

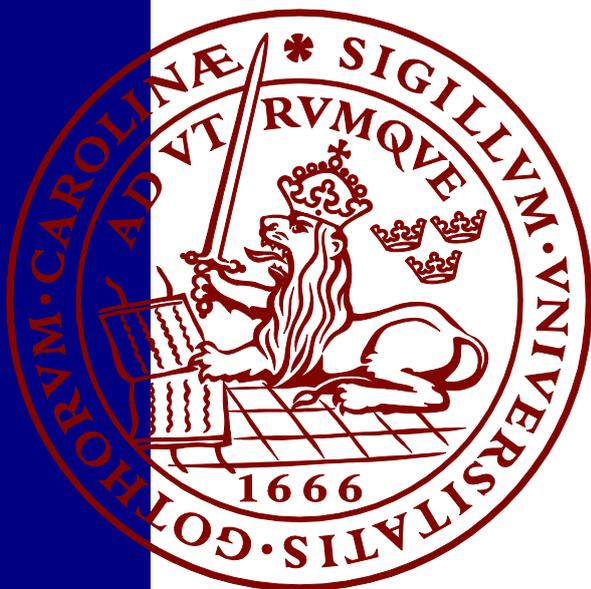
Out of the Dump, Into the Fire

An Analysis of Governance Challenges in Transitioning to a Sustainable Waste Management System in Greenland

Martina Louise Friis Ravn

Master Thesis Series in Environmental Studies and Sustainability Science,
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A thesis submitted in partial fulfillment of the requirements of Lund University
International Master's Programme in Environmental Studies and Sustainability Science
(30hp/credits)



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Submitted May 11, 2021

Supervisor: Inge-Merete Hougaard, LUCSUS, Lund University

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Abstract

A transformation of the waste management system in Greenland has begun in 2020 to solve environmental, health and technical issues of landfilling and incineration. This thesis poses the question whether the new system is tackling the challenges of the current system. Progressing from sustainability transition studies and governance theory, the thesis assesses governance challenges of the institutional and socio-cultural dimensions. It analyzes to what extent the challenges are being tackled in the new system using semi-structured interviews. The thesis finds that overall, the challenges are not tackled, pointing at two intervention points to be further addressed: 1) the collaboration between citizens and municipalities and 2) the focus on the onsite waste workers. The thesis reflects on how Co-production can guide the two to support a transition to a sustainable waste management system. It concludes that Co-production Theory can contribute to guide the first challenge, whereas the second requires additional measures.

Keywords: sustainable waste management, governance modes, sustainability transition studies, co-production theory, institutional & sociocultural dimensions

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“There is no such thing as ‘away.’ When we throw anything away, it must go somewhere”

– Annie Leonard, Executive Director of Greenpeace USA

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Abbreviations

CP	Expert/contracted consultancy party for ESANI
DM	Representatives from Department of Research and Environment in the Self-government
E1	Academic Expert Number 1
E2	Academic Expert Number 2
MP	Municipal Director for Technology and Environment in Sermersooq Municipality
OW-worker	Onsite Waste Worker
RQ	Research Question
SDG	Sustainable Development Goal
ST	Sustainability Transition
WAP20-31	Waste Action Plan 2020-2031
WM	Waste Management
WMS	Waste Management System

1 Introduction

Trends of increasing waste generation levels and increasing complexity of waste are seen in many countries around the world (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018). Improper waste disposal leads to air, water, and soil pollution, which causes negative impacts on human health as well as ecosystem degradation. As stated in the Sustainable Development Goal (SDG) 12, the global target to counteract these negative impacts is, among others, to reduce the impact on the environment and human health by achieving the environmentally sound management of all wastes throughout their life cycle (sub-target 12.4) (UN, n.d.).

The waste management issue that the SDG try to combat is valid for Greenland as well. In Greenland open landfilling and incineration have been the dominant methods in treating waste, corresponding to the global trend (Kaza et al., 2018). This waste management system (WMS) has unfortunate consequences as it has resulted in leachates from open landfills polluting water bodies, smoke from fires at landfills and incineration plants, causing air pollution, as well as food waste attracting animals and causing unhygienic conditions (SDWG, 2019). Additionally, the WMS is facing unique challenges related to climate, big distances, island-like societies, human capital, finance, and waste amount (AIA, 2016; SDWG, 2019).

Until recently Greenland has had a subsistence economy where everything was sourced locally and everything that could be used was used. Very little was disposed, causing little to no impact on the environment and human health. Within the past generations, however, Greenland has transitioned into a modern, globalized society where products and produce from around the world can be found on store shelves, in homes and in garbage bins. The highly complex waste and its growing amount, originating from industrial production cycles requires different treatment methods and a new approach to waste for citizens and the governing entities (AIA, 2016; SDWG, 2019).

The government and municipalities of Greenland are currently taking steps to tackle these issues through the implementation of a new WMS, where the treatment of all waste will be centralized at two state-of-the-art incineration plants, one in Sisimiut and one in Nuuk. The initiative has been launched in 2020 and is expected to be finished in 2023 (ESANI, 2019). The WMS-transition is being implemented as a top-down project, an approach which has so far not proved successful in the old WMS (Eisted, 2011; Hendriksen, 2013). The solution is argued technically and economically viable by the government and the municipalities, but according to Eisted (2011) and Jakobsen, Neidel & Noren-gaard (2017), there exists a knowledge gap in the institutional and socio-cultural dimensions regarding

implementation and governance of new WMSs in Greenland. This is also reflected in a statement by AIA (2016, p. 1): *“When national (...) governments supply a system to help, the systems may not be a good fit for the community and can cause other issues that can lead to the plan being abandoned”*. Therefore, this thesis aims to contribute to address the current knowledge gap regarding how waste can be governed in a sustainable way in Greenland, where sustainability aims for a: *“...development that meets the needs of the present without compromising the ability of future generations to meet their own needs”* (Brundtland et al., 1987, p. 41). The thesis is different from previous studies, as these have focused on the technical, environmental and health aspects of waste management (WM), whereas the institutional and socio-cultural dimensions have been left unaddressed (Lozano, & Gasparatos, 2019).

The thesis treats the WMS at a national scale as the WMS is being centralized, and because the Greenlandic society with its 56,000 inhabitants (World Bank, 2019) is considered a small, highly interdependent society (SDWG, 2019). The thesis keeps a special focus on the interaction between municipalities as the responsible, governing entity, who manages the waste system in Greenland, and actors at other levels (Hjemmestyret 2020; Gustafsson & Ivner, 2017).

1.1 Research Aim

The aim of the thesis is to bring about research, which can support a sustainable WMS in Greenland and in the Arctic setting by exploring the governance challenges in steering WM towards sustainability.

The thesis seeks to answer the four research questions (RQ) to achieve the research aim:

RQ1: *What is the current state of the waste management system in Greenland?*

RQ2: *What are the challenges in steering the system towards sustainable waste management?*

RQ3: *To what extent are these challenges being tackled in the new waste management system?*

RQ4: *How can Co-production guide governance in Greenland to support a sustainable waste management system?*

1.2 Contribution to Sustainability Science

Waste occurs in the interplay between humans and the environment and poses a threat to both. This is central to Sustainability Science where the human-environmental interrelationship is the thematic grounding (Kates et al., 2001). The thesis positions itself in Sustainability Science through its contribution to social change as described by Lang et al. (2012). The thesis does so by addressing, and

potentially influencing the outcome of the proposed WMS-transition through a theoretically informed and methodologically sound analysis. The research is problem-driven and action-oriented by contributing to knowledge that supports governance.

Transdisciplinarity is a central component of Sustainability Science research (Lang et al., 2012). The thesis aims to overcome disciplinary boundaries of academia by integrating knowledge from both Sustainability Science, environmental engineering and governance studies and aims to transcend academia through integration of nonacademic sources of knowledge by contact with actors and experts. The transdisciplinary approach encourages more than a critical examination of current practices, it commits the research to explore options for solving societally relevant problems (Lang et al., 2012). This thesis tries to combine these two aspects by examining practices in *RQ1-2* and explore options for problem solving in *RQ3-4*. I hope that the outcomes of this thesis can contribute to guide governance of sustainable WMSs in the Arctic, in areas with extreme conditions as well as in countries with island-communities, which experiences similar challenges as Greenland (SDWG, 2019).

2 Background

WM in the Arctic faces different challenges to those seen in other parts of the world. This is true for Greenland where a population of 56,000 inhabitants (World Bank, 2019) is scattered over a vast area (2,670 km north-south and 1,050 km east-west) and the climate results in extreme physical conditions. The population density is the lowest in the world with 0.03 persons/km² (Statistics Greenland, 2018). This means that Greenland functions as isolated island-societies, which are mostly too small to work as separate market economies, and where everything is imported either by water- or airway (SDWG, 2019). The geographical and climatic conditions result in a limited infrastructural system that requires special technical solutions (Eisted, 2011; Hendriksen, 2013). For the Greenlandic society, this results in a high-cost level for the municipalities and the Self-government in providing services due to the lack of economies of scale (Hendriksen, 2013; SDWG, 2019).

Approximately 30% of Greenland's population is living in the capital Nuuk (StatBank-GL, 2021), 10% in Sisimiut, 8% in Ilulissat and 6% in Qaqortoq (Statistics-GL, 2018). Besides these four, there are 18 cities (**Figure 1**) and 120 settlements. Settlements are characterized by having between 50-500 citizens (Statistics-GL, 2018). As a result of the colonial history between Denmark and Greenland, approximately 25% of the yearly gross domestic product is covered by the Danish Government (NIRAS, 2020).

