is hoped that when more attention is paid to this issue, decision-makers, planners, and the community will be willing to invest in and exercise control over wastewater management.

What are the challenges that must be addressed in order to achieve sustainable sanitation in Tanjungpinang and Batam?

Considering the sanitation achievement data in Tables 7 and 8, Batam City has a higher percentage of residents with access to proper and safe sanitation than Tanjungpinang. Conversely, the rate of open defecation in Batam City is also higher. The lesson to be learned from this situation is that statistics cannot be used as a definitive indicator of SDG 6 success. As Batam City has achieved greater than 90 percent proper sanitation, however, it is concentrated in mainland areas, leaving the hinterland with high rates of open defecation and unsanitary conditions. It demonstrates the gap in the development of sanitation systems, which should ensure that "no one is left behind." On the other hand, the success that mainland Batam has had in providing sanitation access for a large population while also maintaining a solid institutional foundation can serve as a model for other small island cities such as Tanjungpinang. The lack of access in the hinterland region is currently Batam City's primary obstacle, but as capital resources increase in mainland areas, the city may be able to speed up

the development of sanitation infrastructure in other regions. Meanwhile, Tanjungpinang City, its role as the capital of the province notwithstanding, still needs to prepare rules and policy packages that are precisely on target. The relatively manageable population and land area should serve as an incentive for stakeholders to increase their level of collaboration with organizations and institutions from the outside community.

How can these challenges be addressed by integrated sanitation targets, plans, and outcomes at all levels of government?

According to Table 9, Tanjungpinang and Batam have devised targets, plans, and outcomes based on the unique challenges each city faces. Tanjungpinang endeavors to establish regulations in the sector of wastewater management in order to facilitate the implementation of programs and alternative funding sources. Batam City has divided its attention in accordance with the work limitations of the local government and BP Batam. The mainland will soon have a WWTP with house pipe connections, which will also implement a payment system in 2023, whereas the hinterland will focus on reducing access inequities. Although on a regional scale, Batam and Tanjungpinang have been successful in establishing powerful linkages between sanitation goals, plans, and outcomes. Integration with the national level appears less than harmonious. Sanitation planning appears to require that local governments have the flexibility to first assess the barriers they face and determine their respective goals.

What role does the local government play in achieving sustainable sanitation?

Frequently, the decision-making process in sanitation planning is characterized by inherent trade-offs between socio-political, environmental, technical, and economic factors. Multiple criteria and competing stakeholder preferences are involved in the selection of appropriate and sustainable municipal wastewater treatment sanitation systems. However, the government frequently labels the community as "only users" of sanitation access. Participation of the community in initial planning should pave the way for minimizing the occurrence of inadequate or dysfunctional systems. Users are passive, resulting in low community participation in the maintenance of sanitation facilities. The local government appears to need to make space available for community interest groups, regardless of whether they receive assistance with sanitation facilities. They can engage in public dialogue to listen, ask questions, and gain knowledge about sanitation planning. If this is done, sustainable sanitation can be achieved regardless of factors such as age, gender, or location of residence.

6.2. Reflection

This study has several limitations, one of which is that the four aspects of the concept of sustainable sanitation cannot be examined in depth. For instance, researchers can only provide a general overview of the geographical barriers to accessibility. There has not been any additional discussion regarding studies on soil types, groundwater, climate, and other factors. In order to gain a better understanding of how small island city planning can lead to improved water and sanitation management, there is still a significant amount of exploratory space that needs to be filled. Additionally, the author cannot discuss each water governance principle in detail. Even so, she attempts to provide an analysis that is consistent with the information gleaned from interviews and document reviews. The interview process has adhered to the previously created question guide, but some additional information is essential to this research. The author realizes that collecting data online and in a short period of time does not provide exhaustive research results to explain sanitation problems in Tanjungpinang and Batam and their causes and solutions. Recognizing the limitations of time, personal circumstances, and remote research locations, it is hoped that this study will still be able to shed light on the importance of sanitation issues in infrastructure planning for “making places better together”.

References

- ADB. (2017). *Urban Wastewater Management in Indonesia*. Asian Development Bank.
- Adeoti, T., Fantini, C., Morgan, G., Thacker, S., Ceppi, P., Bhikhoo, N., Kumar, S., Crosskey, S., & O'Regan, N. (2022). *Infrastructure for Small Island Developing States*. UNOPS, Copenhagen, Denmark.
https://content.unops.org/publications/Infrastructure_SIDS_EN.pdf
- Agyeman J. (2013). Global environmental justice or Le droit au monde? *Geoforum*, 54, 236–238. <http://dx.doi.org/10.1016/j.geoforum.2012.12.021>
- Andersson, K., Dickin, S., & Rosemarin, A. (2016). Towards “sustainable” sanitation: challenges and opportunities in urban areas. *Sustainability*, 8(12), 1289.
- Anguelovski, I. (2014). *Neighborhood as Refuge: Community Reconstruction, Place Remaking, and Environmental Justice in the City*. Cambridge. MIT Press.
- Anthonj, C. (2021). Contextualizing Linkages between Water Security and Global Health in Africa, Asia and Europe. *Geography Matters in Research, Policy and Practice. Water Security*, 13, 100093. <https://doi.org/10.1016/j.wasec.2021.100093>
- Araral, E. (2008). Public Provision for Urban Water: Getting Prices and Governance Right. *Governance*, 4, 527–549. <https://doi.org/10.1111/j.1468-0491.2008.00412.x>
- Araral, E., & Wang, Y. (2013). Water Governance 2.0: A Review and Second Generation Research Agenda. *Water Resources Management*, 11, 3945–3957.
<https://doi.org/10.1007/s11269-013-0389-x>
- Asmadi & Suharno. (2012). *Dasar-dasar Teknologi Pengolahan Air Limbah [Wastewater Treatment Technology Principles (In Indonesian)]*. Yogyakarta: Gosyen Publishing.
- AMPL. (n.d.). *Program Percepatan Pembangunan Sanitasi Permukiman (PPSP) - Pokja AMPL: Air Minum dan Penyehatan Lingkungan [Settlement Sanitation Development Acceleration Program (PPSP) - WSS Working Group (in Indonesian)]*. Pokja AMPL : Air Minum Dan Penyehatan Lingkungan. Retrieved August 10, 2022, from <https://www.ampl.or.id/program/program-percepatan-pembangunan-sanitasi-permukiman-ppsp-/1>
- Banerjee, G. (2011). Underground Pollution Travel from Leach Pits of On-Site Sanitation Facilities: A Case Study. *Clean Technologies and Environmental Policy*, 13(3), 489-497.
- Bao, P. N., Aramaki, T., & Hanaki, K. (2013). Assessment of Stakeholders' Preferences towards Sustainable Sanitation Scenarios. *Water and Environment Journal*, 27(1), 58-70.
- Bapelitbangda Batam. (2019). *Gambaran Umum Penduduk Kota Batam 2019 [Batam City Population Overview 2019 (in Indonesian)]*. Badan Perencanaan dan Penelitian Pengembangan Pembangunan Daerah Kota Batam. . Retrieved July 30, 2022, from <https://bapelitbangda.batam.go.id/arsip/1250>
- Baarda, D. B. (2014). *Research. This is It! English Edition*. Noordhoff Uitgevers Bv.
- Baum, R., Luh, J., & Bartram, J. (2013). Sanitation: A Global Estimate of Sewerage Connections without Treatment and the Resulting Impact on MDG Progress. *Environmental Science & Technology*, 47(4), 1994-2000.