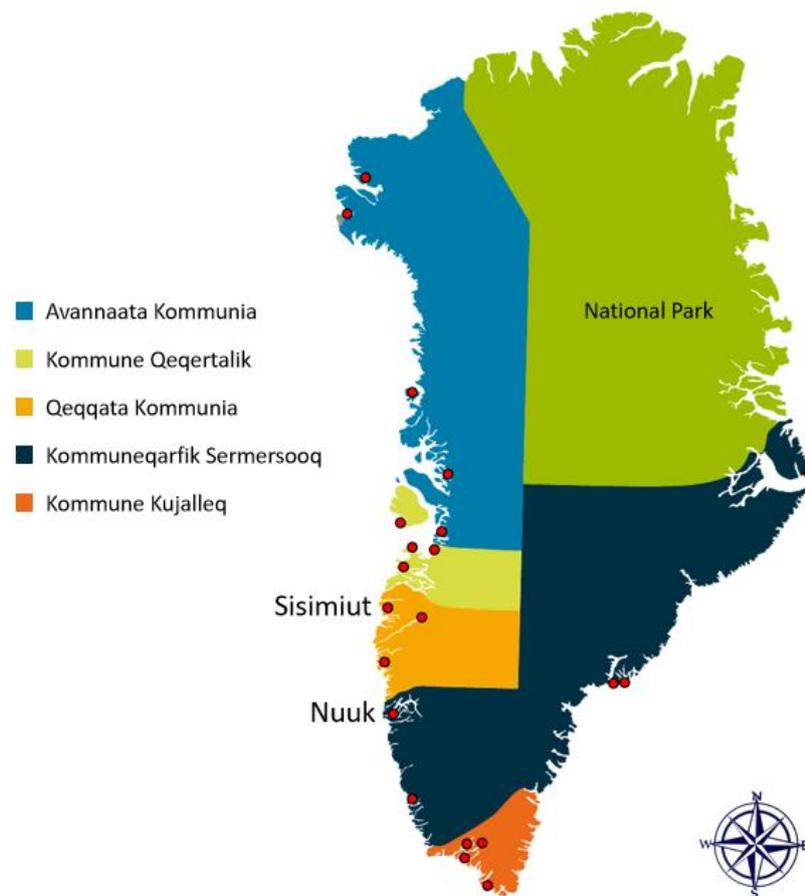


Figure 1: Overview of Greenland and its five municipalities divided by colors. The 22 cities are marked with red-colored dots. The settlements do not appear on the map (Statistics-GL, 2018). Adjusted by author.

2.1 Governance of Greenland

Historically, Greenland has been characterized by network modes of governance e.g., compliance through trust, collaboration and focus on relation building (Aarhus University, n.d.; Evans, 2011; Naalakkersuisut, n.d.). Socially binding contracts formed due to the climatic conditions, isolated societies, and interdependence. Since the colonization in 1721, a hierarchical and market modes of governance increasingly found their way in (Naalakkersuisut, n.d.). The dominant examples being the top-down G50 and G60 policies in the 50's-60's, which aimed at privatization and effectivization of businesses and centralization of the population (DTU, n.d.). Since the 1990's the public administration in Greenland has increasingly been centralized in the pursuit of achieving economies of scale and cost optimization, while a growing neoliberal attitude has resulted in privatizing and marketizing of public services (Hendriksen, 2013; Evans, 2011). From 2009 Greenland has had the opportunity to separate itself from Denmark, and polls are in favor of this (Turnowsky, 2017). However, the move for

independence is impeded by the country's reliance on economic subsidies from the Danish state. So, as for now Greenland remains a part of the Danish Realm¹, but with its own Self-government.

In Greenland today, the Self-government sets out overall policy guidelines, but it is the municipalities, who manages half of the public expense budget (Statistics-GL, 2018). This includes areas such as direct citizen service, local infrastructure, and management of the waste system. In 2009 the municipalities in Greenland were merged from eighteen to four (Hendriksen, 2013), which was then later expanded to five (**Figure 1**) (Inatsisartutlov nr. 30, 2018, §1).

2.2 The Greenlandic Waste Management System

The Greenlandic WMS is based on well-known solutions adapted to the Arctic conditions (Eisted, 2011). The WMS consists of three disposal methods: 1) open landfilling known as '*dumps*', 2) incineration and 3) export of hazardous waste and economically viable fractions such as iron to Denmark. As there is no systematic registration of the amounts of waste, it is not known how the waste is divided between the three disposal methods or how much is produced of different waste fractions. In 2017 the consultancy company COWI estimated, based on limited data, that the municipal recycling rate in Greenland was close to 0%, even though several recycling initiatives have been tried out (Jakobsen et al., 2017).

The five municipalities' tasks are to arrange collection and disposal of waste. Separation of hazardous waste and other fractions are imposed on the individual citizen or company with the duty to hand it in at the municipal receiving facilities, which then collect and prepare the waste for further treatment. The receiving facilities varies according to size of settlement or city. Some have machinery for shredding etc. while others just have a designated area for temporary storage. The tasks of the onsite waste workers (OW-workers) at the receiving facilities include sorting, separation, and packaging of waste as well as landfilling and incinerating. In small settlements the whole WM-process is often in the hands of one municipal employee (Eisted, 2011). **Appendix 9.1** shows an overview of the receiving stations, open landfills and incineration plants.

¹ On the 6th of April 2021, the recently held election in Greenland resulted in the opposition party Inuit Ataqaratiigii (IA) becoming the biggest party. IA is not in favor of independence at any price, and are e.g., against the mining project in Kvanefjeld, which have been suggested as one of the 'fastest' ways to achieve independence from Denmark (Scheel, 2021).

2.2.1 The Current Waste Management System

The current WMS has been characterized by technical and economic challenges because of relatively small amounts of waste, limited data on the waste amounts, sparse population, and high transportation costs (Hendriksen, 2013; ESANI, 2019). Technically, most incineration plants in the bigger cities lack maintenance. The exception being the capital Nuuk (Jakobsen et al., 2017). This results in downtime for the plants and challenges with the accumulated waste. The same applies to the smaller incineration plants, which can be found in approximately 80% of the settlements (Hjemmestyret, 2020). In the beginning of 2014 less than 50% of incineration plants were in operation, and those running were lacking maintenance (Jakobsen et al., 2017). Incineration plants in settlements are run without flue gas cleaning and the produced heat is not utilized. In many places the incineration plants have been lacking capacity, which results in permanently deposited waste in open landfills (**Appendix 9.2**). Hazardous waste like electronics and chemicals end up in the incineration plants and on the open landfills (Eisted & Christensen, 2011). Measurements of incineration plants in cities and in settlements show emission values over the set European limit values posing a risk to the environment and to human health (Jakobsen et al., 2017). All in all, landfills are building up and posing risks to the surrounding environment and the health of the citizens who live nearby, while the incineration plants are either not functioning or posing similar risks.

2.2.2 The Waste Management Transition

The WM-policy in Greenland has continuously developed over time. In 1996 the first 'Waste Action Plan' was developed, followed by action plans in 2002, 2008 and 2010 (Hjemmestyret, 2010). With these action plans as the background, the Self-government developed a plan for a municipal governed WMS in 2018: a '*common, national waste solution*' (Hjemmestyret, 2020). ESANI² was created by the five municipalities together as a common, partly privatized company, which is to take care of all combustible-waste in collaboration with the municipalities. From 2020-2023 two new, state-of-the-art incineration plants, which will utilize produced heating, will be established in Sisimiut and Nuuk by ESANI with the help of a consulting firm. The incineration plant in Nuuk will mainly manage the city's waste, whereas the incineration plant in Sisimiut will manage waste from all other cities and settlements in Greenland. Waste from cities and settlements will be packed and transported by ship to the new incineration plant in Sisimiut, all other incineration plants will be closed. Part of the goal is that the open

² ESANI is an abbreviation created from the first letter in each of the five Greenlandic words for waste, resources, recycling, energy, and company (ESANI A/S, 2019).

landfills around the country will no longer increase in size and can be emptied and closed in the future (Jakobsen et al., 2017; Naalakkersuisut, 2020).

The responsibility between the municipalities and ESANI will be divided so that the municipalities are still responsible for non-combustible waste such as glass, iron, and hazardous waste (Hjemmestyret, 2020). Currently, there is no plan developed for how the non-combustible waste fractions shall be handled by the municipalities. The responsibility of ESANI is to take care of the combustible-waste when the waste is at the dock of cities and settlements. **Figure 2** shows a conceptual figure of who will be the responsible actors in the different parts of the WMS. When the new WMS is implemented, it is the municipalities who will oversee storage and preparation of waste in the cities and settlements (ESANI, 2019). If ESANI concludes that waste is not suitable for incineration or not packed properly, then it will be the municipalities' responsibility to resolve this issue. Within the first year of running the new WMS there will be a focus on dialog between the two actors to solve any problems that might arise. After the implementation phase waste will not be accepted by ESANI if it is not packed correctly. Each settlement is expected to be visited a few times a year (ESANI, 2019).

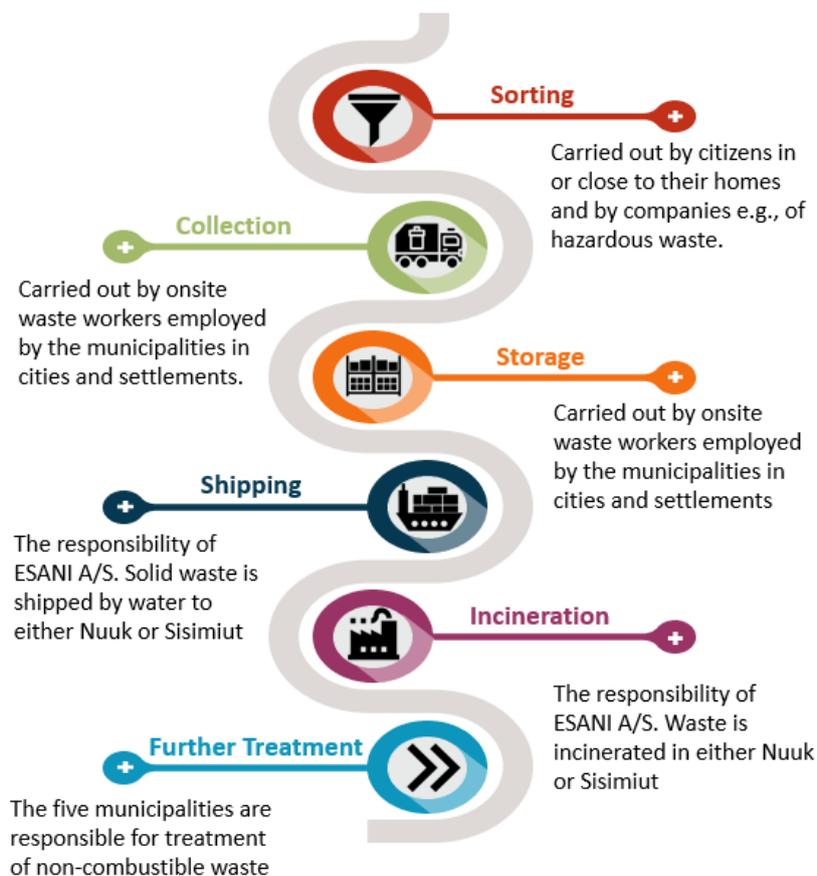


Figure 2: Conceptual figure of the division of responsibility between citizens & companies, OW-workers, the municipalities and ESANI in the proposed WMS (own creation).