- Bulkeley, H., & Betsill, M. (2005). Rethinking Sustainable Cities: Multilevel Governance and the “Urban” Politics of Climate Change. *Environmental Politics*, 1, 42–63. <https://doi.org/10.1080/0964401042000310178>
- Bos, R. (2016). *Manual on the Human Rights to Safe Drinking Water and Sanitation for Practitioners*. IWA Publishing.
- Black, M., & Fawcett, B. (2008). *The Last Taboo Opening the Door on the Global Sanitation Crisis (1st edition)*. Routledge.
- BPK Kepri. (n.d.). *Peta Wilayah Provinsi Kepulauan Riau [Maps of Kepri]*. BPK RI Perwakilan Provinsi Kepulauan Riau [Audit Board of Kepri]. Retrieved April 20, 2022, from <https://kepri.bpk.go.id/peta-situs/>
- BPS. (2011). *Sensus Penduduk 2010 [Population Census 2010]*. Badan Pusat Statistik. Retrieved August 5, 2022, from <https://www.bps.go.id/publication/2013/03/05/becb3cofa2dbec4af7a24430/penduduk-indonesia-hasil-sp-2010.html>
- BPS. (2021a). *Statistik Indonesia 2021 [Statistical yearbook of Indonesia]*. Badan Pusat Statistik. Retrieved August 5, 2022, from <https://www.bps.go.id/publication/2021/02/26/938316574c78772f27e9b477/statistik-indonesia-2021.html>
- BPS. (2021b). *Luas Daerah dan Jumlah Pulau Menurut Provinsi 2021 [Area and Number of Islands by Province 2021]*. Badan Pusat Statistik. Retrieved August 5, 2022, from https://www.bps.go.id/indikator/indikator/view_data_pub/0000/api_pub/UFpWMmJZOVZlZTJnc1pXaHhDV1hPQT09/da_01/1
- BPS. (2021c). *Produk Domestik Regional Bruto Kabupaten/Kota di Indonesia 2016-2020 [Regency/City Gross Regional Domestic Product in Indonesia 2016-2020]*. Badan Pusat Statistik. Retrieved August 7, 2022, from <https://www.bps.go.id/publication/2021/06/07/5f082ed36ac6601d2aco4e05/produk-domestik-regional-bruto-kabupaten-kota-di-indonesia-2016-2020.html>
- BPS. (2021d). *Produk Domestik Regional Bruto Per Kapita 2019-2021. [Gross Regional Domestic Product Per Capita 2019-2021]*. Badan Pusat Statistik. Retrieved August 7, 2022, from <https://www.bps.go.id/indikator/52/288/1/-seri-2010-produk-domestik-regional-bruto-per-kapita.html>
- BPS Kepri. (2022). *Luas Daratan Kepulauan Riau [Land Size of Riau Islands]*. Badan Pusat Statistik Provinsi Kepulauan Riau. Retrieved April 28, 2022, from <https://kepri.bps.go.id/indikator/153/238/1/luas-daratan-provinsi-kepulauan-riau-menurut-kabupaten-kota.html>
- BPS Pabar. (n.d.). *Distribusi PDRB Triwulanan Atas Dasar Harga Berlaku 2021 [West Papua Quarterly GRDP Distribution 2021]*. BPS Provinsi Papua Barat. Retrieved August 12, 2022, from <https://papuabarat.bps.go.id/indikator/52/141/1/-seri-2010-distribusi-pdrb-triwulanan-atas-dasar-harga-berlaku.html>
- BPS Tanjungpinang. (n.d.). *Jumlah Penduduk dan Rasio Jenis Kelamin 2020 [Population and Sex Ratio of Tanjungpinang 2020]*. Badan Pusat Statistik Kota Tanjungpinang. Retrieved August 13, 2022, from <https://tanjungpinangkota.bps.go.id/indikator/40/223/1/penduduk-dan-rasio-jenis-kelamin-penduduk.html>
- Brandenburg, A. M., & Carroll, M. S. (1995). Your place or mine? The effect of place creation on environmental values and landscape meanings. *Natural Resources*, 5, 381–398. <https://doi.org/10.1080/08941929509380931>

- Budihardjo, E., & Sujarto, D. (1999). *Kota Berkelanjutan [Sustainable Cities (in Indonesian)]*. Penerbit Alumni.
- Bulkeley, H., & Betsill, M. (2005). Rethinking Sustainable Cities: Multilevel Governance and the “Urban” Politics of Climate Change. *Environmental Politics*, 1, 42–63. <https://doi.org/10.1080/0964401042000310178>
- Cameron, J., Hunter, P., Jagals, P., & Katherine Pond. (2011). *Valuing Water, Valuing Livelihoods: Guidance on Social Cost-benefit Analysis of Drinking-water Interventions, with special reference to Small Community Water Supplies*. IWA Publishing (International Water Association and World Health Organisation). <https://doi.org/10.2166/9781780405780>
- Cameron, L. A., Chase, C., & Contreras Suarez, D. (2021). Relationship between Water and Sanitation and Maternal Health: Evidence from Indonesia. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3898325>
- Cashman, A., Nurse, L., & John, C. (2009). Climate Change in the Caribbean: The Water Management Implications. *The Journal of Environment & Development*, 1, 42–67. <https://doi.org/10.1177/1070496509347088>
- Coconuts.co. (2015). Government introducing 100-0-100 program so that Jakarta can be slum-free by 2019. Retrieved August 10, 2022, from <https://coconuts.co/jakarta/news/government-introducing-100-0-100-program-so-jakarta-can-be-slum-free-2019/>
- Cheng, A. S., Kruger, L. E., & Daniels, S. E. (2003). “Place” as an Integrating Concept in Natural Resource Politics: Propositions for a Social Science Research Agenda. *Natural Resources*, 2, 87–104. <https://doi.org/10.1080/08941920309199>
- CNN Indonesia. (2022). *Bappenas: Akses Sanitasi Meningkatkan, Tapi Cuma 7 Persen yang Aman [Bappenas: Access to Sanitation Increases, But Only 7 Percent is Safe (in Indonesian)]*. Retrieved August 7, 2022, from <https://www.cnnindonesia.com/ekonomi/20220525112042-532-800974/bappenas-akses-sanitasi-meningkat-tapi-cuma-7-persen-yang-aman>
- Danielf. (2022, May 12). *Pembangunan IPAL BP Batam Atasi Air Tanah Bersih Dari Limbah Air Tinja [WWTP Construction by BP Batam will Overcomes Clean Groundwater from Fecal Waste]*. Wajah Batam. Retrieved August 13, 2022 from <https://wajahbatam.id/2022/05/12/pembangunan-ipal-bp-batam-atasi-air-tanah-bersih-dari-limbah-air-tinja/>
- Dawes, J. H. P. (2019). Are the Sustainable Development Goals self-consistent and mutually achievable? *Sustainable Development*, 1, 101–117. <https://doi.org/10.1002/sd.1975>
- Diep, L., Martins, F. P., Campos, L. C., Hofmann, P., Tomei, J., Lakhanpaul, M., & Parikh, P. (2020). Linkages between Sanitation and the Sustainable Development Goals: A Case Study of Brazil. *Sustainable Development*, 2, 339–352. <https://doi.org/10.1002/sd.2149>
- Dillon, P. (1997). *Groundwater Pollution by Sanitation on Tropical Islands*. UNESCO.
- Djuwita, M. R., Hartono, D. M., Mursidik, S. S., & Soesilo, T. E. B. (2021). Pollution Load Allocation on Water Pollution Control in the Citarum River. *Journal of Engineering and Technological Sciences*, 1, 210112. <https://doi.org/10.5614/j.eng.technol.sci.2021.53.1.12>
- Emmanuel, K., & Spence, B. (2009). Climate Change Implications for Water Resource Management in Caribbean Tourism. *Worldwide Hospitality and Tourism Themes*, 3, 252–268. <https://doi.org/10.1108/17554210910980594>

- Eras-Almeida, A. A., & Egidio-Aguilera, M. A. (2020). What Is Still Necessary for Supporting the SDGSS7 in the Most Vulnerable Contexts? *Sustainability*, 17, 7184. <https://doi.org/10.3390/su12177184>
- Escobar A. (2001). Culture sits in places: reflections on globalism and subaltern strategies of localisation. *Political Geography*, 20, 139–174. [https://doi.org/10.1016/S0962-6298\(00\)00064-0](https://doi.org/10.1016/S0962-6298(00)00064-0).
- Esray, S. A. (2001). Towards a recycling society: ecological sanitation - closing the loop to food security. *Water Science and Technology*, 4, 177–187. <https://doi.org/10.2166/wst.2001.0215>
- FAO. (2021). *AQUASTAT database*. Food and Agriculture Organization of the United Nations. Retrieved May 20, 2022, from <http://www.fao.org/aquastat/statistics/query/>
- Firdayati, M., Indiyani, A., Prihandrijanti, M., & Otterpohl, R. (2015). Greywater in Indonesia: characteristic and treatment systems. *Jurnal Teknik Lingkungan*, 2, 98–114. <https://doi.org/10.5614/jtl.2015.21.2.1>
- Fincher, R. & Jacobs, J.M. (1998). *Cities of Difference*. New York, Guildford.
- Fuso Nerini, F., Tomei, J., To, L. S., Bisaga, I., Parikh, P., Black, M., Borrion, A., Spataru, C., Castán Broto, V., Anandarajah, G., Milligan, B., & Mulugetta, Y. (2018). Mapping Synergies and Trade-Offs Between Energy and the Sustainable Development Goals. *Nature Energy*, 1, 10–15. <https://doi.org/10.1038/s41560-017-0036-5>
- Fylan, F. (2015). *Semi-structured interviewing*. Oxford University Press. <http://dx.doi.org/10.1093/med:psych/9780198527565.003.0006>
- Galliano, S.J., & Loeffler, G.M. (1999). *Place Attachments: How People Define Ecosystems*. Gen. Tech. Rep. PNW-GTR-462. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- George, R. (2008). *The Big Necessity: The Unmentionable World of Human Waste and Why It Matters*. Macmillan.
- Gough, C., & Shackley, S. (2001). The Respectable Politics of Climate Change: The Epistemic Communities and NGOs. *International Affairs*, 2, 329–346. <https://doi.org/10.1111/1468-2346.00195>
- Greear, J. P. (2005). Toward a Political Rehabilitation of Environmentalism: Daniel Kemmis's "Community and the Politics of Place." *Organization & Environment*, 3, 338–347. <https://doi.org/10.1177/1086026605279464>
- Greider, T., & Garkovich, L. (1994). Landscapes: The Social Construction of Nature and the Environment. *Rural Sociology*, 1, 1–24. <https://doi.org/10.1111/j.1549-0831.1994.tb00519.x>
- Hadwen, W. L., Powell, B., MacDonald, M. C., Elliott, M., Chan, T., Gernjak, W., & Aalbersberg, W. G. L. (2015). Putting WASH in the water cycle: climate change, water resources and the future of water, sanitation and hygiene challenges in Pacific Island Countries. *Journal of Water, Sanitation and Hygiene for Development*, 2, 183–191. <https://doi.org/10.2166/washdev.2015.133>
- Hawkins, G. (2006). *The Ethics of Waste: How We Relate to Rubbish*. Rowman & Littlefield.
- Harahap, J., Gunawan, T., Suprayogi, S., & Widyastuti, M. (2021). A review: Domestic wastewater management system in Indonesia. *IOP Conference Series: Earth and Environmental Science*, 1, 012031. <https://doi.org/10.1088/1755-1315/739/1/012031>

- He, C., Liu, Z., Wu, J. *et al.* Future Global Urban Water Scarcity and Potential Solutions. *Nat Commun* 12, 4667 (2021). <https://doi.org/10.1038/s41467-021-25026-3>
- Hutchinson, F. E. (2015). *Mirror Images in Different Frames? Johor, the Riau Islands, and Competition for Investment from Singapore*. ISEAS – Yusof Ishak Institute. Retrieved June 25, 2022, from <http://dx.doi.org/10.1355/9789814620468>
- Hutchinson, F.E., & Chongm T. (2016). *The SIJORI Cross-Border Region: Transnational Politics, Economics, and Culture*. Singapore, ISEAS Publishing.
- Hutchinson, F. E., & Negara, S. D. (2021). *The Riau Islands*. ISEAS-Yusof Ishak Institute.
- Holding, S., Allen, D. M., Foster, S., Hsieh, A., Larocque, I., Klassen, J., & Van Pelt, S. C. (2016). Groundwater Vulnerability on Small Islands. *Nature Climate Change*, 12, 1100–1103. <https://doi.org/10.1038/nclimate3128>
- House of Commons International Development Committee. (2007). *Sanitation and Water*. Sixth Report of Session 2006/07 (1). London: HMG.
- Hooghe, L., & Marks, G. (2003). Unraveling the Central State, but How? Types of Multi-level Governance. *American Political Science Review*, 02. <https://doi.org/10.1017/s0003055403000649>
- Irianti, S. & Prasetyoputra, P. (2021). Rural–Urban Disparities in Access to Improved Sanitation in Indonesia: A Decomposition Approach. *SAGE Open (July-September)*, 1-9.
- Jacobi, P., Kjellen, M., McGranahan, G., Songsore, J., & Surjadi, C. (2010). *The Citizens at Risk from Urban Sanitation to Sustainable Cities*. Routledge.
- Jenkins, M., Cumming, O., & Cairncross, S. (2015). Pit Latrine Emptying Behavior and Demand for Sanitation Services in Dar Es Salaam, Tanzania. *International Journal of Environmental Research and Public Health*, 3, 2588–2611. <https://doi.org/10.3390/ijerph120302588>
- Jewitt, S. (2011b). Geographies of shit: Spatial and temporal variations in attitudes towards human waste. *Progress in Human Geography*, 5, 608–626. <https://doi.org/10.1177/0309132510394704>
- Komarulzaman, A., Smits, J., & de Jong, E. (2016). Clean Water, Sanitation and Diarrhoea in Indonesia: Effects of Household and Community Factors. *Global Public Health*, 9, 1141–1155. <https://doi.org/10.1080/17441692.2015.1127985>
- Komives, K., Vivien, F., Halpern, J., & Wodon, Q. (2005). Water, Electricity and the Poor: Who Benefits from Utility Subsidies? *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3355440>
- Krause, M. (2010). *The Political Economy of Water and Sanitation*. Routledge.
- Kruger, L. E., & Williams, D. R. (2007). *Place and Place-based Planning*. United States Department of Agriculture Forest Service General Technical Report PNW, 698, 83.
- Lahdelma, R., Salminen, P. & Hokkanen, J. (2000) Using Multicriteria Methods in Environmental Planning and Management. *Environmental Management*, 26 (6), 595–605. <https://doi.org/10.1007/s002670010118>
- Lalasati, N. A., & Hadi, M. P. (2019). The characteristics of fecal disposal system in Penyengat Island, Kepulauan Riau. *IOP Conference Series: Earth and Environmental Science*, 1, 012014. <https://doi.org/10.1088/1755-1315/314/1/012014>