In the ‘Waste Action Plan 2020-2031’ (WAP20-31) the WMS-transition is described. While writing this thesis in 2021, the transition is not finished, but has started in 2020 with pilot projects in cities and settlements and plans for the placement of the new incineration plants. While the WAP20-31 states that the new incineration plants will contribute to an economically viable, environment and health appropriate WMS solving the issues mentioned in **section 2.2.1**, the institutional and socio-cultural aspects of the WMS-transition are not described. This leaves several governance challenges originating from the former WMS unaddressed. The thesis investigates how the proposed WMS can take the governance challenges from the institutional and socio-cultural dimensions into account.

3 Theoretical Entry Points

3.1 Sustainability

Sustainability is a word that has endless definitions and connotations to it (Parris & Kates, 2003). A narrow interpretation of sustainability focusing on individual dimensions (i.e., the environmental dimension) has been prevailing in Greenland (Hendriksen, 2013). With this thesis I apply a broader understanding of sustainability aiming for a WMS which addresses multi-dimensions of sustainability; economic, environmental, social and institutional, acknowledging their interconnectedness (Seadon, 2010; Spangenberg, 2007). Integrated solutions are at the heart of this understanding by *“focusing on systems (...) and connection between challenges – not just thematic sectors – to build solutions that respond to people’s daily realities”* (SDG, 2021, Ch. 2). The SDGs recognize that *“action in one area will affect outcomes in others”* (SDG, 2021, Ch. 1). SDG 12 guides what is strived for in a sustainable WMS. The RQs will be answered with sub-target 12.8 in mind: *‘to ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature’* (UN, n.d.) to contribute reaching sub-target 12.4 (**Figure 3**).

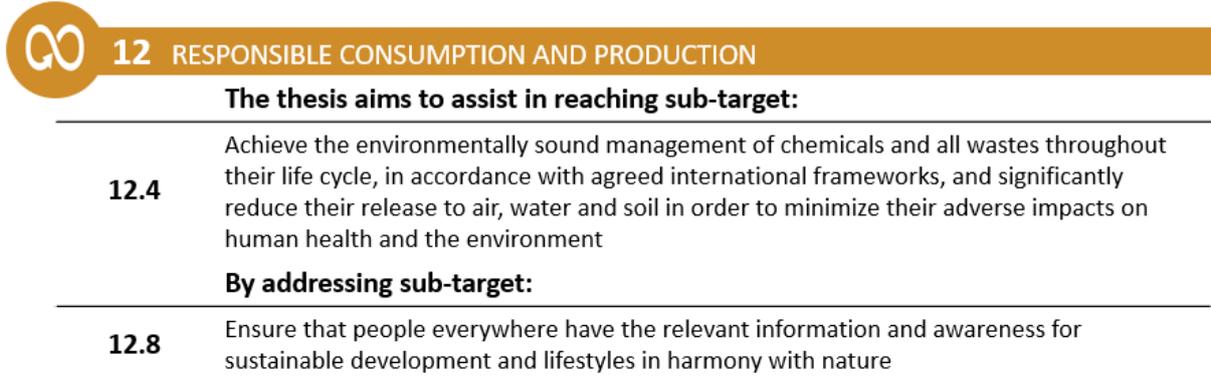


Figure 3: Connection between the aim of the thesis and the sub-targets of SDG 12 (own creation).

3.1.1 Sustainability Transition Studies

Sustainability Transitions (ST) are characterized by long-term, multi-dimensional and fundamental transformation of socio-technical systems towards more sustainable modes of production and consumption (Markard, Raven, & Truffer, 2012). This thesis is guided by the thoughts of ST-studies as it strives for the Greenlandic WMS to succeed in transitioning to a sustainable WMS. ST-studies originates from the sustainability challenges that arises in many domains, e.g. increasing risks from waste production (Kaza et al., 2018). ST-studies builds on the goal of sustainable development and overlaps with Sustainability Science (Parris & Kates, 2003). ST-studies aim to explain the processes, pathways and actors that are involved in transformations (Loorbach, Frantzeskaki, & Avelino, 2017).

WMSs can be conceptualized as socio-technical systems (Markard et al., 2012). A socio-technical system consists of actors (e.g., users, companies, collective actors), institutions (e.g., government, municipalities, norms), material artefacts and knowledge. According to ST-studies technologies in use are intertwined with user practices and lifestyles, regulations, institutional, and political structures (Markard et al., 2012), which makes it extremely difficult to change a system sufficiently to encounter sustainability challenges. ST-studies highlights this interconnectedness, and guides transitions by taking a system approach to comprehend the wickedness of the problem (Seadon, 2010) arguing that for a successful transformation changes of technological, economic, institutional, and socio-cultural dimensions are needed to reinforce each other (Loorbach et al., 2017).

The thesis uses ST-studies as its grand theory (Bryman, 2012) to argue that transitions *“that aim for change will most often be ineffective if they target issues in isolation, rather than design interventions that takes into account entire systemic contexts”* (Axon, 2020, p. 3), without choosing one specific overarching framework found within ST-studies. The ambition by ST-studies to better understand and explore possibilities to advance desired transitions (Loorbach et al., 2017) is used as guiding for how to approach and analyze the institutional and socio-cultural dimensions of the WMS-transition: first, it is crucial to understand the WMS (RQ1), second, understand and acknowledge the existing challenges (RQ2) to third, analyze the potential for long-term, multi-dimensional and fundamental transformation in the WMS (RQ3). When answering RQ2 the thesis's expands the analysis of the WMS to include institutional and socio-cultural dimensions, which have not yet been addressed in research or in the transition plan.

Highlighted aspects in ST-studies which are important to achieve a sustainable transition are governance and the role of public policies (Smith, Stirling, & Berkhout, 2005). ST-studies are seeking to inform governance modes (Loorbach et al., 2017) and Markard et al. (2012) suggests investigating further

complementarities with governance-oriented approaches. I follow this suggestion by bringing theory on governance into play to understand the current and the planned WMS, and to guide the transition. ST-studies have been criticized for their inability to answer questions such as: *Where (with whom) does power reside in transition processes? How are power and agencies performed in transition processes? Whose voices and narratives remain unheard?* (Markard et al., 2012, p. 962). Governance Theory can contribute to address these questions.

3.2 Governance Theory

Governance is the study of how to steer, control or manage relations in and between the society and the environment (Evans, 2011). Different modes of governance exist, the dominant modes being *hierarchy, network, and market* (Table 1). Centralization can be related to the hierarchical mode of governance as decision are made top-down by an authority, whereas privatization and corporatization has roots in market modes (Evans, 2011). New Public Governance is a network-oriented mode of governance, where emphasis is put on inter-organizational relationships, networks, and participatory governance (Sorrentino, Sicilia, & Howlett, 2018).

Table 1: Hierarchy compared to network and market modes of governance are in the thesis used to analyze the governance approaches in the Greenlandic WMS (Evans, 2011). Adjusted by author.

	Hierarchy	Network	Market
Basis of relationship between members	Authority	Complementary strengths and trust	Contract/property rights
Means of interaction	Routines	Relational	Prices
Tools for governing	Regulation	Collaboration	Financial incentives
Commitment of members	High	Medium	Low
Ethos	Formal	Mutual benefits	Suspicion
Choices made by members	Dependent	Interdependent	Independent
Role of the state	Laws, rules, and regulations (the “stick”)	Encourage voluntarily behavior (persuasion)	Economic incentives (the “carrot”)

While ST-studies provides the entry point for this thesis (Bryman, 2012), governance modes can be seen as sets of interventions that can seek to alter the transition (Smith et al., 2005). By merging ST-studies with theory on governance, questions of trust, power, collaboration, and communication in the institutional and socio-cultural dimensions of the transition can be analyzed (Smith et al., 2005). First, governance is operationalized in the thesis by analyzing challenges in relation to modes of governance (RQ2-3), second, governance is operationalized by discussing different options of governance in the proposed WMS (RQ4).

3.2.1 Co-production Theory

Co-production pose an alternative to the hierarchical and market modes of governance, which have been dominating in Greenland (**section 2.1**). In Sustainability Science *“transdisciplinary, community-based, interactive, or participatory approaches are often suggested as appropriate means to meet (...) the requirements posed by real-world problems”* (Lang et al., 2012, p. 25) resonating with Co-production as a governance strategy. Co-production happens when the public administration creates and develops solutions *together* with actors such as citizens and companies instead of *for* them (Agger & Tortzen, 2015), and can thus be categorized as a network-oriented mode of governance. Ostrom brings a definition of Co-production as *“the process through which inputs used to produce a good or service are contributed to individuals who are not ‘in’ the same organization”* (Ostrom, 1996). Co-production separates itself from citizen participation and volunteering by being more ambitious in its division of power (Agger & Tortzen, 2015).

Co-production is an international reaction to governmental challenges such as distrust of the political system, complexity of issues, demographic challenges and growing public demands (Agger & Tortzen, 2015; Boyle & Harris, 2010). The promise is that *“a new way of thinking about public services has the potential to deliver a major shift in the way we provide health, education, policing and other services, in ways that make them much more effective, more efficient, and so more sustainable”* (Boyle & Harris, 2010, p. 3). A crucial element of Co-production is the assumption that citizens have valuable knowledge about the system, which can be used to develop it further. Co-production has a focus on outcomes instead of outputs, which gives it potential to facilitate long-term, sustainable solutions in line with ST-studies.

Some of the critiques of Co-production are that it can reproduce power relations as the governmental or municipal actor retains a central role *“as a resourceful actor that interfaces with the lay actor”* (Sorrentino et al., 2018, p. 289), there is a risk of participation overload and issues of managing who gets to speak. Co-production is explored as a strategy to counter the challenges of the WMS, which have not been solved through the current governance strategies (RQ4). As mentioned in **section 1** this thesis chooses as starting point for a successful transition to focus on the agency of the municipalities as they have the biggest potential to act in the transition through the current governance mode. This resonates with the focus of Co-production Theory, where municipalities are in focus, not as a top-down governed institution but rather as a part of a network in a relational collaboration (Agger & Tortzen, 2015).

4 Methodology

4.1 Research Design

The entrance point to the thesis was a debate on the planned WMS-transition in Greenland taking place in Sermitsiaq AG (the national newspaper) and in KNR (the national broadcasting corporation) during 2020. Citizens expressed their concerns for the transition by commenting on articles and interviews with ESANI (Lund-Andersen, 2020; Heilmann, 2020). I found that the concerns of the citizens resonated with the reservations articulated by Eisted (2011) on what to be aware of regarding governance when implementing a new WMS. Being a former resident in Sisimiut and Environmental Engineering student with some experience with the WMS and having experienced the limitations of the WMS, I recognized a knowledge gap in the current focus of the planned WMS, which needed to be addressed to ensure a sustainable WMS. The case study was thus chosen due to its timeliness and societal relevance.