- Liesbet, H., & Gary, M. (2003). Unraveling the Central State, but How? Types of Multi-level Governance. *American Political Science Review*, 02. <https://doi.org/10.1017/s0003055403000649>
- LIXIL, WaterAid Japan, & Oxford Economics. (2016). *The true cost of poor sanitation*. https://www.lixil.com/en/sustainability/pdf/the_true_cost_of_poor_sanitation_e.pdf
- Lerebours, A. (2016). *Governance of Water and Sanitation - As applied to humanitarian and development projects*. ACF International. <https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/2794>
- Letema, S. C. (2012). *Assessing Sanitary Mixtures in East African Cities*. Wageningen Academic Publishers. <http://dx.doi.org/10.3920/978-90-8686-769-1>
- MacDonald, M. C., Chan, T., Elliott, M., Kearton, A., Shields, K. F., Barrington, D. J., Souter, R. T., Powell, B. R., Bartram, J., & Hadwen, W. L. (2017). Temporal and Thematic Trends in Water, Sanitation and Hygiene (Wash) Research In Pacific Island Countries: A Systematic Review. *Journal of Water, Sanitation and Hygiene for Development*, 3, 352–368. <https://doi.org/10.2166/washdev.2017.021>
- Mara, D. (2018). ‘Top-Down’ Planning for Scalable Sustainable Sanitation in High-Density Low-Income Urban Areas: Is It More Appropriate Than ‘Bottom-Up’ Planning? *Journal of Water, Sanitation and Hygiene for Development*, 2, 165–175. <https://doi.org/10.2166/washdev.2018.101>
- Marfai, A., Sarastika, T., Trihatmoko, E., Rahantan, R., Sarihati, R., & Suriadi. (2018). *Kajian Daya Dukung dan Ekosistem Pulau Kecil [Study of carrying capacity and small island ecosystem (in Indonesian)]*. Gadjah Mada University Press. .
- Maulana, A., & Benita, T. (2017). Typologi of Island City in Indonesia. *IOP Conference Series: Earth and Environmental Science*, 012026. <https://doi.org/10.1088/1755-1315/79/1/012026>
- Mardotillah, M., Gunawan, B., Soemarwoto, R., & Raksanagara, A. (2019). Pengaruh Kepercayaan, Pengetahuan dan Sikap terhadap Akses Jamban di Perkotaan [The Influence of Trust, Knowledge and Attitude on Access to Toilets in Urban Areas (in Indonesia)]. *Jurnal Sosial Humaniora*, 2, 88. <https://doi.org/10.12962/j24433527.v12i2.4574>
- Mendoza, R. M. O. (2018). *Water and Sanitation Sustainability*. Arcler Press.
- Melosi, M. V. (2008). *The Sanitary City: Environmental Services in Urban America from Colonial Times to the Present*. University of Pittsburgh Press. <https://doi.org/10.2307/j.ctt6wrc97>
- Moreno, L., Pozo, M., Vancraeynest, K., Bain, R., Palacios, J. C., & Jácome, F. (2020). Integrating Water-Quality Analysis in National Household Surveys: Water and Sanitation Sector Learnings of Ecuador. *Npj Clean Water*, 1. <https://doi.org/10.1038/s41545-020-0070-x>
- Murtiono, H., Gunawan, I. G. N. A., Aguspriyanti, C. D., Putri, T. N., & Poetri Z, R. N. D. (2021). Analisis Sistem Sanitasi Dasar di Permukiman Pesisir Pulau Penyengat [Analysis of Basic Sanitation System in Coastal Settlement Penyengat Island (in Indonesian)]. *Journal of Architectural Design and Development*, 2, 187. <https://doi.org/10.37253/jad.v2i2.6347>

- Mujiyani, Deny Hidayati, Laksmi Rachmawati, Toni Soetopo, & Gustomo Bayu Aji, R. C. (2002). *Pengelolaan Pulau-Pulau Kecil [Small Islands Management (in Indonesian)]*. Jakarta: The Indonesian Institute of Sciences - LIPI.
- McIntosh, A. C. (2003). *Asian Water Supplies: Reaching the Urban Poor*. Asian Development Bank and International Water Association.
- Mycoo, M. A. (2018). Achieving SDGs 6: Water Resources Sustainability in Caribbean Small Island Developing States through Improved Water Governance. *Natural Resources Forum*, 1, 54–68. <https://doi.org/10.1111/1477-8947.12141>
- Narotama, M. R. (2020). *Inside Indonesia: The peoples and cultures of Indonesia*. Inside Indonesia: The Peoples and Cultures of Indonesia. Retrieved April 25, 2022 from <https://www.insideindonesia.org/small-island-life>
- Nawasis. (2020). Hati-hati Tangki Septik Meledak! [Beware of Exploding Septic Tank]. NAWASIS – National Water and Sanitation Information Services. Retrieved August 9, 2022, from <http://nawasis.org/portal/berita/read/hati-hati-tangki-septik-meledak-/51697>
- Nawasis. (2021a). Capaian Akses Sanitasi Aman 2021 [Safely Managed Sanitation Index 2021]. NAWASIS – National Water and Sanitation Information Services. Retrieved July 10, 2022, from <http://nawasis.org/portal/galeri/read/capaian-akses-sanitasi-aman-2021/52472>
- Nawasis. (2021b). Tingkat BABS di Tempat Terbuka Tahun 2021 [Open Defecation Index 2021]. NAWASIS – National Water and Sanitation Information Services. Retrieved July 10, 2022, from <http://nawasis.org/portal/galeri/read/tingkat-babs-di-tempat-terbuka-tahun-2021/52473>
- Nawasis. (2021c). Capaian Akses Sanitasi Layak 2021 [Improved Sanitation Index 2021]. NAWASIS – National Water and Sanitation Information Services. Retrieved July 10, 2022, from <http://nawasis.org/portal/galeri/read/tingkat-babs-di-tempat-terbuka-tahun-2021/52473>
- Nilsson, M., Griggs, D., & Visbeck, M. (2016). Policy: Map the Interactions between Sustainable Development Goals. *Nature*, 7607, 320–322. <https://doi.org/10.1038/534320a>
- Nisaa, A. F. (2021). *Menilik Akses Air Minum Layak dan Layanan Sanitasi di Indonesia - ITS News*. Retrieved May 26, 2022, from ITS News. <https://www.its.ac.id/news/2021/03/26/menilik-akses-air-minum-layak-dan-layanan-sanitasi-di-indonesia/>
- Nurhidayat, A., & Hermana, J. (2009). Strategi Pengelolaan Air Limbah Domestik dengan Sistem Sanitasi Skala Lingkungan Berbasis Masyarakat di Kota Batu, Jawa Timur [Domestic Wastewater Management Strategy through Community-Based Environmental-Scale Sanitation System in Batu City, East Java]. In *Proceedings of the National Seminar on Technology Management X MMT- Institut Teknologi Sepuluh Nopember*. <http://mmt.its.ac.id/download/SEMNAS/SEMNAS%20X/MTL/02.%20Prosiding%20Alfi%20Nurhidayat%20-%20Ok.pdf>
- Nurse, L., Mclean, R., Agard, J., Briguglio, L., Duvat, V., Pelesikoti, N., & Tompkins, M. (2014). *Climate Change 2014 – Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

- Neuman, M., & Smith, S. (2010). City Planning and Infrastructure: Once and Future Partners. *Journal of Planning History*, 1, 21–42. <https://doi.org/10.1177/1538513209355373>
- Noll, R. (2002). The economics of urban water systems. *Thirsting for efficiency: The economics and politics of urban water system reform*, 43-63. <http://dx.doi.org/10.1016/B978-008044077-4/50005-3>
- Odagiri, M., Thomas, A., Listyasari, M., Mills, F., Bain, R. E. S., Muhammad, Z., Slaymaker, T., Mardikanto, A., Gultom, A., Indiyani, A., Rangkuti, H., & Willetts, J. (2021). Safely Managed On-Site Sanitation: A National Assessment of Sanitation Services and Potential Fecal Exposure in Indonesia. *International Journal of Environmental Research and Public Health*, 15, 8204. <https://doi.org/10.3390/ijerph18158204>
- OECD (2010), "Multi-level Governance: A Conceptual Framework", in *Cities and Climate Change*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264091375-11-en>.
- Okurut, K., Kulabako, R. N., Chenoweth, J., & Charles, K. (2014). Assessing Demand for Improved Sustainable Sanitation in Low-Income Informal Settlements of Urban Areas: A Critical Review. *International Journal of Environmental Health Research*, 1, 81–95. <https://doi.org/10.1080/09603123.2014.893570>
- Pham-Truffert, M., Metz, F., Fischer, M., Rueff, H., & Messerli, P. (2020). Interactions among Sustainable Development Goals: Knowledge for Identifying Multipliers and Virtuous Cycles. *Sustainable Development*, 5, 1236–1250. <https://doi.org/10.1002/sd.2073>
- Pasaribu, J. M. (2021). Abundance but Thirsty: Governing Water Supply Provision to Prevent Scarcity in Tanjungpinang City, Indonesia. *Master Thesis*. University of Groningen, the Netherlands.
- Parikh, P., Diep, L., Hofmann, P., Tomei, J., Campos, L. C., Teh, T.-H., Mulugetta, Y., Milligan, B., & Lakhanpaul, M. (2021). Synergies and Trade-Offs Between Sanitation and The Sustainable Development Goals. *UCL Open Environment*, 1. <https://doi.org/10.14324/111.444/ucloe.000016>
- PPN/Bappenas, K. (n.d.). *Tegaskan Komitmen Air Minum dan Sanitasi Aman, Bappenas Bersiap Helat KSAN 2021 [Commitment for Water and Sanitation, Bappenas will conduct KSAN 2021]*. Kementerian PPN/Bappenas. Retrieved August 11, 2022, from <https://www.bappenas.go.id/id/berita/tegaskan-komitmen-air-minum-dan-sanitasi-aman-bappenas-bersiap-helat-ksan-2021-2wws8>
- Ramesh, R., & Ramachandran, S. (1999). Coastal Zone Management: Issues and Initiatives in Small South Asian Nations. In *Perspectives on Integrated Coastal Zone Management*. Springer Berlin Heidelberg. http://dx.doi.org/10.1007/978-3-642-60103-3_14
- Rheingans, C., & Moe, C. (2006). Global Challenges in Water, Sanitation and Health. *Journal of Water and Health*, 4(S1), 41-57.
- Rusca, M., Alda-Vidal, C., & Kooy, M. (2017). Sanitation Justice? In *Water Justice* (pp. 210–225). Cambridge University Press. <http://dx.doi.org/10.1017/9781316831847.014>
- Rosemarin, A., Ekane, N., Caldwell, I., Kvarnstrom, E., McConville, J., Ruben, C., & Fogde, M. (2015). Pathways for Sustainable Sanitation Achieving the Millennium Development Goals. *Water Intelligence Online* <https://doi.org/10.2166/9781780401850>
- Rosemarin, Arno, McConville, J., Flores, A., & Qiang, Z. (2012). *The Challenges of Urban Ecological Sanitation: Lessons from the Erdos Eco-Town Project, China*. Practical Action Publishing.

- RJG. (2015). Kawasan FTZ Batam [FTZ Batam Area]. PT. Rizki Jaya Globalindo – Perusahaan Kargo & Muatan. <https://rjg.co.id/kawasan-ftz-batam/>
- Saldana, J. (2009). *The Coding Manual for Qualitative Researchers*. Thousand Oaks, California Sage.
- Sartika, R. E. A. (2019). *4 Kasus Ledakan “Septic Tank”, Salah satunya di Gedung DPRD [4 Cases of “Septic Tank” Explosions, One of them in the DPRD Building]*. Kompas.com. Retrieved August 10, 2022 <https://www.kompas.com/tren/read/2019/11/05/210000765/4-kasus-ledakan-septic-tank-salah-satunya-di-gedung-dprd?page=all>
- Sathaye, J., Najam, A., Cocklin, C., Heller, T., Lecocq, F., Llanes-Regueiro, J., & Winkler, H. (2007). Sustainable development and mitigation. In *Climate change 2007: Mitigation of climate change* (pp. 691-743). Cambridge University Press.
- Sugiyanto. (2020, October 15). *Butuh Peran Aktif Publik Tanggulangl Pencemaran Limbah Domestik [Public Participation is needed to Overcome Domestic Waste Contamination]*. Kumparan.com. Retrieved August 13, 2022 from <https://kumparan.com/batamnews/butuh-peran-aktif-publik-tanggulangl-pencemaran-limbah-domestik-1uOXkvzL6Yi/full>
- Supriatna, H. (2007). Water Resource Infrastructure Development Strategy through Integrated Coastal Management Approach in Pelabuhan Ratu Coastal Area. *Master Thesis*. Bandung Institute of Technology, Bandung, Indonesia.
- SuSanA. (2018). *Sustainable sanitation and the SDGs: interlinkages and opportunities – Resources*. SuSanA: Sustainable Sanitation Alliance, Germany. <https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/2859>
- Stake, R. E. (1995). *The Art of Case Study Research*. SAGE. <https://legacy.oise.utoronto.ca/research/field-centres/ross/ctl1014/Stake1995.pdf>
- Shivendra, B. T., & Ramaraju, H. K. (2015). Impact of Onsite Sanitation System on Groundwater in Different Geological Settings of Peri Urban Areas. *Aquatic Procedia*, 4, 1162-1172.
- Tortajada, C. (2006). Water Management in Mexico City Metropolitan Area. *International Journal of Water Resources Development*, 2, 353–376. <https://doi.org/10.1080/07900620600671367>
- Uddin, S. M. N., Li, Z., Mang, H. P., Huba, E. M., & Lapegue, J. (2014). A Strengths, Weaknesses, Opportunities, and Threats Analysis on Integrating Safe Water Supply and Sustainable Sanitation Systems. *Journal of Water, Sanitation and Hygiene for Development*, 4(3), 437-448.
- UN. (n.d.). *Goal 6: Ensure access to water and sanitation for all*. United Nations Sustainable Development. Retrieved August 13, 2022, from <https://www.un.org/sustainabledevelopment/water-and-sanitation/>
- UNDP. (2015). *UNDP WGF Issue Sheet: Water and Sanitation Governance*. UNDP. Retrieved August 8, 2022, from <https://www.undp.org/publications/undp-wgf-issue-sheet-water-and-sanitation-governance>
- UNICEF. (2015). *Progress on sanitation and drinking water: 2015 update and MDG assessment*. Joint Water Supply, & Sanitation Monitoring Programme. Retrieved July 18, 2022, from https://data.unicef.org/wp-content/uploads/2015/12/Progress-on-Sanitation-and-Drinking-Water_234.pdf