I read available news articles along with comment tracks, while conducting a literature review of the WMS. While reading, I gathered information on the actors and experts relevant for the transition and choose relevant actors and experts to further contact and interview. I established contact to the interviewees which was met with a high level of interest for the topic, confirming the relevance of looking into it. I conducted semi-structured interviews, which were analyzed together with the WAP20-31 to shed light on the RQs through a thematic analysis. Finally, I discussed Co-production Theory as a governance approach to guide the WMS in a sustainable direction (Table 2). I performed triangulation to increase the depth of the research as well as the validity and credibility by integrating different methods and data sources to avoid potential biases (Flick, 2009).

Table 2: Overview of RQ1-4, and following data and methods used to answer them (own creation).

Research Question	Data	Method
RQ1: <i>What is the current state of the waste management system in Greenland?</i>	Literature	Literature review
RQ2: <i>What are the challenges in steering the system towards sustainable waste management?</i>	Interviews & document	Thematic analysis
RQ3: <i>To what extent are these challenges being tackled in the new waste management system?</i>	Interviews & document	Thematic analysis
RQ4: <i>How can Co-production guide governance in Greenland to support a sustainable waste management system?</i>	Findings from RQ2 & RQ3	Critical discussion

4.2 Data and Methods

4.2.1 Literature Review

A literature review was conducted to provide the contextual base (Hancock & Algozzine, 2006). Google Scholar and LUBsearch were the two scientific databases used to find literature. The criteria used to evaluate the applicability of literature were a) relevance, b) currency, c) reliability (Bryman, 2012). Relevance was determined by the spatial system boundaries of 1) Greenland and 2) the Arctic area. Besides that, general theoretical literature on sustainable WM-practices were deemed relevant. The currency was for literature on the WMS deemed to be the current WMS-period from 1990 to 2020. Reliability was ensured by looking for peer-reviewed or edited papers and by assessing the credibility and objectivity of the author. The literature review was used to answer *RQ1* and to develop the interview questions.

4.2.2 Actor and Expert Identification

The literature review and initial news media research helped to determine experts and actors with relevant knowledge and understanding of the transition and governance of the WMS. An overview of the experts and actors chosen for interviews can be seen in **Table 3**, where the names of the interviewees are anonymized and are instead characterized by professions. Two experts from academia were chosen to contextualize the challenges. Both are knowledgeable about Greenland through years of academic work and fieldwork with focus on WMSs and governance challenges. Besides, four stakeholders; the Self-government, municipalities, ESANI and its contracted party, which is providing consultancy in developing and implementing the WMS-plan, were chosen as relevant actors in the transition - especially in relation to their power of influencing and executing governance strategies as well as knowledge on current challenges (**Figure 4**).

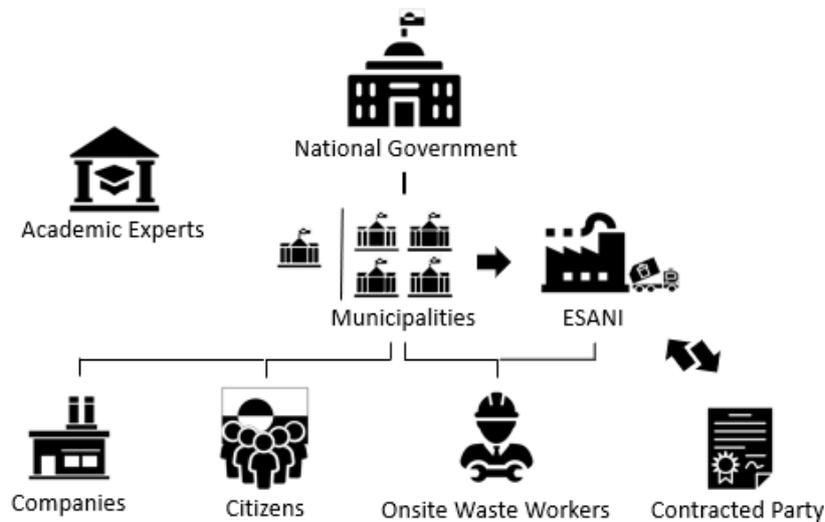


Figure 4: Conceptual overview of the different experts and actors and the links between them mapped through the literature review (own creation).

4.2.3 Semi-structured Interviews

To complement the information accessible in the document WAP20-31 that is describing the planned WMS-transition, interviewing as a method was chosen to deepen the understanding of the different parts of the WMS, and its challenges. As stated in **section 1** institutional and socio-cultural dimensions of the WMSs in Greenland have not been the focus in research so far and as the transition is ongoing, it was necessary to approach the actors who are actively engaged in the WMS-transition to collect data. Six interviews were carried out with seven interviewees (**Table 3**).

Due to the Covid-19 pandemic all interviews were conducted online via the platforms Zoom and Teams and recorded with the permission of the interviewees. In all six cases semi-structured interviews were conducted (Jamshed, 2014). Through a guided interview it was possible to identify the knowledge of the interviewee, which I found most important for answering the RQs, based on both their experience as well as my gathered knowledge (Jamshed, 2014). The interview guide was created based on the literature review and developed continuously through the inputs of interviewees (**Appendix 9.3**). The interview questions varied slightly between the interviewees based on their professions and potential biases.

Table 3: Overview of expert and actor groups interviewed for the thesis and the identifier used in the text (own creation).

Expert/Actor Group	Representative	Identifier	Data Source	Method of Analysis
Academic Expert	Researcher of WMSs in Greenland, Environmental Engineer	E1	Semi-structured Interview	Thematic Interview Analysis
	Greenlandic connoisseur and researcher in governance and development in Greenland	E2		
Municipal Level Actor	Municipal Director for Technology and Environment in Sermersooq Municipality	MP		
	Director of the National Waste Company, ESANI	ESANI		
National Level Actor	Representatives from the Department of Research and Environment in the Self-government	DM		
Contracted Party/Expert	Project owner for ESANI, Rambøll A/S, providing expertise on developing and implementing the new WMS	CP		

4.2.4 Thematic Analysis

A thematic analysis is the process of identifying patterns and themes within a data set (Bryman, 2012; Clarke, & Braun, 2014). The method was used to analyze and evaluate the transcribed interviews and the WAP20-31 document. The thematic analysis strategy was chosen as it was deemed as appropriate for mapping the existing challenges and determine to what extent these were perceived to be met in the planned WMS and how. Themes were selected based on an inductive process. After a familiarization with the material through the process of transcribing and re-reading the WAP20-31 an initial coding process started. Every statement seeming relevant for the RQs was color coded. These codes focused on e.g., trust, centralization, and colonization, later gathered into broader themes based on what were mentioned repeatedly by more interviewees. The interviews were analyzed using a combination of a semantic (reading explicit content) and latent (reading into the subtext) approach (Bryman, 2012; Clarke, & Braun, 2014).

4.3 Limitations

4.3.1 COVID-19 Pandemic

The COVID-19 pandemic limited the possibility to conduct fieldwork, resulting in a distant, desk study. It was planned to visit incineration plants and open landfills to carry out interviews with OW-workers and citizens to get their take on institutional and socio-cultural challenges. As the pandemic made this impossible, the focus on the municipalities was strengthened. All interviews were moved online. The disadvantages of the online set-up were the limitations of non-verbal communication, connection issues as well as confidentiality issues (Bania & Dubey, 2020). However, moving the interviews to an online setting may have had the unintended benefit of creating a more non-intrusive, safe, and comfortable environment as well as being a convenient way for the interviewees to engage in an interview as online meetings are easy to set-up (Bania & Dubey, 2020).

4.3.2 Positionality Statement

Ontological and epistemological beliefs influence research as stated by Holmes (2020, p. 2): *“Very little research in the social (...) field can be value-free”*. To strive for transparency about these beliefs this section is a reflexive consideration of my positionality (Holmes, 2020). As a researcher within the field of Sustainability Science with a background in Environmental Engineering, I take a critical stand on the current WM-practices in Greenland dominated by landfilling and incineration.

When I choose to conduct research on the WMS-transition in Greenland as a Dane, I enter a debate where my nationality becomes sensitive to the topic as Greenland and Denmark have an intertwined and complicated history (**section 2.1**). Through decades Greenlandic policies have been dictated or influenced by Danes (Sørensen, 2020). I am aware that this historical context influences my position as a foreign Danish research; and how I, and my research, are met as well as how I view the topic. This can be limiting to what answers I get from interviewees, who might see me as ‘yet another outsider imposing solutions’. I do not completely take an outsider perspective as I have lived in Sisimiut for half a year (Holmes, 2020). At the same time, I am not a Greenlander, which among other things means that I am not knowledgeable about the Greenlandic language, Kalaallisut (Rischel, 2016). This restricts me in who I can talk with, how I am viewed and how the conversation unfolds. Linguistically, it might cause misunderstandings. It can entail a certain resistance or a curiosity for the same reason. By being aware of my influence and ensure that the representation of my interviewees align with their self-identities, I aim to limit the impact and the resistance that might arise due to my background.

5 Results

ST-studies point to the importance of broadening the focus from economic, technical, and practical WMS-challenges that the publications by Eisted (2011) and Jakobsen et al. (2017) have investigated, to also include governance challenges of the WMS originating from the institutional and socio-cultural dimensions. In this chapter these two dimensions are addressed. Each section starts by describing the identified challenge in steering WM in Greenland towards a sustainable system followed by a section that relates the challenge to the proposed WMS-plan. A conceptual overview of the challenges is visualized in **Figure 5** with arrows indicating their influence on each other. Four of five challenges are interconnected, these are presented first, followed by the fifth, to make the order as intuitive as possible.

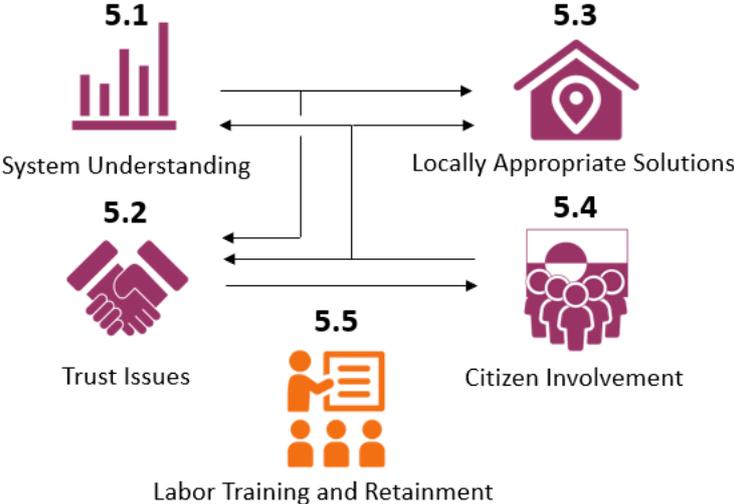


Figure 5: Overview of the five governance challenges identified and their influences on each other (black arrows) in steering towards a sustainable WMS. The purple color relates to challenges influenced by a more centralized, top-down governance approach between citizens and municipalities. The orange color relates to the challenge influenced by a mix of hierarchical and market modes of governance between the OW-workers and municipalities. The numbers refer to the sections in the text (own creation).