- UNICEF Indonesia. (2022). Indonesia: Hampir 70 persen sumber air minum rumah tangga tercemar limbah tinja [Indonesia: Nearly 70 percent of household drinking water sources are contaminated with faecal waste]. UNICEF. Retrieved August 7, 2022, from <https://www.unicef.org/indonesia/id/press-releases/indonesia-hampir-70-persen-sumber-air-minum-rumah-tangga-tercemar-limbah-tinja>
- UNOPS. (n.d.). *The Unique Challenge of Small Island Developing States*. UNOPS [United Nations Project Services Office]. Retrieved April 21, 2022, from <https://www.unops.org/news-and-stories/stories/the-inconsiderate-intruder-climate-change-and-small-island-developing-states>
- Usman, M. A., Gerber, N., & von Braun, J. (2016). The Impact of Drinking Water Quality and Sanitation Behavior on Child Health: Evidence from Rural Ethiopia. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2809568>
- Widyarani, Wulan, D. R., Hamidah, U., Komarulzaman, A., Rosmalina, R. T., & Sintawardani, N. (2022). Domestic Wastewater in Indonesia: Generation, Characteristics and Treatment. *Environmental Science and Pollution Research*, 22, 32397–32414. <https://doi.org/10.1007/s11356-022-19057-6>
- Wehn, U., Collins, K., Anema, K., Basco-Carrera, L., & Lerebours, A. (2020). Stakeholder Engagement in Water Governance as Social Learning: Lessons from Practice. In *OECD Principles on Water Governance* (pp. 34–59). Routledge. <http://dx.doi.org/10.4324/9780429448058-4>
- World Bank. (2022). *Climate Stories Small Island States*. World Bank Group. Retrieved June 28, 2022, from <https://www.worldbank.org/en/news/feature/2022/04/11/on-the-frontlines-of-climate-change-small-island-states-can-lead-in-resilience>
- White, I., & Falkland, T. (2010). Management of Freshwater Lenses on Small Pacific Islands. *Hydrogeology Journal*, 18, 227–246. <https://doi.org/10.1007/s10040-009-0525-0>
- Whittington, D., Lauria, D. T., Wright, A. M., Choe, K., Hughes, J. A., & Swarna, V. (1993). Household Demand for Improved Sanitation Services in Kumasi, Ghana: A Contingent Valuation Study. *Water Resources Research*, 6, 1539–1560. <https://doi.org/10.1029/93wr00184>
- WHO. (2019). *Sanitation*. World Health Organization. Retrieved May 28, 2022, from <https://www.who.int/en/news-room/fact-sheets/detail/sanitation>
- WHO. (2020). *Regulating Sanitation Services As A Public Good*. Retrieved August 13, 2022, from World Health Organization. <https://www.who.int/news/item/19-11-2020-regulating-sanitation-services-as-a-public-good>
- WSP-EAP. (2015). *Buku Katalog Pilihan Informasi Jamban Sehat [Proper Latrine Information Book (in Indonesian)]*. Water and Sanitation Program East Asia and the Pacific (WSP-EAP). World Bank Office Jakarta. <https://cupdf.com/document/buku-katalog-pilihan-informasi-jamban-sehat.html?page=1>
- WSP. (2009). *Urban Sanitation in Indonesia: Planning for Progress*. Water and Sanitation Program. World Bank Office Jakarta. https://www.wsp.org/sites/wsp/files/publications/Urban_San_Indonesia.pdf
- WSP. (2011). *Opsi Sanitasi yang Terjangkau untuk Daerah Spesifik [Affordable Sanitation Options for Specific Areas (in Indonesian)]*. Water and Sanitation Program. World Bank Office Jakarta. https://www.wsp.org/sites/wsp/files/publications/wsp_Opsi_Sanitasi_yang_terjangkau.pdf
- Yin, R. K. (2017). *Case Study Research and Applications* (6th Ed.). SAGE Publications.

Appendix 1. Interview Guide

Research Title:

Sustainable Sanitation for Small Island Cities

Analyzing the challenges and critical success factors for Tanjungpinang and Batam to attain sustainable sanitation

I am, Novi Asti Lalasati, conducting research on the topic of Sustainability Sanitation on Small Island Cities with a case study of Tanjungpinang and Batam in partial fulfillment of the requirements of Master Thesis work in Environmental and Infrastructure Planning, University of Groningen, Netherlands. This master thesis research investigates how geophysical features and a multi-level governance approach drive the sanitation targets and achievements in those two cities. The research will use qualitative data collected through policy documents and interviews. You have been invited to participate in this research as an interviewee.

General information of interviewee:

Date of interview :

Name of interviewee :

Position :

- Government agencies Private companies Community groups
 Planning practitioner Academician

Details: _____

Prefer to be mentioned anonymous:

- Yes No

Agrees with recording interview

- Yes No

Duration of interview: _____ minutes

Please provide your (interviewee) consent that:

1. You have been informed about the purpose of the research*
2. You have spontaneously and in complete freedom accepted to be interviewed
3. You consent the use of anonymized interview data for the research aims of the project, including its publication**

I declare that I am aware that:

- The research includes the collection of individual responses, opinions, evaluations
- Each participant is free to ask for clarifications on the data collection procedure and about every other aspect of the project
- Each participant is free to leave the session in every moment
- The eventual refusal to participate or the renunciation during the session will not involve any negative consequence for the participant

Steps of the interview:

1. Explain the interviewer background and research purpose: master thesis at RUG
2. Explain the research objectives and limitation: analyzing challenges and critical success factors for sustainable sanitation in small island cities (focus on domestic wastewater)
3. Explain the definition of such terminology. Ask if it clear enough.
4. Ask if there are any questions in advance.
5. Ask if the interviewee would introduce her/himself (name, position, relevancy)
6. Ask several question and potential follow-up questions related to the research
7. Closing: ask if there any questions/suggestion.

Appendix 2. List of Questions

Main questions	Potential follow-up questions
General contexts	
In your opinion, what presents the greatest challenge in the establishment of sustainable sanitation (domestic wastewater) in Tanjungpinang/Batam City?	How significant is the ____ aspect (depending on the respondent's answer)?
Clear allocation of roles and responsibilities	
What is your main duty or rule agency in water and sanitation governance in Tanjungpinang/Batam?	
Are the roles and responsibilities of agencies involved in water and sanitation governance articulated in a clear and concise manner?	If not, please elaborate on whether there is overlap and inefficiencies of roles and responsibilities.
Which organizations have roles and responsibilities that overlap?	
What effects does fragmentation and lack of coordination have on water and sanitation governance?	How can these overlapping areas be rectified?
Policy coherence	
Are related policies clear, or are there overlaps and redundancies?	Please provide examples of overlaps between policies.
Capacity development	
Do the agencies involved have the capacity to carry out their roles and responsibilities?	If the answer is no, please provide the reasons why the organizations whose limitations you are familiar do not have the capacity to fulfil the request.
Data and information	
Are the data at your organization of sufficient quality to carry out the tasks and responsibilities?	If not, please explain how it could be improved.
Governance-financing nexus	
Does your organization have sufficient funding to govern water and sanitation efficiently?	If no, do you have any suggestion mechanisms for increasing finances?
Regulatory frameworks	
Are the laws and regulations that govern your agency's mandate adequate to achieve efficiency in water and sanitation governance?	If no, are regulatory and legislative reforms possible?
Equity across users, territories and generations	
Do all users have equal access to a reliable water and sanitation service?	If not, how the community overcome the issue? Is there any grassroots movement? Is there any private/business parties involve within this issue?
Do all settlements have equal access to a reliable water and sanitation service?	
Do you think that water and sanitation pricing is equitable for all users?	Please explain about the details regarding plan and survey related to this issue.

Stakeholder engagement	
Is there sufficient participation of stakeholders by water and sanitation governance agencies?	If not, what do you believe to be the causes of low participation or limited engagement?
Monitoring and evaluation	
Do all stakeholder involved monitor and evaluate their performance adequately?	If you believe that this activity is adequate or inadequate, please explain why.

Notes:

Questions can also be tailored to ongoing conversations with interviewee and pertinent documents (i.e. SSK – City Sanitation Strategic; *Buku Putih Sanitasi*, etc).