5.1 System Understanding

Having a proper system understanding building on a well-developed data base is part of the foundation for steering towards sustainable WM and achieving a successful transformation of a system (Markard et al., 2012; Smidth et al., 2005). Not having sufficient knowledge is a challenge as the system is likely to encounter complications that could otherwise have been avoided, and which might result in the WMS failing. This challenge is present in the Greenlandic WMS (Hjemmestyret, 2020).

5.1.1 Current Challenge

Greenland has almost no existing data for waste production and patterns (E2; ESANI; DM), and because of this the WMS is poorly understood by the governing actors. The newest and most comprehensive data sets available on the WMS originates from the project by Eisted (2011) and data from Sermersooq municipality, where waste has been weighed since 2015 (CP). E1 highlights that the current WMS in Greenland has been built on data 'guestimates'. In some cases resulting in overestimates on waste production of up to 30-40%. E2 argues that existing incineration plants have been insufficient from the beginning due to material issues and dimensions. E1 adds that the existing WMS was integrated based on a 'good offer' for the Self-government rather than on system knowledge and sound data.

5.1.2 Tackling the Challenge

Overall, the proposed WMS is, as the current system, developed from inadequate knowledge, according to E2 who states that similar to the previous WMS, vested interests might have influenced the new WM-plan. The experts agree that the proposed WMS is not thoroughly analyzed, and that there are too many places where the WMS can be challenged. ESANI, MP and DM on the other hand argue that the proposed WMS is developed based on sound knowledge including pilot projects from Sermersooq municipality, which has then been used for the rest of Greenland as the best guestimate. ESANI acknowledges that uncertainty does exist in the data, and thus also in the dimensioning of new incineration plants but argues that the system for transporting waste from settlements in Sermersooq municipality to Nuuk have showed positive results. There are mixed views on whether the knowledge foundation for the proposed WMS is stronger than for the current WMS.

5.2 Trust Issues

Questions of trust are rarely considered in transitions even though commitment to policy presumes that institutions *"have sufficient and legitimate power to implement an agreed solution to a recognized public problem"* (Smidt et al., 2005, p. 1503). The means of communication and conflict resolution in a WMS depends on the levels of trust actors have in each other (Evans, 2011; Lozano, & Gasparatos, 2019). Citizens need to trust the knowledge of the Self-government and municipalities to adhere to proposed governance initiatives (Evans, 2011). Trust issues occur due to beliefs, opinions and experiences between actors and institutions (Evans, 2011).

5.2.1 Current Challenge

ESANI and E1 argue that there is lack of trust in that the Self-government in Nuuk understands what is going on in the rest of Greenland. The experience is that decisions are made without understanding

the local context (**section 5.3**). This belief is largely based on flawed projects in the past, and initiated projects ending up never being carried out (CP). This kind of trust issues is especially present in Northern Greenland due to its large distance to Nuuk.

The lack of trust is not a one-way challenge; the authorities also have some degree of distrust in the population, which keeps them from engaging citizens in new projects (E1). In the opinion of the municipalities and the Self-government, they have often completed their part of a project, but the lack of willingness by the citizens to engage in WMSs has led to poor project results (MP; DP). CP mentions that the municipalities have a certain anxiety in meeting the citizens face to face, even though societies are often so small that most people know each other personally. This affects the collaboration between municipalities and citizens and diminish the potential to establish trust.

5.2.2 Tackling the Challenge

Lack of trust blocks further collaboration between citizens, municipalities, and the Self-government. E2 points to the proposed WM-plan not having solved this challenge. A stated example is the insufficient knowledge on Northern Greenland (**section 5.3**) in the proposed WMS-plan, which have led to a general resistance towards and distrust in the project in the region, why Avanaata Municipality has withdrawn from the agreement (E2; Hjemmestyret, 2020). As a citizen expresses it in Sermitsiaq AG: *“How can you just plan something like that... Is Nuuk the only thing in Greenland?”* (Heilmann, 2020) In other municipalities, there is a deeper trust in the WM-plan; ESANI and DM state that the plan has been well received in most places as the citizens, especially in the cities, agree that there is a WM-issue and have voiced a wish for the waste to be cleaned up. Still, there is an impatience by the citizens in getting the WMS implemented. As mentioned in **section 5.2.1**, part of the reason for this is that the citizens have experienced earlier waste-projects failing, and as they have not yet seen any tangible results from the new WMS, they are skeptical about the actual completion of the transition (ESANI and MP).

Trust issues between the actors can be identified as originating from a hierarchical mode of governance (cf. Evans, 2011), as WM-plans based on insufficient knowledge are executed top-down by the municipalities and the Self-government as the regulating authorities, leaving the citizens to act as passive by-standers who are dependent on the decisions made and actions carried out by the authorities. The authoritarian relationship between the actors is shown in regulation as the tool of governing, which formal interaction with the citizens does not create trust (**Table 1**).

5.3 Locally Appropriate Solutions

As stated by Evans (2011) a centralized command-and-control approach becomes problematic when there are many entities to govern, which seems true for the proposed WMS, and striving for diversity might be better *“suited to the complexity and local requirements of sustainability than a single centralized plan”* (Evans, 2011, p. 158). Lack of locally appropriate solutions are influenced by the lack of sound data and poor system understanding. The centralized command-and-control governing mode leads to solutions, which do not correspond to the citizens’ daily realities, and thus poses a challenge that can potentially result in the proposed WMS being abandoned (SDG, 2021; AIA, 2016).

5.3.1 Current Challenge

The interviewees are emphasizing the importance of the big local differences in Greenland, and that locally appropriate WM-solutions must be developed at settlement or city level (E1; E2; CP; ESANI). E1 highlights that data on the WMS has historically, at times, been gathered by Danish employees in Denmark with no connection to or understanding of the local context, which have resulted in Danish norms, understandings and standards being translated, often poorly, to the local context. There are also Greenlandic and Danish officials working in the Self-government, who do not have an on-the-ground-feeling with what is going on locally, resulting in less appropriate solutions, which again, intensifies distrust by the citizens (E2) (**section 5.2**). The experts point to the municipal structure in Greenland being a direct copy of the Danish structure, which is problematic as the two countries are little alike, and that the centralized mode of governance is a poor fit for the island-based society. They argue that instead a different, contextualized governance system should be developed for Greenland.

5.3.2 Tackling the Challenge

The need for locally appropriate solutions is the biggest challenge for the proposed WMS, but ESANI and the WAP20-31 explains that the proposed WM-plan is looking at individual solutions for most settlements and cities, and that the design for this has been under way for several years. For example, a simple container setup could be a locally appropriate solution in the smallest settlements to collect and store the waste in the planned WMS.

As mentioned in **section 5.2.2**, the most northern municipality, Avanaata, has withdrawn from the national WM-plan. Their argument being that the difficulties with context-specific logistics in the proposed plan are too big for the municipality with over 40 settlements that can only be accessed during a short period of time annually, and only using smaller ships or barges. A citizen is expressing the same concern on Sermitsiaq AG: *“(...) the plan does not contain an acceptable solution for all the settlements*

that cannot be navigated for six months at a time” (Lund-Andersen, 2020). Whether it is practically feasible to reload waste in settlements down to the size of a handful of people remains an unanswered question in the proposed plan (E1; E2).

However, thinking in centralized terms for the planned WMS is environmentally and economically beneficial as waste in Greenland will never be a for-profit business and there are synergies in having common systems (E1; CP; Hjemmestyret, 2020). Due to the relatively small amounts of waste in Greenland it is necessary to collaborate nationally with respect to which waste fractions to sort to achieve an environmental gain (Hjemmestyret, 2020). The WAP20-31 and ESANI mentions that making a common, national WMS and sharing both income and expenses is what makes the proposed WMS economically feasible, but the new system has not yet solved the challenge with locally appropriate solutions emerging from the centralized approach.

5.4 Citizen Involvement

Citizen involvement is participation in planning, developing and administering by actors who are not in the governmental institutions. Introducing a new WMS entails a long implementation phase for both employees and citizens requiring citizen involvement complimentary to information to be successful (Eisted, 2011; Evans, 2011; Hjemmestyret, 2020). Low citizen involvement is a hindrance to gathering knowledge on and creating the locally appropriate solutions necessary in Greenland (**section 5.3**) (cf. Evans, 2011), and for governing the WMS, as the success of a WMS depends entirely on the willingness of citizens to use the system properly (Eisted, 2011). Low citizen involvement contributes to distrust between actors as plans are forced upon citizens (cf. Evans, 2011) (**section 5.2**). The interviewees argue that in settlements citizen involvement in the form of *‘fiery souls’*³ are key to achieving a sustainable WMS.

5.4.1 Current Challenge

As touched upon in **section 2.1**, Greenlandic governance applies a top-down approach. In this system, citizens have a low degree of participation and thus a correspondingly low understanding of the system (cf. Evans, 2011). It is still the widespread understanding that WM is taken care of by the municipality outside the influence of the citizens (Eisted, 2011). The distance between citizens and authorities is large from a WM-perspective, reinforcing distrust between the two actors (**section 5.2**). The two

³ *‘Fiery soul’* is the direct translation of the danish word *‘ildsjæl’*. The English translation, which comes closest to this word is a mix of a community leader, enthusiast and engaged individual. As the interviewees all used this specific, and rather rarely used, word, it was decided to use the direct translation to signal the distinctiveness.

experts criticize the communication from the Self-government and municipalities to the citizens, which is often based on measures such as information leaflets. They mention the need for more continuous and interactive strategies in transitions. CP agrees with the experts, that citizen involvement is missing. Citizen involvement is key due to the high need for locally appropriate solutions and lack of system knowledge (**section 5.3**), and due to the high relocation of citizens in cities and settlements (**section 5.5**) (CP; E1; Hjemmestyret, 2020). CP explains that today citizens are asked by the municipalities to write a formal complaint if they are against an implemented solution, rather than being included in the project planning which would be useful due to their local knowledge. Instead, consultants are hired in. The Self-government points to the yearly 'Environmental Days', that they arrange and facilitate, which are aimed at exchanging experiences to develop ideas and look at what work and does not work, but the target of this initiative are municipalities rather than the citizens (Hjemmestyret, 2020).

5.4.2 Tackling the Challenge

The development of the proposed WM-plan was done by the five municipalities together with technicians and with support from the Self-government through collaborative working days in Nuuk (Hjemmestyret, 2020), reflecting a partly inclusive process, but excluding the citizens. In the WAP20-31 citizen involvement is mentioned as part of the goals, but when analyzing the plan, it is not operationalized, and is only focused on one-way information strategies e.g., information meetings, questioning whether the inclusion is deep enough. Similar to the current WMS there is not focus on collaboration by the municipalities on how to involve citizens in the proposed WM-plan nor focus on collaboration between municipalities and the citizens. E2 states that it will be too easy for citizens on the local city or settlement level to change what has been planned and take a relaxed attitude to the WMS, and further argues that this should be countered by enhancing citizen involvement in the proposed plan.

E1, ESANI and DM argues that initiatives have previously been especially successful when a fiery soul is present. This can be a citizen or a municipal employee. However, as soon as this fiery soul disappears, WMSs become challenged. The interviewees expressed that the fiery souls are key in making citizens implement the proposed WMS (Hjemmestyret, 2020; ESANI and DM). In settlements the fiery souls are often a leading, resourceful family, which the rest of the society will tend to follow in their priorities. To find, motivate and involve these resourceful people, whether they influence the other citizens voluntarily or through their jobs, are one of the big challenges but also an opportunity in the implementation of the proposed WMS (ESANI; DM).

Concordant to the results in **section 5.2-5.3**, hierarchical modes of governance have guided the development of the proposed WM-plan, which fits poorly with the need for improved citizen involvement,

that CP, ESANI and DM points to, and which is key to a sustainable development that emphasizes the “(...) *idea that citizens should have the ability to influence how the places in which they live are managed, emphasizing local action and community inclusion*” (Evans, 2011, p. 62). The role of citizen involvement has not changed in the proposed WMS, and the strategy focusing on information campaigns is being repeated (cf. Hjemmestyret, 2020).

5.5 Labor Training and Retainment

The OW-workers are the link between the citizens and the municipalities in the WMS. Labor training i.e. proper education of the OW-workers is vital for the employees to carry out their role in the WMS (Lozano, & Gasparatos, 2019; Qeqqata, 2017). Technical equipment or a thought-through WM-system is worth nothing if the employees do not understand the role they play, challenging the goal of achieving a sustainable WMS (Smith et al., 2005). Retainment can be affected by e.g., working conditions, salary, collaboration and communication between employees and their superior. Retainment is important for sustainability as a high replacement of employees is a challenge for transfer of information and thus system understanding (Qeqqata, 2017). Lack of leadership in the public sector can leave the OW-workers, whose roles are vital in both the current and proposed WMS (**Figure 2**), in an unfortunate position. As the G50 and G60-policies influenced Greenland, an erosion of the centralized, hierarchical mode happened through which different sectors were partly or fully privatized, reflecting a market-oriented mode of governance (DTU, n.d.). The OW-workers and a system approach have been lost in the transition from a purely hierarchical to a mix with a market-oriented mode of governance, which have resulted in challenges for the island-like society (E1).

5.5.1 Current Challenge

According to the interviewees there are competences present in the Greenlandic society, which can facilitate sustainable WM, but bringing these capabilities into play are difficult. Since the introduction of the Self-government, the Greenlandic society has been sectorized. Before, onsite managers were present in all settlements and cities, who supervised all sorts of municipal areas e.g. infrastructure, energy, water and waste. However, this was changed to disassemble big, top-down, state-governed companies corresponding to a growing neoliberal attitude, outsourcing, privatizing and corporatizing public services (E1). Today, in the settlements this means that the success of the WM is, as touched upon in **section 2.2**, often dependent on one person with a limited contact to the superior in the municipality (Eisted, 2011; Qeqqata, 2017). Often OW-workers if competent are headhunted to private companies due to better salary and benefits. Lack of incentives to stay in the public sector thus challenge the retainment of publicly hired labor resulting in incompetent management, lack of proper

maintenance of technical equipment and loss of information disclosure between the different employees, which have contributed to failed systems (E2; CP; Qeqqata, 2017). This in turn impacts the trust in the authorities and the WM-projects that are proposed for implementation. Even though it might not be the WM-solution itself, which does not work, the citizens would still perceive it as a failure of the WM-solution.

All in all, competences of the municipal OW-workers have not been properly developed or supported by the municipalities, resulting in that dealing with waste is perceived as an unattractive job, which is looked down upon (CP; E1). One interviewee argues that in most settlements around Greenland it is not prudent to have people with specialized, full-time jobs, but instead security in the societies should be ensured by spreading tasks over more hands to ensure consistency, something which neither a hierarchical nor market mode of governance supports.

5.5.2 Tackling the Challenge

The planned WMS has funds for courses, education, and salary of the employees in ESANI who will run the two incineration plants in Nuuk and Sisimiut which is significantly different from what has previously been offered by the municipalities (MP). MP thus expects challenges related to training and retainment to be solved as the incentives for the employees are improved. Bringing resources in the form of a proper working environment, education, and salary to the OW-workers that are not employed by ESANI, but by the municipality, is still missing. This, however, is key to retain labor and strengthen the competences (Hjemmestyret, 2020; Qeqqata, 2017).

The proposed WMS is supposed to be simpler, to minimize issues with maintenance, lack of local competences and retainment (ESANI; MP; DM; CP). Still, technical wear and tear may happen just as much in the proposed WMS as in the current WMS, if the OW-workers and municipalities do not communicate and collaborate better about the needs of the OS-workers (E1; E2; WAP20-31). There will still be machinery for sorting and packaging, which needs maintenance and managing performed by the OW-workers. CP points to a need for a more organized system to keep an eye on how things are going in the settlements and cities for the OW-workers. A yearly or biannual check, which has been the former practice, is not enough. The proposed WMS does not have a plan for a more organized monitoring system yet (WAP20-31).

The challenge of the OW-workers does thus not seem to be sufficiently countered in the proposed WMS. As in the current system, the OW-workers will possess a key task as the link between the citizens, ESANI A/S, who takes care of combustible waste and the municipalities, who takes care of non-

combustible waste. It is a potential weak link if the capabilities and retainment of the OW-workers are not improved. There is a need for recognizing the OW-workers role in the WMS.

5.6 Summarizing Remark

The power in the transition is in the hands of the Self-government, ESANI and the municipalities, and is exercised through a top-down approach, which does not tackle the identified challenges of trust, knowledge, locally appropriate solutions, and citizen involvement (**section 5.1-5.4**). The voices and the narratives of the citizens remains unheard (cf. Markard et al., 2012), while training and retainment of OW-workers are challenged and might result in negative technical and environmental impacts like those experienced in the current system (**section 5.5**). The interviewees themselves point to the need for activating fiery souls, improve citizen involvement and focus on the OW-workers to achieve a sustainable WMS, all things that are not incorporated in the WMS-plan.

In 2011 Eisted (2011) suggested, that increased and better utilization of produced district heating from incineration together with an improved collection of hazardous waste would be key for improving the Greenlandic WMS from an environmental point of view. He strongly recommended that efforts to involve citizens should be investigated and improved. Eisted's first recommendation has been met as the incineration plants in Nuuk and Sisimiut will utilize the energy from incineration, but the second recommendation has not been followed in the proposed WMP as analyzed in **section 5.4**.

Also, a recommendation by Jakobsen et al. (2017) presented in an idea catalog of the Nordic Council of Ministers was to focus on possibilities for local recycling of waste fractions and on political initiatives e.g., in the form of improved regulations or national plans. Jakobsen et al. (2017) also pointed to the importance of thinking through the whole WMS to design it not only with respect to economy and environment, but also to the institutional and socio-cultural dimensions. The proposed WMS takes a national perspective as recommended, but without focusing on institutional and socio-cultural dimensions. Additionally, the plan does not yet involve concrete plans for local recycling and collection of hazardous waste as mentioned by Eisted (2011) and Jakobsen et al., (2017), but only a goal of improving these, limiting the system thinking of the planned WMS to the combustible waste. Through ST-studies the question of what dimensions were unaddressed for the WMS to make a fundamental, long-term shift from an unsustainable to a sustainable WMS was posed (cf. Loorbach et al., 2017). It was found that there still is an insufficient focus on institutional and socio-cultural challenges, resulting in the design of a new WMS, which does not consider the entire systemic context as recommended by Jakobsen et al. (2017) (cf. Axon, 2020).

Based on the analysis of the governance-modes and referring to ST-studies, it is summarized that there is a lack of multi-actor networks in planning and implementation of the WMS. This is reflected in a WMS-transition, which does not fundamentally change the system neglecting institutional and socio-cultural challenges. Governance of the challenges in transitioning to a sustainable WMS calls for strategies to empower locally appropriate solutions developed in citizen-municipality networks, as the dominant governance modes of state and market are at odds with sustainability of the WMS (cf. Loozbach, 2017). ESANI and MP mentions that the next step in the transition will be to put effort into the implementation plans for the proposed WMS. There is thus a window of opportunity in contributing to tackling the governance challenges.

6 Discussion

Hierarchy and market modes of governance, which are broadly reflected in the Greenlandic society (**section 2.1**), are influencing the governance of planned WMS, and seem insufficient in countering the governance challenges in the WMS of an island-based society. From the view of ST-studies, fundamental, multi-dimensional change of the WMS is not reached through the governance approaches in the planned WMS as institutional and socio-cultural challenges are unaddressed. The results pointed to the need for better citizen involvement in designing locally appropriate solutions and better collaboration between the municipalities and the citizens as well as internally between the municipalities and its OW-workers (**Figure 5**).

It is thus relevant to discuss whether a modern reorientation towards a historically network-oriented mode of governance in Greenland (**section 2.1**), emphasizing the active role of citizens better, reflects the island-like societies and could be of use to tackle the challenges to reach a sustainable WMS. Involving citizens in governance can improve quality of decisions (Evans, 2011; SDWG, 2019) as it recognizes the knowledge and experience of those living within the system and moves from regulation to collaboration as a tool of governing, from an authority-based relationship to one based on complementary strengths and trust (**Table 1**).