Appendix 3. Percentage of Households by Province Having Access to Improved Sanitation

Province	2019	2020	2021
Aceh	73.16	77.06	77.55
Sumatera Utara	79.59	81.08	82.02
Sumatera Barat	63.98	68.11	68.68
Riau	80.04	83.99	83.64
Jambi	75.60	77.82	80.36
Sumatera Selatan	74.67	76.94	77.29
Bengkulu	75.91	78.10	79.81
Lampung	79.22	78.81	83.89
Kep Bangka Belitung	90.32	92.58	92.24
Kepri	89.13	89.19	91.62
DKI Jakarta	92.89	93.04	95.17
Jawa Barat	69.64	71.40	71.66
Jawa Tengah	80.29	83.24	83.28
DI Yogyakarta	94.67	96.96	97.12
Jawa Timur	78.78	80.98	80.97
Banten	81.01	82.00	82.89
Bali	94.59	95.01	95.95
Nusa Tenggara Barat	80.02	82.89	82.85
Nusa Tenggara Timur	64.55	69.70	73.36
Kalimantan Barat	72.08	75.81	78.39
Kalimantan Tengah	69.23	72.31	73.77
Kalimantan Selatan	76.56	81.17	81.43
Kalimantan Timur	89.27	89.17	89.77

Kalimantan Utara	77.20	82.09	79.80
Sulawesi Utara	82.36	85.49	84.85
Sulawesi Tengah	71.95	74.61	76.06
Sulawesi Selatan	87.80	88.96	91.57
Sulawesi Tenggara	79.75	82.38	85.62
Gorontalo	74.57	75.68	78.58
Sulawesi Barat	73.39	77.07	80.12
Maluku	70.00	75.06	76.77
Maluku Utara	72.52	75.99	77.11
Papua Barat	76.39	78.71	77.89
Papua	38.27	40.31	40.81
Indonesia	77.39	79.53	80.29

Notes:

- The Susenas census was not conducted in the Provinces of NAD (Aceh) and Maluku in 2000.
- The Susenas census was not conducted in NAD Province in 2001. (Aceh)
- The 2002 Susenas census was conducted exclusively in the provincial capitals of Aceh, Maluku, North Maluku, and Papua.
- Since 2019, the concept used refers to the SDGs metadata, which states that a household has access to improved sanitation services if it has defecation facilities that are used isolated or with certain (limited) households or in communal toilets, using a type of goose-neck toilet, and a place for final disposal of feces in a septic tank or WWTP, or it could be in a hole in the ground if you live in a rural area.

Source Url: <https://www.bps.go.id/indicator/29/847/1/persentase-rumah-tangga-menurut-provinsi-dan-memiliki-akses-terhadap-sanitasi-layak.html>

Access Time: March 22, 2022, 8:46 pm

Appendix 4. Percentage of Households with Access to Improved Sanitation by Regency/City in Kepri

City/Regency	2017	2018	2019
Karimun	86.31	85.87	89.13
Bintan	85.4	88.65	95.1
Natuna	84.41	80.5	86.71
Lingga	76.74	76.07	81.1
Kepulauan Anambas	63.22	70.45	63.14
Batam	47.06	62.41	60.41
Tanjungpinang	17.66	23.73	25.95
Kepri	93.89	91.73	94.81

Source: BPS Kepri, retrieved from Survei Sosial Ekonomi Nasional

<https://kepri.bps.go.id/indicator/29/438/1/-persentase-rumah-tangga-yang-memiliki-akses-terhadap-sanitasi-layak-menurut-kabupaten-kota.html>

Access Time: July 1, 2022, 2:18 am

Appendix 5. Exemplification of the Citation and Document Review Analysis

The majority of the documents have been published, but there are a few agency-restricted documents used solely for academic purposes. These documents can be accessed via the following link with an access request; if there are any issues or additional questions, please email the author at noviastilalasati@gmail.com or n.a.lalasati@student.rug.nl

https://drive.google.com/drive/folders/1UG5-zv-aYIRyTmzy8vpa2b_YR3odXVpF?usp=sharing

The page number in column 1 is based on the total page number of the document (e.g. the cover counts as page 1).

Cited from	Interpretation	Presented on the page	
NA1, p. 14	<p><i>Pengendalian pencemaran dan/atau kerusakan lingkungan hidup sebagaimana dimaksud pada ayat (1) dilaksanakan oleh Pemerintah, pemerintah daerah</i></p> <p>The government and regional governments are responsible for the control of pollution and/or environmental damage referred to in subsection (1).</p>	Local governments have been mandated by national regulations to be able to control environmental damage, but not all local governments have specific rules for managing their environment. This demonstrates that the authority of the law does not operate harmoniously at all levels of government.	65
NA2, p. 3	<p><i>Pulau Kecil adalah pulau dengan luas lebih kecil atau sama dengan 2.000 km² (dua ribu kilo meter persegi) beserta kesatuan Ekosistemnya</i></p> <p>Small Island is an island with a surface area of less than or equal to 2,000 km² and its ecosystem unit.</p>	The law serves as the foundation for local governments to consider the distinct characteristics of small island ecosystems. This is related to the place-based approach.	65
NA3, p.9	<p><i>Tersedianya dana operasional, penghasilan tetap, dan tunjangan lainnya bagi perangkat Pemerintah Desa sesuai dengan ketentuan peraturan perundang-undangan</i></p> <p>According to the provisions of the law, the availability of operational funds, fixed income, and other allowances for Village Government officials.</p>	As stated on page 13, the village government receives an operational allocation of funds, whereas the <i>kelurahan</i> (urban sub-district or village) government relies heavily on the APBD (regional budget for all expenditures). It pertains to sanitation sector funding in Tanjungpinang and Batam.	13
NA4, p.324	<p><i>Tabel Pembagian Urusan Pemerintahan Bidang Pekerjaan Umum dan Penataan Ruang</i></p> <p>Tabel of Distribution Government Affairs in Public Works and Spatial Planning.</p>	The Local Government is charged with managing and advancing the domestic wastewater system.	65

<p>NA5, pp.22-23</p>	<p><i>Tujuan dan Sasaran</i> <i>“Terselenggaranya pemenuhan infrastruktur permukiman yang diprioritaskan pada sanitasi layak dan aman”</i> <i>Proyek Prioritas: Infrastruktur Pelayanan Dasar</i></p> <p>Goals and Outcomes "The implementation of the fulfilment of residential infrastructure with a priority on improved and safely managed sanitation" Priority project: basic infrastructure</p>	<p>The National Government is committed to the completion of sanitation infrastructure, and infrastructure development is its top priority project (technical plan). This target is difficult to achieve in the archipelago due to accessibility issues. The top priorities of sanitation strategies in Tanjungpinang and Batam (hinterland) differ.</p>	<p>69, 71</p>
<p>NA6, p.4</p>	<p><i>Kriteria Utama, terdiri dari: a) Komitmen Kepala Daerah dan DPRD kabupaten/kota. b) Angka kesakitan akibat sanitasi buruk. c) Cakupan layanan sanitasi (air limbah, persampahan, drainase) yang rendah. d) Kepadatan penduduk tinggi. e) Prosentase penduduk miskin tinggi. f) Jumlah kawasan kumuh perkotaan.</i></p> <p>Main Criteria, which include: a) Commitment of the Regional Government Leader and the Regency/City People’s Representative/Parliament; b) The rate of morbidity caused by poor sanitation; c) Low sanitation service coverage (wastewater, garbage, drainage); d) Density of population; e) High poverty rate; f) Urban slums</p>	<p>The criteria that are utilized by the central government in order to select local governments to participate in the PPSP program and receive funding for it are as follows: One of the main aspects is the commitment of the local government. Political will is matter.</p>	<p>54</p>
<p>BT1, p.37</p>	<p><i>Pemberian izin pembuangan limbah ke laut dilakukan oleh pejabat berwenang sesuai dengan ketentuan peraturan perundang-undangan.</i></p> <p>The issuance of a permit to dispose of waste into the sea is performed by a duly authorized official in accordance with the law.</p>	<p>The government of Batam has issued a regional environmental protection and management legislation (a follow-up to the NA1 document). This regulation also stipulates that all waste (including domestic wastewater) that is discharged into the sea must be treated beforehand and is subject to regulation by the competent authority. The mainland is managed by BP Batam, while the hinterland is administered by the city government.</p>	<p>60</p>