6.1 Bringing Co-production Theory into Play

Co-production Theory as a network-oriented mode of governance can be the promise of a new social contract between the citizens and the municipalities (Agger & Tortzen, 2015). The municipalities can change their role from delivering pre-designed solutions (**section 5.4.2**) to facilitating and mobilizing processes and collaborations: *“The central idea in co-production is that people who use services are hidden resources, not drains on the system, and that no service that ignores this resource can be*

efficient" (Boyle & Harris, 2010, p. 11). Co-production Theory can help to facilitate better collaboration and equal relations between the municipal employees and the citizens, and thus move away from a hierarchy-oriented mode of governance.

As Boyle & Harris (2010, p. 6) write *"Co-production occurs in the critical middle-ground when user and professional knowledge is combined to design and deliver services"*. Based on the interviews it is argued that there has been a lack of integration of local citizen and OW-worker knowledge in WM-solutions and that the same challenge is reflected in the new WM-solution.

According to Co-production Theory, influence of citizens is bigger the earlier in the process they are involved (Agger & Tortzen, 2015). This is in line with the principle of environmental decision-making as stated in the Aarhus Convention⁴, which requires governments to *"provide for early public participation, when all the options are open and effective public participation can take place."* (Evans, 2011, p. 193). Asking the citizens for ideas for a project from the beginning generates knowledge, but it also has the potential to increase involvement in the project instead of resistance to it as the project is then not something which is solely imposed, but something which is co-produced or even co-initiated.

6.2 Intervention Points

Based on the results, two things are identified as intervention points, which influence the remaining challenges in the planned WMS: **1)** lack of collaboration between the municipalities and the citizens and **2)** lack of focus on the OW-workers. The reason for the **first** challenge to be highlighted is that the lack of collaboration between citizens and the municipalities is directly related to both the amount of trust between the actors and how well-developed local solutions can be with citizen involvement as the possible catalysator. Through an improved collaboration between the two actors, better data could be produced, helping to close the knowledge gap in the WMS. Hence, this is an intervention point which is interconnected with four out of five identified challenges (**Figure 5**). The reason for the **second** challenge to be highlighted is that even though the first intervention point is addressed, the planned WMS has a weak point in training and retainment of municipal labor, which can undermine the planned WMS if not addressed (**section 5.5**).

The keywords for both intervention points are an increased focus on mutualism and localism in the WMS. There is a need for rediscovering the human resources and remaking relational networks in the system to support the municipal service transition (cf. Boyle & Harris, 2010).

⁴ The Aarhus Convention is a convention on among others public participation in environmental matters. It states the right for the citizens to participate in environmental decision-making (EU, n.d.)

6.2.1 Enhancing Collaboration Between Municipalities and Citizens

Missing collaboration between the citizens and the municipalities affects the development of locally appropriate solutions and results in a low level of trust in the WMS. The results highlighted that there is no single answer for how the WMS should be designed in Greenland. There are only site-specific answers, which calls for bottom-up approaches to achieve locally appropriate solutions. It is necessary to look at separate settlements and cities and ask questions such as ‘what waste should be sorted and what waste should not?’, and ‘how does it make sense to handle the waste?’. The intervention point, if not addressed, is likely to result in reluctance of the citizens to engage with the new WMS in the intended way, making it prone to failure (Eisted, 2011).

The planning-process for the WMS-transition has, to some extent, already been executed. Still, the citizens can be involved in the planning-process by being co-designers of the new, individual waste receiving facilities in cities and settlements. Naboskab in Denmark has carried out several projects on co-creation of waste solutions in Danish municipalities through workshops, social media, interactive posts, competitions, phone-interviews and first movers – both digitally and in real life, which can work as inspiration for facilitating processes and collaborations (Naboskab, n.d.; Naboskab, 2020).

Citizen meetings can be more than just Q&A sessions which is the common approach today in Greenland (CP). It can be citizen workshops with smaller gatherings to make everybody comfortable enough to raise their voice and co-design locally appropriate solutions. Relational contact between the citizens and the municipality is possible to achieve as the communities in general are small. Another way to involve the citizens in the design-phase is through social media groups, where it is easy to make room for discussion and sharing of ideas. This approach has proved successful within the health sector in Greenland, where initiatives from the citizens have been implemented (CP). Overall, gathering ideas from the citizens on the local design of WM-solution, so that it is the ideas of citizen which are implemented instead of ideas from above, is recommended.

Another area, where Co-production Theory can contribute to an enhanced collaboration between municipalities and citizens, is by Co-production, where public services are redesigned, so that responsibility for the operation of a service in the local community is moved from the municipalities to the hands of local citizens (partly or completely), changing the role of the state. As the implementation-phase of the WMS-transition has not yet begun, there is room for involving citizens. Thus, Co-production Theory can guide the WMS-transition by encouraging the municipalities to start involving the citizens in the process as co-implementers (Agger & Tortzen, 2015).

The concept of fiery souls has been mentioned repeatedly by the interviewees and taking better advantage of these might be possible if the responsibility for all waste is not tied up on one municipal OW-worker. It can be beneficial to spread the responsibility over more hands, both employees and citizens, to increase the resilience of the city or settlement and avoid challenges with labor retainment. In a small Danish city this approach has been carried out, where associations and volunteers have taken over several public tasks (Hebsgaard, 2013). In Greenlandic cities and settlements, identifying local opportunities e.g., where the WMS has been functioning well or where one or more fiery souls can be identified, might be a way to improve locally appropriate solutions and improve resilience. An incentive for the citizens can be that money saved from operational costs will benefit the city or settlement. Also moving the responsibility into the citizens hands can give citizens more influence on their own daily reality and empower them as they are trusted to make the right decisions and become doers, not the done-for (Boyle & Harris, 2010).

6.2.2 *Countering the Challenge with the Municipal, Onsite Waste Worker*

Lack of focus on the OW-workers' key role in the WMS signals that there is a lack of system understanding in the planned WMS. The question whether Co-production can help solve the challenge of training and retainment of OW-worker is more exploratory than how the theory is utilized in **section 6.2.1**. Usually, Co-production describes inter-organizational relationships and multi-actor relations (Sorrentino, Sicilia & Howlett, 2018). Instead, the thoughts of Co-production Theory are here used to guide *intra*-municipal collaboration, where the two participants are characterized as 1) the regulating actor, often the Technical and Environmental Department of the municipality (MP) and 2) the executive actor i.e., the OW-workers, who carries out decisions made by the regulating actor (Sorrentino, Sicilia & Howlett, 2018).

Co-production has the potential to create a new synergy between the two actors like the one discussed for municipalities and citizens. In the process of designing locally appropriate solutions for WM, not only the citizens, but also the OW-workers can contribute to co-produce solutions e.g., by designing receiving facilities. This is especially relevant as the concrete plans for how to handle non-combustible waste are not yet developed. This would acknowledge the importance of the OW-worker and the knowledge they possess. Co-production suggest that instead of focusing on providing top-down education of the OW-workers, knowledge exchange about the WM-system should be a two-way process. It is the OW-workers who know most about the local WM-challenges. Co-production can enable this collaboration and equal partnership through similar activities as for citizen involvement e.g., workshops for gathering ideas on WMS-design and additionally through co-development of a OW-worker

education. In Co-production Theory the importance of knowledge and skills, resources and tools are key to engage citizens. To better engage and thus retain OW-workers, proper development of knowledge and skills need to be prioritized by the municipalities. This is not to be a top-down process, but a continuous exchange of ideas and knowledge.

Moving beyond internal collaboration in the municipalities as mentioned above, Co-production can suggest that the OW-workers play a central role in the Co-production process between the municipalities and the citizens. They can fill the role as intermediaries and familiar face between the municipalities and the citizens building social networks i.e., fulfilling the relational part of network-oriented governance (Kivimaa, Boon, Hyysalo, & Klerkx, 2019).

Above it is reflected how Co-production processes can guide intra- and intermunicipal relations. Still, some aspects in the lack of focus on the OW-worker, is left unaddressed e.g., how proper salary and proper working conditions are guaranteed. Something that Co-production is limited in dealing with.

6.3 Limitations of Co-production Theory

6.3.1 Power of Municipalities

Empirically, Co-production initiatives have been initiated by municipalities (Agger & Tortzen, 2015). This would be the same for the Greenlandic context, as it is the municipalities who today possess the power of action in the WMS-transition, and thus have the power to change this in accordance with Co-production Theory. This power relation can potentially be a limitation to Co-production in Greenland as resistance among professionals i.e., the municipalities to hand over power can be a pervasive feature (Agger & Tortzen, 2015). An issue originating from that is also, that unequal power relations can live on into the new governance mode once Co-production has started. Aagaard, Sørensen & Torfing (2014) points to it being a potential challenge for the institutions e.g., municipalities to give off control due to lack of trust in the engagement and knowledge of citizens, which was also reflected in **section 5.2**.

6.3.2 Vulnerability of Voluntarily Based Approaches

When arguing for a more network-oriented mode of governance it is important to highlight that even though *“networks with low levels of centrality can be more inclusive of different groups and are highly resilient to the loss of specific actors”* they also *“lack accountability and can be inefficient at solving simple problems due to the lack of overall coordination.”* (Evans, 2011, p. 109). This is the opposite side of the coin of a centralized approach, where a central actor can be held responsible. Just as high levels of centralization have disadvantages due to the hierarchical exercise of power and rigid top-down

procedures, which are less democratic (Evans, 2011), a decentralized network which outsource public responsibilities to volunteers has the disadvantage of affecting issues of quality and representation. Regarding fiery souls, there are several risks as it is based on voluntary commitment. Fiery souls can fall ill or burn out, thus the accountability in the system is potentially weakened. The WMS must also be resilient to fiery souls moving away due to private matters or market forces. The big relocation in Greenland poses a challenge for voluntary commitment, which is the same challenge as for OW-workers. It is relevant to consider how much responsibility municipalities can demand from their citizens without requiring too much, how far it is possible to go and what challenges can appear in the process of shifting responsibility.

Hodson & Marvin (2010) argues for the important role of intermediary organizations as 'agents of change' bridging social and governance interests in achieving sustainable transformations. To strengthen a network-oriented approach, the possibility of making a somewhat centralized institution could be a suggestion, existing as a mediator between the municipality and the citizens to mitigate the limitations of a purely network-based mode of governance (Kivimaa et al., 2019). Previously, technical- and infrastructural managers with extensive local knowledge were present in all 18 municipalities and were continuously in contact with the city and or the settlement. Reestablishing intermediaries like these could be a starting point to facilitate better coordination between the OW-workers and the municipalities, as well as to facilitate citizen involvement (cf. Kivimaa et al., 2019). A central actor with the responsibility of being connected to citizens, the municipality and OW-workers could make it easier to coordinate collective action and drive the transition. This could help to solve the issue of accountability in a purely network-based governance mode (Evans, 2011). Thus, creating a nexus between the current hierarchical mode and a modern, but historically and culturally embedded, network mode of governance.