BT2, p.12	<p><i>Tarif layanan selain tarif layanan Air Baku berlaku mulai penagihan tanggal 1 Januari 2021</i></p> <p>Other service rates than Air Baku (clean water) service rates become effective on January 1, 2021.</p>	Since 2021, the government of Batam has provided a legal basis for the imposition of extra costs for wastewater services. This demonstrates the government's commitment to providing adequate water and sanitation services.	68
BT3 (Bab II), p.34	<p><i>Diagram pembuangan air limbah di Kota Batam yang dikelola secara aman dan tidak aman</i></p> <p>Diagram of waste water disposal in Batam City which is managed safely and unsafely</p>	The diagram demonstrates that the majority of domestic wastewater discharged into the sea in Batam City has not yet undergone a safe treatment procedure. Even though Batam has seven WWTPs (infrastructure), there is still room for improvement in terms of sanitation management.	60
BT4, pp. 6-7	<p>Misi Kota Batam: Tujuan dan Sasaran (dalam grafik)</p> <p>Graphic of Batam City's Mission: target and outcomes</p>	The main goal of the Batam City Government is to reduce infrastructure disparities between mainland and hinterland areas.	71
BT5, p. 13	<p>Perbandingan tariff layanan air limbah di beberapa kota lainnya</p> <p>Comparison of tariff for wastewater service with other cities</p>	BP Batam has compiled a report on the One Bill policy by comparing it to other cities that have implemented the policy previously. This study was conducted by BP Batam, indicating that this institution has the authority in terms of funding (in many sector, including sanitation) in the Batam mainland.	68
TJ1 (Bab IV), pp.1-4	<p>Tujuan, Rencana, dan Sasaran Air Limbah</p> <p>Target, Plan, Outcomes for Wastewater Management</p>	This document contains the goals, plans, and outcomes for the management of domestic wastewater in Tanjungpinang. Repeatedly emphasized in TJ1, TJ2, and TJ3 was the output of legal products (regional regulations) related to wastewater as the primary objective.	71
TJ2, p.13	<p><i>Kelembagaan dalam pengelolaan air limbah di Tanjungpinang</i></p>	The municipal government of Tanjungpinang has	73

	Governance in Tanjungpinang for wastewater management	compiled a list of organizations engaged in wastewater management. The roles and responsibilities of these institutions are then streamlined to highlight their respective power/functions.	
TJ3, p.3	<i>Tabel profil sanitasi kota Tanjungpinang</i> Table of Tanjungpinang sanitation profile	The table provides details on Tanjungpinang City's sanitation performance and the gap between it and the national goal. This table also illustrates the extent to which local governments have attempted to meet these national objectives thus far.	55

Appendix 6. List of Key Insights derived from Numerous Interview Transcripts

The interviews were conducted in Indonesian, hence the transcripts were also written in Indonesian; however, the authors have thoughtfully quoted and interpreted them into English in order to provide; support; refute the document review's findings and the author's arguments. If there are any issues or additional questions, please email the author at noviastilalasati@gmail.com or n.a.lalasati@student.rug.nl

The following link provides access to audio recordings and transcripts of interviews upon request.

https://drive.google.com/drive/folders/1UG5-zv-aYIRyTmzy8vpa2b_YR3odXVpF?usp=sharing

Interviewee (Code)	Key Insight	Presented on the page
UR	BPPW is a regional government partner for the implementation of the PPSP program. This program's outputs are the Sanitation Profile Book (Buku Putih Sanitasi) and City Strategic Sanitation Strategy (SSK). Currently, Batam and Tanjungpinang are the only two cities that have completed the SSK preparation process. The implementation of the SSK program is supported by local consultants in each municipality. Each year, not all cities receive the central government's budget/facility for individual consultant assistance, in this case represented by BPPW. The cities of Tanjungpinang and Batam have received the facility (consultant) in 2021. In general, UR describes the function of the BPPW institution and the PPSP program.	54
PS	Aspects ranging from technical (geographical) to non-technical problems can be used to examine a number of sanitation management challenges in Batam City (socio-economic, institutional, and funding). He explained that the sanitation conditions in Batam were very good, but only in the mainland, while the services in the hinterland were still inadequate. PS emphasizes this as a result of technical piping issues that resulted in inadequate WWTP coverage on a communal scale.	60
DD	DD illustrates how government structures in Tanjungpinang City and Batam City contribute to the slower pace of sanitation management in Tanjungpinang City. In contrast to Batam, which has begun large-scale projects such as the construction of a city/regional-scale WWTP, Tanjungpinang City is still in the process of constructing a communal-scale WWTP. However, the majority of WWTPs that have been constructed are not properly managed by the community, as a result of a lack of campaign/socialization by the Tanjungpinang City Health Office. He emphasized that the problems in the city of Tanjungpinang were closely related to social and economic issues. Communities that are not yet fully aware of the need for access to proper sanitation, as well as the government's limited funding capacity, impede the provision of sanitation services (using APBD and Special Allocation Funds, there is almost no role for the private sector).	64

TW	The government expands the economy to ensure the welfare of the people in response to rapid urbanisation. On the other hand, the economy is responsible for the emergence of numerous environmental issues. Nonetheless, this can be pursued more effectively through the economic acceleration and infrastructure development initiatives of two organizations, the Batam City Government and BP Batam. Local governments greatly appreciate the existence of PP 62/2019, which clarifies the roles and responsibilities of those two institutions: Batam City Government and BP Batam. TW, who was accompanied by QF and AK during the interview process, provided an overview of sanitation management in the context of government/institution.	66
QF	QF accompanied TW during the interview to explain the technical problems of sanitation management. QF emphasized that the challenges to achieving universal sanitation access in Batam are difficult-to-access hinterland areas and the difficulty of distributing various materials. She added that the priority of the Batam city government for hinterland regions is currently the provision of clean water services.	60
AK	AK accompanied TW to the interview to explain non-technical issues in Batam City's sanitation management (hinterland). In an effort to promote sanitation in the hinterland, she described her involvement with the Health Office. Currently, residents of hinterland areas confront a clean water crisis, so the public's awareness of wastewater management remains low. It is costly, and the importance of constructing latrines and septic tanks is disregarded. She described the views of the residents of the coastal community (stilt houses) as a whole.	64
SJ	Through brief conversations and additional documents, SJ emphasized that the role of the private sector in the management of sanitation in Tanjungpinang is still minimal and that there are few human resources (institutions) that manage the domestic wastewater sector. Even though, the roles of the institutions did not overlap, but as the coordinator and planner (Bappeda), he stated that efforts were still required to build more effective coordination between the institutions.	65
IR	The political legitimacy that has been accorded to BP Batam since 1970 is related to the fact that the organization already possesses an advanced master plan for the management of domestic wastewater. IR also provided an update on the status of the house pipe connection to the WWTP. In addition to that, he offered specific information regarding funding for the sanitation industry. He admitted that it is necessary to manage domestic wastewater in Batam because there is faecal contamination in several reservoirs in Batam. This is something that he acknowledged. Moreover, he stated that promoting Batam as a location for foreign investment is aided by a well-developed infrastructure.	60

While interviews with SJ are conducted through the WhatsApp service, which is brief and cannot be displayed in the folder, interviews with other people can be recorded and have written transcripts using the Zoom Meeting and Google Meeting media platforms. Nonetheless, SJ has provided additional information on confidential documents, such as institutional and funding studies, via the Tanjungpinang City Bappeda staff (attached in the screenshot).