6.4 Reflection & Future Research

This research aimed to be exploratory by identifying the challenges in the planned WMS and opening a discussion on solutions to tackle these. Possible biases reflected in mainly interviewing governing actors might be present, although I aimed at getting outsider views by including academic researchers in my pool of interviewees. Interviews with citizens and OW-workers were not carried out for the thesis. To improve the nuances of the governance challenges, additional interviews with these actors are suggested, to aim for all voices and narratives to be heard. In my opinion it is especially relevant to get the view of citizens, when further discussing the potential solution of Co-production.

Building on this thesis' conclusion that there is a basis for more network-oriented modes of governance, further research is suggested to produce an idea catalogue on locally appropriate Co-production-initiatives and to carry out pilot projects applying these initiatives. DM points at incineration by ESANI as a starting point for changing the Greenlandic WMS. However, it is expected that the municipalities will continue investigating what waste can be reused and recycled. Further research could go in the direction of exploring how the goal of the municipalities, to recycle and reuse more, can be achieved. Currently, how to achieve this goal is something which is left unaddressed, and that the municipalities are to plan individually. This could also be explored in relation to Co-production Theory.

7 Conclusion

This thesis aimed at supporting the transition to a sustainable WMS in Greenland by developing relevant knowledge and understanding of the current state of the WMS and its challenges, then analyzing if those challenges are addressed by the new WMS, which is being implemented.

The thesis assessed the current state of the WMS in Greenland, concluding that it is technically and environmentally challenged, and that the municipalities have developed a financial plan in collaboration with the Self-government to counter this. However, through the lens of ST-studies a lack of emphasis on understanding the institutional and socio-cultural dimensions, leading to unresolved governance challenges with the WMS-plan, were identified. Five governance challenges of the current WMS were identified as not being addressed by transitioning to the planned WMS: 1) poor system understanding of the WMS, 2) distrust between actors, 3) lack of locally appropriate solutions, 4) low citizen involvement and 5) challenges with training and retainment of OW-workers.

The results showed that a centralized, top-down governance approach is reflected in three of the five challenges of the old WMS: 1) trust issues, 2) lack of locally appropriate solutions and 3) in the attitude towards citizen involvement. Past trends of increasing sectorization and privatization, representing a market mode of governance, have influenced the challenges of training and retainment of OW-workers. Based on the analysis that the dominant governance modes of hierarchy and market are at odds with a sustainable WMS, it was suggested to investigate a nexus with a network-oriented mode of governance.

The thesis discussed how Co-production, as a network-oriented mode of governance, can guide governance of the challenges in the WMS, to support the proposed WM-plan in becoming sustainable. The thesis concludes that Co-production can be utilized to enhance citizen involvement, contributing to create locally appropriate solutions, which build trust between actors and creates a sound

knowledge base for the transformation. The thesis discussed the implications of Co-production on the lack of focus on the OW-workers, and concluded that Co-production can inform intra-municipal collaboration, and that OW-workers have the possibility to interact as intermediaries between the municipalities and citizens.

Overall, a more network-oriented mode of governance was identified as beneficial for achieving a sustainable WMS, especially in an Arctic region such as Greenland, which is characterized by island-like societies, and therefore requires approaches focused on localism and mutualism. The thesis contributed to a sustainable, integrated WM-solution by contributing with knowledge and information about Greenland's WMS (cf. sub-target 12.8), strengthening the capacity to move towards a sustainable WMS (cf. sub-target 12.4) aligning with SDG 12.

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9 Appendices

9.1 Mapping of the Current Waste Management System in Greenland

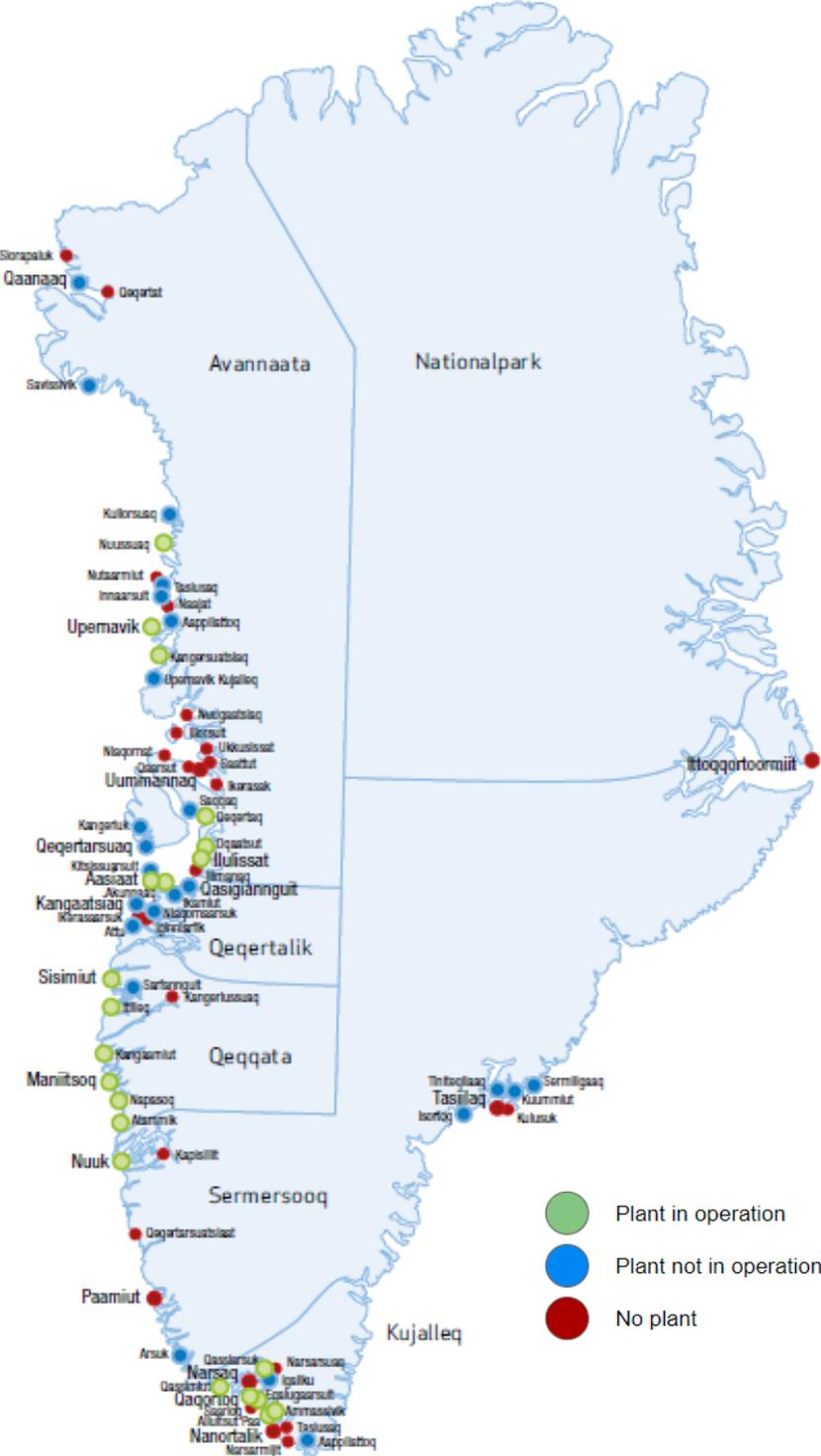


Figure 6: Incineration plants in 2020 in Greenland (Grønlands Hjemmestyre, 2020). Adjusted by author.



Figure 7: Dumps/controlled landfills in 2020 in Greenland (Grønlands Hjemmestyre, 2020). Adjusted by author.

9.2 Visual Presentation of Waste Management in Greenland



Figure 9: The open landfill in Sisimiut, Greenland's second biggest city (Bredsdorff, 2011)



Figure 10: The incineration plant and part of the open landfill in Sisimiut, Greenland's second biggest city (Bredsdorff, 2011)



Figure 11: Example of a small incinerator in a settlement (Bredsdorff, 2011)



Figure 12: WM and open landfill near the coast (Bredsdorff, 2011)

9.3 Interview Guide

First, I want to say thank you for taking the time to talk with me today. I appreciate it. I will start by introducing myself. I have a background as an environmental engineer with a focus on waste, but in my thesis, I deal with the more socio-cultural, institutional and governance aspects of the Greenlandic WMS. I have lived in Sisimiut for a while and that was where I became interested in WM in the Arctic. Also, my father has told many stories about the landfills that he played on throughout his upbringing in Nuuk.

As you know, I am doing research for my master thesis on the ongoing transition of the Greenlandic WMS, and I have become especially interested in understanding the governance perspectives better – what have been the sociological and governance challenges (and opportunities) with the current WMS and how these will be met in the proposed WMS and what this all means for the way the proposed WMS will be governed.

The purpose of this interview is to get your perspectives on what you have seen as the sociological and governance challenges in the current WMS and how you think the future WMS should try to address those challenges.

For me to be properly present during the conversation and be sure not to miss important details, I want to ask you permission to record our conversation. The interview is for academic use only and will of course not be used for commercial purposes.

Guiding interview questions:

1. I would like to start by asking you to describe a little about yourself and your role in relation to the new national waste solution?
2. How would you describe the current WMS?
3. What have you perceived as the biggest challenges with the current WMS in addition to the environmental problems caused by incineration and landfills?
4. Do you know how it is planned to meet the challenges in the proposed WMS? (And do you see any potential problems that could arise as result of the planned measures?)
5. Are there initiatives, in addition to those already planned, that you would propose to meet the challenges in the proposed WMS?
6. There is a lot of talk about citizen involvement in these years, as a way for citizens to gain greater influence and feel co-responsibility for the municipal solutions. Is that something that you see as a possible path for the municipalities? And if so, what do you think this would mean?

7. Do you see any opportunities in the population that could help steer the country's waste practices in a more sustainable direction?
8. What would it look like if you were to imagine a future, sustainable WMS?
9. Is there anything you think is important to include that we have not touched upon in our conversation?

Thank you very much for taking the time to answer my questions and talk with me today! Your inputs have been very valuable for my thesis. If you have any questions in the future about the research, feel free to contact me. I am also interested in your opinion on others I should possibly talk to. At last, I want to hear if I may contact you if a couple of follow-up questions should arise.